LIMITING LONG TERM ILLNESS: A QUESTION OF WHERE YOU LIVE OR WHO YOU ARE? A MULTILEVEL ANALYSIS OF THE 1971-1991 ONS LONGITUDINAL STUDY

S. GLEAVE, M. BARTLEY, R.D. WIGGINS.

Social Statistics Research Unit, City University, Northampton Square,
London EC1V 0HB, U.K.

Originally presented as a solicited paper to the APHA Conference, Indianapolis,
November 9-13 1997

ACKNOWLEDGEMENTS: This paper forms part of the programme of work of the ESRC Health Inequalities Programme : DIMENSIONS OF HEALTH OVER PERSONS, TIME AND PLACE. **Project Team** Heather Joshi, Simon Gleave, Kevin Lynch, Richard Mitchell, Social Statistics Research Unit, City University; Dick Wiggins, Department of Sociology, City University; Pierella Paci, Department of Economics, City University; Mel Bartley, Department of Epidemiology and Public Health, UCL and SSRU.

The authors gratefully acknowledge the funding and assistance of the ESRC, grant number L128251012 in the Health Inequalities Programme and of the ONS for access to the Longitudinal Study.

CONTENTS

STRUCTURED ABSTRACT

Objectives - to investigate the contribution of individual and area characteristics to geographical variations among county districts in limiting long term illness.

Design - Longitudinal Study of the Office of National Statistics (ONS) Longitudinal Study.

Setting - England and Wales

Subjects - Random sample of 69,361 men aged between 16 and 45 at the time of the 1971 census and followed up for 20 years.

Outcome measure - Limiting long term illness ascertained at the 1991 census.

Results - Wide variations between districts in the rates of limiting long term illness in 1991 were only partly explained by men's individual experience of unemployment, low social class and other disadvantages in 1971 and 1981. Further explanation was contributed by classifying their areas of residence according to the ONS classification. The relationship between patterns of individual disadvantage and the risk of illness was not the same in all types of area. Some areas remained which had higher or lower rates of illness than expected on the basis of both individual and area characteristics.

Conclusion - The experience of disadvantage over time affects the risk of limiting long term illness. Geographical differences are not, however, entirely explained by the distribution of individual characteristics; the same individual history may face a different risk of illness in different kinds of region.

1. INTRODUCTION

This paper uses linked longitudinal data from the 1971, 1981 and 1991 decennial censuses of England and Wales to explore the links between men's ill health and their personal and local material circumstances. Epidemiological studies have repeatedly shown that health in Britain is subject to a 'Health Divide' which is both social and geographical (Whitehead 1987, Cook et al 1982, Shaper 1984, Sloggett and Joshi 1994). It has recently been shown that mortality differences between regions have increased quite sharply, so that we now have the largest regional mortality differences in the postwar period (Dorling 1997). Several explanations have been put forward for this. Changes in the underlying health status of the stably resident population are thought unlikely to be the full story. Mortality in England and Wales fell sharply during the 1980s in all demographic groups except young men (Drever and Whitehead 1997). However, this fall has also been very unevenly distributed (Phillimore et al 1994).

In 1991 for the first time, a British census included a question on long term illness which limits the activities of the individual. Analysis of the census data has shown sharp regional differences in this measure, which largely parallel those for mortality. However limiting long term illness is more concentrated geographically than mortality (Langford and Bentham 1996), so that a purely biomedical explanation does not seem adequate.

One explanation for such regional differences in health is that different sorts of people, with different personal histories and behaviours, live in different areas: the 'compositional effect'. Another type of explanation appeals to 'contextual' effects, including climate, water quality, pollution, and industrial structure and history. Originally, industrial location in Britain was determined for reasons related to physical resources such as the availability of raw materials (coal, iron ore), or conditions which were right for processing these materials. A damp climate is needed for textile manufacture, soft water is needed for this and other processes, which meant that certain industries were concentrated in the north and west of Britain. Between the censuses of 1971 and 1991 there was rapid contraction in many of the heavy industries located in the north and west of the country. The areas of traditional heavy industry became areas of high unemployment, resulting in a characteristic combination of natural and social hazards, past and present, to health.

The first step in assessing the relationships between individual and area characteristics and health is to clarify whether regional variation is any greater than one would expect on the basis of the characteristics of the individuals alone. As a result of economic history, certain types of people are concentrated in certain areas. We know that occupation, education and ethnicity, for example, are related to health; are regional differences merely a product of the different composition of areas in these respects ?

2. OBJECTIVES

In this paper multilevel modelling (Goldstein 1995) is used to explore whether geographical differences in limiting long term illness are determined solely by the distribution of individual factors, or whether factors operating at a geographical local level may also be regarded as playing a role. This question has been addressed by others in different ways (e.g. Sloggett and Joshi 1994)

Our approach has been to follow recent work which has emphasised that inequalities in health take the form of a 'finely grained' gradient throughout the social structure rather than a division between the 'deprived' and the rest of the population (Davey Smith 1997, Davey Smith et al.1997). Accordingly we have characterised individuals in terms of a both their social position and social

trajectory over time. Areas have not been defined in terms of deprivation in electoral wards, but by a more broadly based classification of county districts. This classifies areas in terms of characteristics such as the nature of the most prevalent social class, degree of prosperity and predominance of particular types of industry (Wallace and Denham, 1996). Further details follow in the next section.

The paper explores the role of two types of influence on regional variations in limiting long term illness (LLTI). The first of these is the combination of individual characteristics and work history: contrasting men who, at one extreme, have experienced an advantaged lifecourse during the period between 1971 and 1991 including higher education, a higher social class and no unemployment for example, with those who have a more disadvantaged personal history. The second is the area in terms of the county district and its characteristics. The paper examines both whether geographical variations in the prevalence of limiting long term illness diverge from what would be expected on the basis of individual characteristics and social trajectories alone, and examines the nature of those areas in which rates are higher or lower than expected on this basis. Because patterns of both illness and labour market history are different, and more complex, in women, the ways in which these processes may affect women's health will be addressed in a separate paper.

We will explore the interplay of individual and locational influences by using multilevel modelling which allows both area and individual effects to be represented in a two level population hierarchy. Individual men at level-1 are nested within areas as county districts (in this paper this term refers to local authority administrative areas) at level-2. By separating out individual and area level characteristics it becomes possible to investigate how variables defined at the county district level might affect the prevalence of limiting long term illness over and above the contribution of an individual's characteristics and summaries of their own occupational and migration histories. In this analysis geography is defined as county districts (local authority administrative areas). However imperfect this may be as a definition of 'place' or 'space', it does represent a unit of resource for local authorities in England and Wales. The authors are well aware that the very definition of area used here is itself an artefact of census geography (Openshaw, 1994). Our intention is to demonstrate the methodology and the scope for area level analyses as well as provide an understanding of the factors associated with the incidence of long term illness.

3. METHOD

3.1 Data source and structure

Sample

The LS is a 1% linked sample of individuals from 1971, 1981 and 1991 (Hattersley and Creeser, 1995). The dataset contains Census information and a limited health history from the National Health Service Central Register. Analysis is done at county district level for the 403 districts in England and Wales. Our sample was made up of 69,352 men aged between 16 and 45 in 1971 (and hence aged 36-65 in 1991) who had full Census records at the three time points. In order to avoid as far as possible results being swamped by the high chance certain individuals had of reporting limiting long

term illness in 1991, we removed any individuals who were classified as temporarily or permanently sick in either 1971 or 1981 from our analysis. For our sample the average number included in a county district is 173.

Limiting Long Standing Illness

The outcome variable in the analysis was the question asked in the 1991 census whether the respondent had a long term illness which precluded them from working or carrying out their daily activities.

Individual Characteristics

In an attempt to explain the level of reported LLTI a number of individual characteristics were included in the model: age, education, ethnicity, social class in 1971; and three summary indicators spanning the period 1971 to 1981 to reflect social mobility and migration. The degree of social mobility experienced by an individual explicitly takes account of a person's social position at the outset of the period following (Bartley and Plewis 1997). In addition to a crude allowance for the dissonance of any reported migration both within and between county districts there is another labelled 'ever resident in the South-east'. This follows evidence to suggest that any period of residence in the South East may provide an 'escalator effect' for an individual's occupational history - providing a 'push-up' the occupational ladder (Fielding 1995). Finally, any reported period of non employment[1] in either 1971 or 1981 was also included to examine the impact of unemployment on limiting long term illness. All of the variables are derived from successive censuses between 1971 and 1991 held as part of the ONS Longitudinal Study (LS). A complete summary table of individual level variables is shown below in table 1:

Table 1: Individual level variables

Variable	Categories
Age	Measured as continuous variable
Work Status	Workers in 1971 and 1981 Non workers in either 1971 or 1981
Education	Degree holder Non degree holder
Region	Lived in South East in 1971 or 1981 Lived outside South East in 1971 or 1981
Ethnicity	White Non white

[1] Work status was divided into two categories - the first can be considered as workers and included students as well as those actually employed. The second was non workers - these were mainly the unemployed but also included those who were not seeking work such as those who could support themselves. A very small number of early retired were also in the latter category.

Social Mobility 1971-1981	Upward Stable Downward Not classified in 1971 Not classified in 1981 Not classified 1971 and 1981
Origin Social Class 1971	Professionals and Intermediate Skilled non manual Skilled manual Partly skilled and unskilled No social class
Migration 1971-1991	Same district Different district, same county Different county

As the majority of these variables are categorical they each have an arbitrary reference category in the modelling analysis that follows. For variables with more than two categories, this will be the first named category. Otherwise, the reference category for dichotomous variables is simply conveyed by the label denoting possession of the first named attribute (e.g. white for ethnicity). Age was mean centred around the average age of 29.9. Inclusion of a quadratic term in age was adopted as a conventional means to improve the statistical fit.

Geographical Unit

The second level units used in this analysis are the 403 county districts from 1991 as defined by the boundary commission. The only level 2 variable used in the modelling was a cluster code developed by ONS from Census data to describe the character of the district (Wallace and Denham, 1996). Essentially county districts are described as belonging to one of twelve homogenous groups based on similarities derived from 37 individual census items. These are listed in Appendix A. The labels used in the area classification and in our analysis are shown below together with the number of districts in each group and the average percentage of LLTI reported for the group:

Table 2: District Level Variables

Area Classification	Number of Districts	% Total Districts	Mean %LLTI
Coalfields	43	10.72	21.76
Coast and Countryside	66	16.46	13.19
Growth	25	6.23	7.18
Inner London	17	4.24	16.55
Manufacturing	23	5.74	16.39
Mixed Economies	37	9.23	13.11
Mixed Urban and Rural	44	10.97	12.20
Most Prosperous	86	21.45	9.94

Ports and Industry	15	3.74	20.50
Resort and Retirement	24	5.99	12.54
'Scotland'	3	0.75	16.31
Services and Education	18	4.49	10.68
Totals/Overall LLTI	401	100.00	13.39

Source: The ONS Classification of Local and Health Authorities of Great Britain, Wallace and Denham (1996). Please note that 'Scotland' does not refer to the country itself only districts in England and Wales deemed to be socially and economically similar to Scotland. *Please also note that the total number of districts is 401 rather than 403 because the City of London and the Isles of Scilly contained no individuals once the population for analysis had been selected.*

'Coalfield' and 'Ports and Industry' have the highest levels of reported LLTI whereas growth and most prosperous' areas report the lowest levels of LLTI.

3.2 Modelling strategy

All modelling was implemented by the software package MLn (Woodhouse 1996).

Formally the appropriate statistical model for a binary outcome is described as a logistic multilevel regression model. Algebraically we have: -

$$y_{ij} = \exp(f_{ij} + u_j)/(1+\exp(f_{ij} + u_j)) + e_{ij}$$

where f_{ij} denotes the fixed part of the model, u_j is the random part of the model at district level and e_{ij} is the random part of the model at the individual level. The e_{ij} are assumed to be binomially distributed (Goldstein 1995). The fixed part of the model contains a linear function of both individual and area level explanatory variables. The random part of the model identifies two components of variance: between area (level-2 variance) and that between individuals within area (the level-1 variance). The inclusion of area level characteristics in the model is equivalent to attempting to explain any between area differences in terms of local effects. In this application we have only included a single level-2 characteristic- the area classification described in table 2.

The modelling strategy consisted firstly of fitting a simple variance components model to identify the components of variation, described as a null model since it does not contain any explanatory variables at all. The next step was to include an individual's age. As age is expected a priori to be a predictor of LLTI status, it has to be included in any model. Thus a simple model with age and age squared as the only explanatory variables is referred to as our *base* model. A term for the intercept and associated random components at level-1 and level-2 identifies the two variance component estimates for between and within areas. The next step is to include all individual characteristics in the model then checking by means of a backward elimination of each characteristic in turn to examine whether or not a statistically significant contribution (referred to as the reduction in the log likelihood, p32 Woodhouse 1996) is made to

the model. The resulting model is described as our *interim* model. Finally, the level-2 ONS area classification is included in an attempt to reduce area level variance. This is referred to as our *final* model. The results for all three models are presented below. The interpretation of the modelling provides insight on two different aspects of the analysis. Firstly, on the interpretation of the fixed effects and their ability to explain between area differences. Comparison of the log-likelihoods (the difference is approximately χ^2) before and after the inclusion of individual characteristics as "fixed effects" allows us to see how far differences between areas are explained by differences between the individuals they contain. Secondly, the analysis of residuals once the level 2 variable, the ONS classification of area, has been included provides important information about the extent to which the model actually recovers or predicts the extent of reported illness at an area level. Put another way an analysis of area (level 2) residuals reveals the extent to which an area still has an excess of ill health or 'good' health once individual characteristics and the variables describing the type of area have been included.

Quite apart from modelling area differences, multilevel analysis provides an opportunity to allow fixed effects to vary within areas. This represents a distinct advantage over and above ordinary regression modelling which does not recognise the hierarchical structure of the population and imposes a single set of estimated regression coefficients, or 'fixed effects', across areas. Another significant advantage of multilevel analysis permits variances to be modelled directly. For example the variance between areas might vary according to the type of area they were in or the variance between individuals might vary according to an individual's age. Our focus here will be to explore the substantive implications of the influence of individual characteristics on LLTI in the context of where LS members live. Thus individual effects will be explored to the extent to which they may vary across areas. Modelling area variation in terms of the ONS area classification is the first step in explaining the influence that area may have on an individual's chance of reporting LLTI once we have taken their individual circumstances into account. For this paper any explanation of area difference will be approached in terms of a reduction in level-2 variance as individual and area level variables are introduced into the model. This is preferred to the intraunit correlation, a ratio of level-2 variance to the total variance, which is strictly only applicable for a continuous outcome (Goldstein, H. (1991) and Hedeker, D.(1997)).

This type of analysis is a breakthrough for data from the ONS Longitudinal Study as previously, analysis was only allowed on a limited set of variables read from a machine readable table. In the last year, ONS has allowed us the opportunity to download individual level data (under strict supervision) onto a standalone PC where multilevel analysis can be carried out on larger and more interesting sets of data.

4. RESULTS

4.1 The implication of the modelling for the interplay of individual and area level differences

The three stages of multilevel modelling are summarised in table 3 below:

Table 3: Baseline, interim and final models for LLTI as a binary outcome for 69,352 men aged 16-45 in 1971 nested within 401 county districts in England and Wales. Standard errors are shown in parentheses.

	Base Model	Interim Model	Final Model
FIXED EFFECTS			
(Level 1)			
Constant	-2.183 (0.028)	-3.197 (0.061)	-3.088 (0.061)
Age	0.090 (0.002)	0.095 (0.002)	0.094 (0.002)
Age^2	0.0007 (0.0002)	0.0005 (0.0002)	0.0005 (0.0001)
Non workers (1971 or 1981)		0.883 (0.035)	0.872 (0.035)
No Degree		0.414 (0.058)	0.414 (0.058)
Not in South East(71 or 81)		0.226 (0.038)	0.094 (0.035)
Non White		0.247 (0.063)	0.246 (0.062)
Downward Social Mobility (71-81)		0.270 (0.036)	0.263 (0.036)
Not classified 1971		0.422 (0.089)	0.411 (0.089)
Not classified 1981		0.450 (0.174)	0.447 (0.174)
Not classified 1971 and 1981		1.631 (0.322)	1.607 (0.320)
Skilled Non Manual ’71		0.198 (0.047)	0.191 (0.047)
Skilled Manual ‘71		0.404 (0.036)	0.388 (0.036)
Partly Skilled/Unskilled ‘71		0.727 (0.041)	0.706 (0.041)
(Level 2)			
Growth Areas			-0.219 (0.043)
Most Prosperous			-0.455 (0.080)
Ports and Industry			0.344 (0.070)
Coalfields			0.514 (0.050)
RANDOM EFFECTS			
Level 1*	1	1	1
Level 2 (county district)	0.172 (0.017)	0.091 (0.011)	0.040 (0.007)
Log likelihood	30,184	24,773.5	24,756

* Constrained by logistic multilevel model to be 1.

From our baseline model, a positive relationship between an individual's age and the probability of reporting a limiting long term illness is clearly confirmed. The quadratic term in age is also useful: health determinants seem to have stronger effects at older ages. There was no evidence for the presence of any extrabinomial variation (p89,p95 Woodhouse 1996). Our base model reveals that between area differences (level-2 variance at 0.172) are present. By including individual level characteristics at level-1 we almost achieve a halving of the level-2 variance (a reduction of level-2 variance to 0.091 in our interim model). This implies that area differences decrease once we take account of the characteristics of the individuals who make up the local populations. We return to this point in section 4.2 below. Attempting to model the between area difference by taking account of the type of area produces yet another halving of the level-2 variance (level-2 variance at 0.040 in our final model). The fixed (individual level) part of the model which reveals that any period of inactivity during the two decades combines with below degree level attainment, not having been observed in the South East of England and being other than white to increase an individual's chance of reporting a limiting long term illness. Varying combinations of these characteristics will also result in enhanced risk of reporting illness if an individual was in a semi or unskilled occupation at the outset of the twenty year period or has recorded downward occupational mobility. Being unclassified to an occupation at one or both dates, suggesting a break in the continuity of employment over the period, also increases this risk.

Allowing these 'fixed effects' to vary across areas revealed some evidence of variability[2]. The impact of downward mobility could vary according to where an individual lives. However, this variation is unlikely to reverse the magnitude of the effect noted in the fixed part of the model (σ=.0182 , s.e.=0.0276 **)**. A similar comment can be applied to the effect for skilled non-manual workers (σ=.0135, s.e.=0.0346). A more variable effect was present for the effect of periods out of the labour market. In the fixed part of model a break in the continuity of employment indicates a higher risk of reporting limiting longterm illness. For some areas this effect could indeed be reversed or at least absent (σ=1.456, s.e. =0.7248) but preliminary analysis has not revealed why this occurs. Notable area effects provide an interesting contrast between prosperous and growth areas with declining areas described as 'coalfields' and 'ports'. The former, more buoyant areas, appear to protect individuals from reporting a limiting long-term illness whereas residence in the latter inflate the chance of reporting illness even allowing for age and other individual level characteristics.

.

[2] The variance term associated with a regression coefficient in the fixed part of the model is usually referred to as 'sigma', or σ. Loosely it is akin to a reliability coefficient, + and - 2σ around the estimated fixed effect would give a reasonable guide to the extend to which the effect could vary across areas. We have reported sigmas for the terms above.

4.2 Residual analysis as a signpost for an understanding of area differences

The next step was to examine the areas with significantly higher or lower rates of illness after individual characteristics and the area type had been accounted for. For the purpose of this analysis a level-2 residual which is *positive* has higher levels of reported limiting long term illness than is predicted by the multilevel regression model. Conversely a *negative* level-2 residual indicates lower levels of reported limiting long term illness than expected. Substantively, a negative level-2 residual may well indicate a healthy effect of area whereas a positive level-2 residual which may indicate an unhealthy effect of area. For the analysis that follows a *zero* residual is simply a residual estimate that includes zero in its 95% confidence interval. In order to be able to say something about the effect of area on reported ill-health we examine these residuals by their area classification. For each group of residuals (negative, zero and positive) we contrast the observed distribution of residuals by area classification to that expected on the basis of the distribution of the 401 districts under analysis (see table 2 above). The results are given for each model in tables 4a,4b and 4c.

In general, as we step through the modelling the number of areas with either positive or negative residuals steadily contracts. In terms of prediction this is comforting news. The base model with no information about an individual's characteristics other than their age has 28 negative (healthy) and 62 positive (unhealthy) residuals. The interim model which explicitly includes individual characteristics, work and migration histories has only 12 negative (healthy) and 33 positive (unhealthy) residuals. Put another way once we begin to take account of individual socio-economic characteristics and job histories a lot of residual area effect can be explained. So what remains at an area level tells us about the nature or character of the area in so far as its impact on reported limiting long term illness is concerned. In these first two stages of modelling we have not explicitly included an area level classification to try to explain any between area differences. However, to trace what actually happens to these residuals in terms of their area classification is revealing.

Once area classification is included in the final model the number of positive and negative residuals reduces dramatically from 45 to 10. These residuals carry information about the methodological inexactitude of an area classification and its relationship with LLTI as well as possible signposts or challenges to our interpretation. There may well be something unique and interesting about the very areas which are not described by the model itself. We will examine this in more detail.

Each model presents level-2 residuals as significantly positive ('+ve)' or negative ('-ve') and the remainder as zero ('0'). These have been crossclassified by their area classification and their distribution contrasted within each group of residual with the expected distribution of areas for England and Wales as a whole. For each column

there is a chi square for a single sample goodness of fit test. We begin with the base model.

Table 4a shows the base model, with only age terms included. Positive and negative residuals here indicate areas where people are more or less likely to have a limiting long-term illness than we would expect on the basis of differences in age distribution of the population in each area.

Table 4a. Level-2 residuals for Base Model by area classification

Residuals

	-ve		0		+ve	
	Obs	Exp	Obs	Exp	Obs	Exp
Coalfields	0	3.00	12	33.34	31	6.64
Coast and Countryside	3	4.61	59	51.19	4	10.21
Growth	10	1.74	15	19.38	0	3.86
Inner London	0	1.19	15	13.19	2	2.63
Manufacturing	0	1.61	15	17.85	8	3.56
Mixed Economies	0	2.58	35	28.71	2	5.72
Mixed Urban and Rural	1	3.07	42	34.12	1	6.80
Most Prosperous	10	6.01	75	66.71	1	13.30
Ports and Industry	0	1.05	3	11.63	12	2.32
Resort and Retirement	0	1.68	23	18.63	1	3.71
'Scotland'	0	0.21	3	2.33	0	0.47
Services and Education	4	1.26	14	13.96	0	2.78
Totals	28		311		62	
χ^2	61.09		28.45		167.05	
degrees of freedom	11		11		11	
p	<0.01		<0.01		<0.01	

The base model appears to highlight a clear geographical divide in terms of reported limiting long term illness. The areas with high positive residuals and thus high levels of unexplained limiting long term illness are generally found in South Wales or the North of England. The English districts tend to be highly urbanised areas with a history of mining or heavy industry whereas the Welsh areas are more generally most recent ex-mining areas.

The high negative residuals which indicate low levels of limiting long term illness tend to be found in the South of England and are generally rather rural in make up. There are exceptions with the prosperous, medium sized towns of Newbury, Wycombe, Chelmsford and Stratford upon Avon. However, all of these districts are surrounded by countryside and appear completely different to the highly urban areas described above. Analysis of mortality has also identified these healthier rural areas (Charlton 1996)

Based on a direct comparison of observed and expected numbers of districts for each grouping of residuals we see amongst the positive residuals (unhealthy) is a preponderance of areas drawn from amongst the 'coalfields' and 'ports and industry'. Whereas amongst the negative residuals (healthier areas) areas drawn from 'growth' and 'most prosperous' groupings are over-represented.

Table 4b shows the residuals for the interim model which includes individual characteristics and mobility and migration history as fixed effects. In this model the excess of areas in the 'growth' category is reduced to one district. This might well suggest that for districts in the 'growth' areas that reported illness is largely accounted for by the individuals themselves rather than the nature of the area itself. Indeed all but one of these areas (Mole Valley, Mid Sussex, Three Rivers, Chiltern, Guildford, Wokingham, Rushcliffe, St Albans and 'Windsor and Maidenhead') are in the South East, thereby conferring possession of the escalator effect on all of the individuals living there. Rushcliffe in Nottinghamshire is the exception. All of these areas share higher percentages of men with a degree, consistent economic activity, and favorable patterns of geographical and social mobility compared to the national picture. Where Rushcliffe appears to stand out is that the men in this sample have higher than expected levels of upward social mobility when compared to other growth ares (23.4% compared to 21.7% for all growth ares and 21.4% nationally). The growth area whose residual remains significant in the interim model is Surrey Heath. Whilst in the South East it has the lowest reported level of LLTI for the country as a whole. A formidable outlier for the model to capture! Amongst the growth areas it distinguishes itself as an area with an established professional class (41% in social class I & II compared to 35% for growth areas as a group or 21.7% nationally). There is also relatively less upward social mobility (19.7% compared to 21.7% for growth areas as a whole). Its exceptionally low level of reported LLTI suggests something about the area which is not simply captured by the aggregate descriptions of the area based on the personal characteristics of the men who live there.

Table 4b. Level-2 residuals for Interim Model by area classification

	Residuals					
	-ve		0		+ve	
	Obs	Exp	Obs	Exp	Obs	Exp
Coalfields	0	1.29	23	38.16	20	3.54
Coast and Countryside	2	1.98	62	58.60	2	5.46
Growth	1	0.75	24	22.18	0	2.06
Inner London	0	0.51	16	15.09	1	1.40
Manufacturing	0	0.69	20	20.43	3	1.89
Mixed Economies	1	1.10	35	32.86	1	3.05
Mixed Urban and Rural	0	1.32	43	39.05	1	3.62
Most Prosperous	8	2.57	78	76.36	0	7.08
Ports and Industry	0	0.45	10	13.31	5	1.23
Resort and Retirement	0	0.72	24	21.32	0	1.98
'Scotland'	0	0.09	3	2.67	0	0.25
Services and Education	0	0.54	18	15.98	0	1.48
Totals	12		356		33	
χ^2	17.18		8.46		107.17	
degrees of freedom	11		11		11	
p	NS		NS		<0.01	

Table 4c shows the results of the final model which includes the area classification as a level 2 variable. This shows that the distinction between 'coalfields' together with 'ports and industry' and 'most prosperous' together with 'growth' is associated with significant differences in limiting long term illness between areas even after individual characteristics have been allowed for. The extent to which it does not tell the whole story is shown by the remaining residuals. Their persistence or emergence is likely to be explained both in terms of the inadequacy of individual characteristics and area classification for our purpose as well as their possible interaction.

Table 4c. Level-2 residuals for Final Model by area classification

	Residuals					
	-ve		0		+ve	
	Obs	Exp	Obs	Exp	Obs	Exp
Coalfields	1	0.32	39	41.92	3	0.75
Coast and Countryside	0	0.49	65	64.36	1	1.15
Growth	0	0.19	25	24.36	0	0.44
Inner London	0	0.13	17	16.58	0	0.30
Manufacturing	0	0.17	21	22.44	2	0.40
Mixed Economies	0	0.28	37	36.09	0	0.65
Mixed Urban and Rural	0	0.33	44	42.89	0	0.77
Most Prosperous	0	0.64	85	83.87	1	1.50
Ports and Industry	2	0.11	13	14.62	0	0.26
Resort and Retirement	0	0.18	24	23.42	0	0.42
'Scotland'	0	0.02	3	2.93	0	0.05
Services and Education	0	0.13	18	17.56	0	0.31
Totals	3		391		7	
χ^2	36.48		0.60		16.54	
degrees of freedom	11		11		11	
p	<0.01		NS		NS	

The extent to which health differences between the 401 county districts can be explained by individual characteristics and the type of area to which the county district is assigned is illustrated in figures 1 to 4. Figures 1 and 2 take the 20 county districts with the highest and lowest levels of health compared to what would be expected on the basis of age alone (the base model). (Please note that the .PDF version of Working Paper no. 77 does not include Figure 2.) These are contrasted with the 12 remaining negative residuals and the 20 county districts with the worst health (highest positive residuals) on the basis of the interim model which includes individual level variables. Thus if an area shows a long bar line in the base model which disappears in the interim model, this shows that individual characteristics have completely explained any health difference in that area.

There are 12 areas with low levels of limiting long term illness relative to what would be expected on the basis of age and individual characteristics alone. These reduce to just 3 in the final model which includes area type.

Figure 3 illustrates that relatively large negative residuals in the interim model (e.g. the New Forest) can be explained once the area classification is included in the model.. Where new areas enter the grouping for the final model suggests an interaction between individual characteristics and area level classification, notably for Scunthorpe, Sheffield and Kingston-upon-Hull.

Figure 4 shows the 20 areas with the worst health in the interim model and contrasts them with the 7 that remain significant once area type is included in the final model. The inclusion of an area effect in the final model removes a number of districts from this grouping (e.g. Easington). However for five districts (Blaenau Gwent, Rhondda, Ogwar, Camarthen and Burnley) the explanatory power of area classification is not strong enough to explain the excess of reported LLTI. Additionally, Oldham and Warrington join this group, again suggesting an interaction between individual and area level characteristics.

The reader may find that the table of rank order of districts in terms of LLTI together with their area classification in Appendix B assists the interpretation of the remaining outlying residuals in the final model that follows.

The three areas with negative residuals are all drawn from districts described as a 'coalfield' (Scunthorpe) or as 'ports and industry' (Sheffield and Kingston-upon-Hull). On the face of it this seems to contradict our understanding of the fixed effect for these districts located in these particular areas. According to our model expectations these areas should be the least healthy. Scunthorpe has the lowest reported %LLTI in the 'coalfield' group and is also in the bottom quintile of the national distribution. Kingston-upon-Hull and Sheffield hold the bottom two positions for reported %LLTI within the 'ports and industry' group. The classification of area types was not designed to study the social determination of health and we would not expect a perfect relationship between the two. It is not altogether surprising that only some of the area effect is explained by those aspects of economic and industrial structure used in the typology. Whilst at the other end of the spectrum amongst the positive residuals we have three districts with the highest reported levels of LLTI for the 'coalfields' group the suggestion here is that the model under-predicts the extent of reported ill-health despite their membership of a high reporting area group. Notable exceptions in terms of other area classifications also join this group; Carmarthen, the highest reporting level of LLTI within the 'coast and country' group also ranked five nationally and Burnley and Oldham with the highest levels of reported LLTI amongst the 'manufacturing' group and Warrington classified as 'most prosperous' but with a reported % LLTI well above the national average. These areas may all be victims of an imprecise relationship between area type and reported LLTI but there may well be more to uncover.

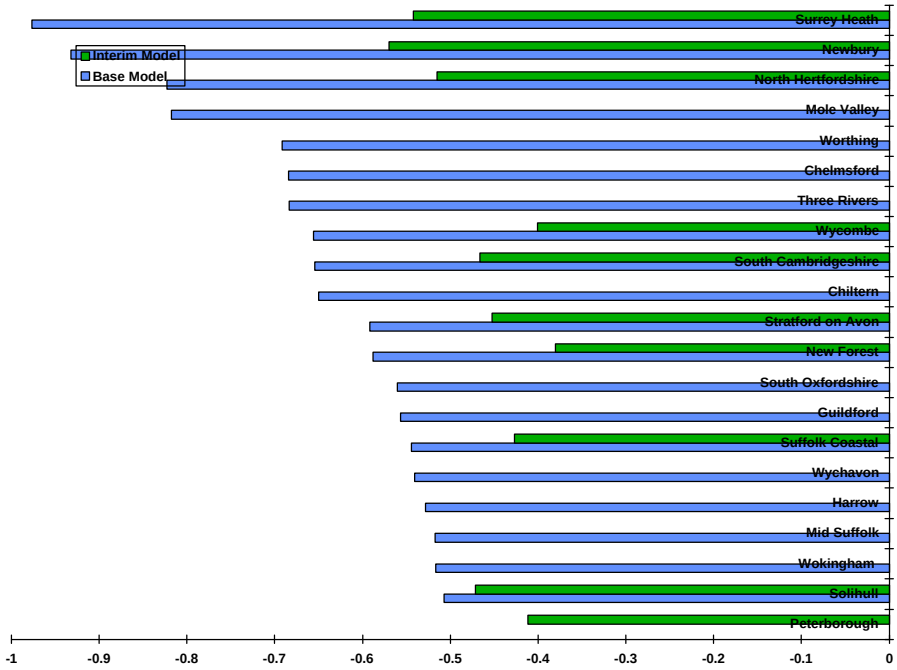

Fig 1. Top 20 areas with significant negative residuals from the multilevel modelling.
(Base vs Interim Model)

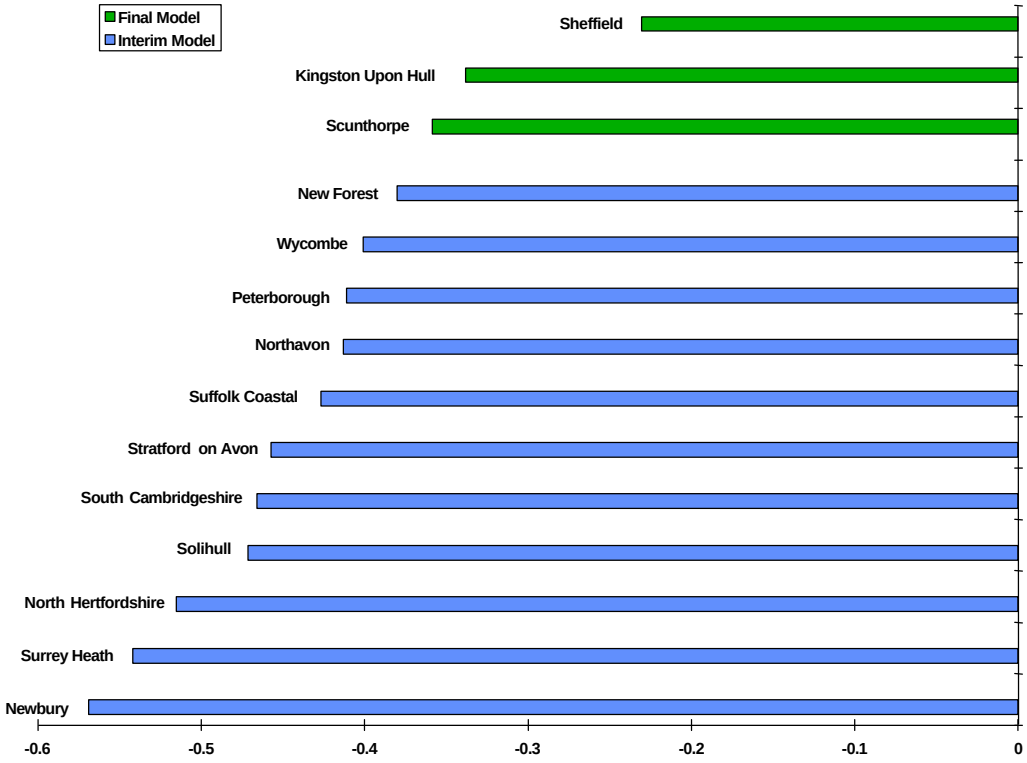

Fig 3. Areas with significant negative residuals from the multilevel modelling. (Interim vs Final Model)

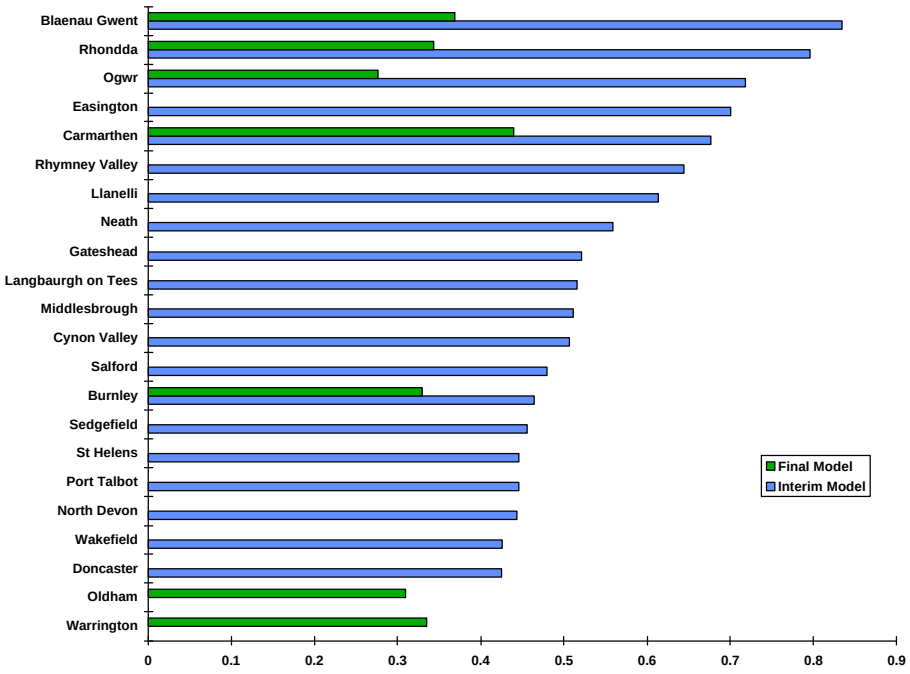

Fig 4. Top 20 Areas with significant positive residuals from the multilevel modelling.
(Interim vs Final Model)

5. DISCUSSION

This analysis has been carried out in response to the finding that limiting long term illness show very marked geographical variations in England and Wales. With the inclusion of a question on long term illness in the 1991 census, it has been possible for the first time this century to observe this pattern clearly (Charlton and Wallace 1994, Gould and Jones 1996).

We have shown effects of individual characteristics (education, social class, ethnicity), social and geographical trajectories in the period 1971 to 1981, and of area type on the likelihood of reporting a limiting long term illness in 1991. Much of the variation in illness may inded be understood in terms of the individual, as has been reported by previous studies (Sloggett and Joshi 1994). Use of a longitudinal data set allows individuals to be characterised in terms of both personal characteristics and processes of social and geographical mobility extending through time. Over and above these influences, however, those in areas described as coalfield and ports and industry were seen to have a higher than expected risk of LLTI, and those in the 'most prosperous' areas a lower risk than expected. Area variation is therefore given a meaning in terms of geophysical, industrial and economic characteristics of areas.

During the 1980s, the local economies in the areas we have shown to have the highest rates of unexplained LLTI, and the rates which are the furthest in excess of those which would be expected purely on the basis of individual characteristics, were transformed. The total number of jobs of the type normally undertaken by male breadwinners with relatively low levels of education (low skills demands but relatively high pay) was drastically reduced. Insofar as they were replaced by new jobs, these tended to be in light industry and service sectors: which did not carry levels of pay sufficient for a "family wage". Beatty and Fothergill (1996) have described how, in the coalfield areas, decrease in the numbers of mining jobs was not accompanied by proportionate increases in the numbers of unemployed miners: for example between 1981 and 1991 a loss of around 160,000 jobs in coal was accompanied by an increase in unemployment of only 500 men. Some of this was due to migration, however the missing resident male workforce could be accounted for to a large extent by rapid increase in economic inactivity, the major form of which was permanent sickness.

This is not to say that as unemployment rose so did a form of malingering. In times of low unemployment, it has been shown that most men with long term illness remain active in the labour force (Bartley and Owen 1996). The jobs that had been lost were not only relatively highly paid for the level of education needed, but also involved a high level of exposure to industrial hazards such as falls, burns, chemical spillage, fumes and dusts. The areas in question are also ones with adverse "objective risk" has been shown to produce levels of mortality higher than would be expected on the basis of regional social and economic deprivation as measured by the Townsend index (Langford and Bentham 1996). Gould and Jones (1996) suggest that the distribution of LLTI shown by their multi-level modelling of SAR data suggest a role for occupational disease.

The perception of oneself as having a limiting illness, however, may be a combination of the effect of underlying ill-health and the availability or non-availability of central social roles such as employment as the "breadwinner" (Blane et al 1996, Haynes et al 1997). So the heavy concentration of LLTI in certain areas may be explainable in terms of the shifting availability of such roles to men who are also at high risk of disease. Both economic and cultural factors may have acted to amplify the effects of more direct causes of disease in the production of local rates of limiting long term illness.

County districts have been used in this analysis because they provide a readily accessible geography. They are also relevant as administrative units of resource allocation. Placing an individual in such a context obviously raises questions about the

substantive meaning of 'place' itself. This will be true for any areal unit based on census geography and the whole issue of defining area needs further investigation. A powerful adjunct will then be how fine to draw the net? Rather than attempt to cover these questions we start by demonstrating how an appropriate analytical framework can be applied to one particular geographical hierachy.

The most obvious extension to our analysis would be the inclusion of ward as an intermediate unit in the hierarchy. Compositional measures at the ward level could be included to explain any variation between wards within county districts. Sloggett and Joshi (1994 and 1997) used ward deprivation indicators to describe place alongside individual deprivation characteristics from both 71 and 81 in models to predict health and mortality. Their conclusion that deprivation measured at the individual level had stronger predictive power than– the scores of wards on deprivation indicators might lead policy makers to believe that it is only individual characteristics that matter, and not where you live. The present study suggests that individual effects are not the whole story. It takes larger areal units, and includes information about places which is not also attached to individuals, and uses a statistical methodology which actually separates out otherwise unexplained elements of place from individual characteristics. We have found a significant amount of variation between areas (albeit with larger areal units), and that it is possible, after accounting for individual characteristics, to explain a significant amount of variation between areas, notably, that between prosperous and growth areas with those in coalfields and ports and industry. This suggests that for certain places there may be something about the environment which affects their health over and above individual characteristics.

Both approaches agree that the relationships at the individual level are strong. The apparent contradiction on area effects is probably due to Sloggett and Joshi omitting the sort of geographical information which is included in the area classification, it could also be explained in terms of the differences in the units of analysis and their description, but the fundamental advantage of multilevel modelling is that it is a more sensitive instrument than they were able to use, carefully separating the effect of place and its classification. Subsequent analysis will attempt to elaborate the Sloggett and Joshi (1994, 1997) approach in a multilevel framework.

Our own analysis of level-2 residuals in section 4.2 throws up contradictions between area classification and the expected levels of %LLTI for certain county districts (notably Scunthorpe, Sheffield and Kingston-upon-Hull with much lower levels of reported %LLTI and Warrington with much higher %LLTI than expected). This finding serves as a strong reminder that area and its classification will always be constrained by its definition and description. Contradictions may drive the search for more efficient areal groupings and classification schemes but they may also reveal the absence of subtlety- the extent to which place actually has a role in shaping an individual's health (we know nothing about service provision for example). Formally, we can look harder to discover why the effect of some terms (like periods in and out of the labour market) vary from area to area or test for interactions that explicitly model

the interplay between individual and place. Informally, the existence of such modelling contradiction may take our research questions beyond the statistical information we have at hand. All of these considerations need further attention if we are to gain clearer insights about the health consequences of the link between where you live and who you are.

6. CONCLUSION

What use of multilevel modelling has enabled us to do is analyse the risks of LLTI within a framework that explicitly recognises a population hierarchy where individuals reside within areas. As well as representing a theoretical advantage over conventional OLS (Woodhouse 1996) the modelling reflects the role of area in shaping illness reporting in a social and geographical context.

The adoption of the sick-role is routinely analysed in medical sociology as the combined outcome of "disease", that is, the underlying biological abnormalities causing symptoms, and "illness behaviour", or the response of the individual to those symptoms. Illness behaviour is shaped by the social environment, and reflects the impact of disease on the ability to carry out social roles (Blane et al 1996). We have therefore examined at the individual level a set of variables reflecting the employment role: periods spent out of employment, ethnicity, periods spent in the economically most resilient areas of the country (south east) and downward social mobility from lower to higher status and from better to worse paid types of employment. These experiences over the 20 year period of observation can be seen to have affected the risk of LLTI. They have not, however, completely explained the regional variation. Prevalence of LLTI has been shown to vary between areas defined by the ONS classification, even in men with similar personal histories.

7. REFERENCES

Bartley, M., Owen, C. (1996) Relation between socio-economic status, employment and health during economic change, 1973-1993. *British Medical Journal* 313:446-449.

Beatty, C., and Fothergill, S. (1996) Labour market adjustment in areas of chronic industrial decline: the case of the UK coalfields. Regional Studies, 367, 627-640.

Blane, D., Power, C., Bartley, M. (1996) Illness behaviour and the measurement of class differentials in morbidity. *Journal of the Royal Statistical Society "A"* 1996; 159: 77-92.

Bartley, M. and Plewis. I. (1997) Does Health-Selective Mobility Account for Socio-Economic Differences in Health? *JHSB* December 1997.

Charlton, J. and Wallace, M. (1994) Long-term illness: results from the 1991 Census. *Population Trends* spring: 18-25.

Charlton, J. (1996) Which areas are healthiest? *Population Trends* spring: 17-24.

Cook, D., Bartley, M., Cummins, R. and Shaper, A. (1982) Health of unemployed middle aged men in Great Britain. *Lancet.* 8234: 1290-1294.

Davey Smith, G (1997a): Down at heart - the meaning and implications of social inequalities in cardiovascular disease. *Journal of the Royal College of Physicians of London* 31:.414-424

Davey Smith,G, Neaton, JD, Wentworth, D, Stamler R, Stamler J. (1997) Socioeconomic differentials in mortality risk among men screened for the Multiple Risk Factor Intervention Trial .1. white men *American Journal Of Public Health* 86: 486-496.

Dorling, D. (1997) *Death in Britain: How local mortality rates have changed: 1950s to 1990s* . York. Joseph Rowntree Foundation.

Drever, F., Whitehead, M. (1997) *Inequalities in Health 1997* London: HMSO.

Fielding (1995) Inter-regional migration and intra-generational social class mobility 1971-1991 in Savage, M. and Butler, T. (1995) (eds) *Social Change and the Middle Classes*, London:UCL.

Goldstein, H. (1991). Nonlinear multilevel models: with an application to discrete response data. *Biometrika 78, p.45*.

Goldstein, H. (1995) *Multilevel Statistical Models (2nd edition).* London, Edward Arnold; New York, Halstead Press.

Gould, MI, Jones K. (1996) Analyzing perceived limiting long term illness using UK census microdata. *Social Science and Medicine* 42: 857-869.

Harris, CC. (1987) *Redundancy and Recession in South Wales* Oxford. Blackwell.

Hattersley, L., Creeser, R. (1995) *Longitudinal Study 1971-1991: History, organisation and quality of Data*. HMSO, 1995.

Haynes, R., Bentham, G., Lovett, A., Eimermann, J. (1997) Effect of labour market conditions on reporting of limiting long term illness and permanent sickness in England and Wales. Journal of Epidemiology and Community Health, Vol.51., 283-288.

Heddeke, D. (1997). Personal communication.

Langford I H, Bentham G. (1996) Regional variations in mortality rates in England and Wales, an analysis using multi-level modelling *Social Science and Medicine* 42: 897-908.

Morris LD.(1985) Renegotiation of the domestic division of labour. in B. Roberts, R. Finnegan, D. Gallie (eds.) *New Approaches to Economic Life* Manchester: Manchester U.P.

Openshaw, S., (1984). The modifiable areal unit problem. CATMOG 38, GeoBooks, Norwich.

Phillimore, P., Beattie, A., Townsend, P. (1994) Widening Inequality of Health: Northern England 1981-1991. *British Medical Journal* 1994; 308: 1125-8.

Shaper A. (1984) Geographic variations in cardiovascular mortality in Great Britain. *British Medical Bulletin*. 40,4: 366-373

Sloggett, A. and Joshi, H. (1994) Higher mortality in deprived areas: community or personal disadvantage? *British Medical Journal 1994*; 309:1470-1474.

Sloggett, A. and Joshi, H. (1997) Indicators of deprivation in people and places: longitudinal perspectives. Environment and Planning A, Vol. 29, (in press).

Wallace, M., Denham, C. (1996) The ONS Classification of Local and Health Authorities of Great Britain.HMSO: London.

Whitehead, M (1987) *The Health Divide*: *Inequalities in health in the 1980s*. London: Health Education Council.

Woodhouse, G. (1996) *Multilevel Modelling Applications: A guide for users of MlN*. London, Multilevel Models Project, Institute of Education, 1996.

Appendix A

The 37 small area statistics that make up the ONS classification are.

Demographic Structure	% of residents aged 0-4
	% of residents aged 5-14
	% of residents aged 25-44
	% of residents aged 45-64
	% of residents aged over 65
	% of residents identifying as black
	% of residents identifying as asian
Household Composition	average number of residents per household
	households with 4+ children as percentage of all households with children
	% of all households which are single working age person households
Housing	% of residents in owner occupied accommodation
	% of residents in public sector rented accommodation
	% of residents in private rented accommodation
	% of residents with no central heating
	terraced housing as a % of all dwellings
	purpose built flats as a % of all dwellings
	% of dwellings with 7+ rooms
	average number of rooms per person
Socio Economic Character	% of residents living at a different address 12 months earlier
	% of residents with an HE qualification
	% of residents in households where the head is in social class I or II
	% of residents in households headed by social class IIIN
	% of residents in households headed by social class IV or V
	% of households with 2 working adults and no children
	% of dependents in lone carer households
	% of children in single adult households
	% of residents in households without a car
	% of households with 2 or more cars
	persons in employment travelling to work by public transport
	directly standardised rate for limiting long term illness

Employment	unemployment rate for men and women of working age
	% of working age women who work
	% of residents who are students
	persons in employment in agriculture
	persons in employment in mining
	persons in employment in manufacturing
	persons in employment in service employment

Appendix B - Ranking of County Districts by observed percentage of reported limiting long-term illness amongst men aged 36-65 in 1991(%LLTI)

Rank	District	%LLTI	Area Code
1	Rhondda	39.42	Coalfields
2	Blaenau Gwent	36.44	Coalfields
3	Easington	32.45	Coalfields
4	Llanelli	32.41	Coalfields
5	Carmarthen	31.96	Coast and Countryside
6	Cynon Valley	30.77	Coalfields
7	Neath	29.41	Coalfields
8	Merthyr Tydfil	29.35	Coalfields
9	Port Talbot	29.27	Coalfields
10	Dinefwr	28.79	Coast and Countryside
11	Rhymney Valley	28.77	Coalfields
12	Middlesbrough	27.41	Ports and Industry
13	Ogwr	26.79	Coalfields
14	Langbaurgh on Tees	26.03	Coalfields
15	Rhuddlan	25	Resort and Retirement
16	Burnley	25	Manufacturing
17	Gateshead	24.68	Ports and Industry
18	Lliw Valley	24.04	Coalfields
19	Bolsover	23.85	Coalfields
20	Blackburn	23.44	Manufacturing
21	Derwentside	23.44	Coalfields
22	Salford	23.43	Ports and Industry
23	Knowsley	23.04	Ports and Industry
24	Sedgefield	23.02	Coalfields
25	Doncaster	22.55	Coalfields
26	Islwyn	22.22	Coalfields
27	Ashfield	22.16	Coalfields
28	Brecknock	21.74	Coast and Countryside
29	South Tyneside	21.62	Ports and Industry
30	Camden	21.5	Inner London
31	Hackney	21.43	Inner London
32	North Devon	21.43	Coast and COuntryside
33	Hartlepool	21.32	Coalfields
34	Newham	21.32	Inner London
35	North Tyneside	21.26	Ports and Industry
36	St Helens	21.17	Coalfields
37	Barnsley	20.95	Coalfields
38	Wakefield	20.75	Coalfields
39	Allerdale	20.71	Mixed Urban and Rural
40	Berwick Upon Tweed	20.69	Scotland
41	Sunderland	20.56	Ports and Industry

42	Aberconwy	20.51	Coast and Countryside
43	Medina	20.39	Resort and Retirement
44	Kerrier	20.33	Coast and Countryside
45	Stoke on Trent	20.26	Coalfields
46	Liverpool	20.22	Ports and Industry
47	Dover	20.16	Mixed Economies
48	Newcastle Upon Tyne	20.16	Ports and Industry
49	Tynedale	20	Coast and Countryside
50	Carrick	19.81	Coast and Countryside
51	Wigan	19.8	Coalfields
52	Torfaen	19.66	Coalfields
53	Colwyn	19.57	Coast and Countryside
54	Rotherham	19.46	Coalfields
55	Oldham	19.22	Manufacturing
56	Leicester	19.21	Manufacturing
57	Durham	19.18	Mixed Economies
58	Westminster	19.13	Inner London
59	Preseli Pembrokeshire	19	Coast and Countryside
60	Manchester	18.92	Ports and Industry
61	East Lindsey	18.79	Coast and Countryside
62	Haringey	18.75	Inner London
63	South Pembrokeshire	18.64	Coast and Countryside
64	Wrexham Maelor	18.56	Coalfields
65	Southwark	18.55	Inner London
66	Wansbeck	18.37	Coalfields
67	Mansfield	18.34	Coalfields
68	Taff-Ely	18.31	Coalfields
69	Lincoln	18.27	Mixed Economies
70	Barking and Dagenham	18.23	Ports and Industry
71	Nottingham	18.21	Ports and Industry
72	Great Grimsby	18.18	Ports and Industry
73	Teesdale	18	Coast and Countryside
74	Rochdale	17.95	Manufacturing
75	Sefton	17.95	Coalfields
76	Preston	17.79	Manufacturing
77	Warrington	17.7	Most Prosperous
78	Swansea	17.56	Coalfields
79	Sandwell	17.45	Manufacturing
80	Thurrock	17.44	Mixed Economies
81	Tower Hamlets	17.21	Inner London
82	Pendle	17.04	Manufacturing
83	Chester le Street	17.02	Mixed Economies
84	West Lindsey	16.94	Coast and Countryside
85	Stockton on Tees	16.89	Coalfields
86	Bradford	16.86	Manufacturing
87	Halton	16.76	Coalfields
88	Boothferry	16.67	Mixed Urban and Rural
89	Newport	16.67	Coalfields
90	Plymouth	16.61	Mixed Economies

91	Luton	16.59	Manufacturing
92	Wirral	16.53	Coalfields
93	Hammersmith	16.51	Inner London
94	Tameside	16.51	Manufacturing
95	Ynys Mon - Isle of Anglesey	16.38	Coast and Countryside
96	Rossendale	16.38	Manufacturing
97	Kennet	16.33	Most Prosperous
98	Kingston Upon Hull	16.17	Ports and Industry
99	Radnorshire	16.13	Coast and Countryside
100	Ealing	16.12	Inner London
101	Lambeth	16.11	Inner London
102	Birmingham	16.08	Manufacturing
103	Boston	16	Scotland
104	Weymouth and Portland	16	Mixed Economies
105	Bolton	15.94	Manufacturing
106	Norwich	15.92	Mixed Economies
107	North East Derbyshire	15.87	Mixed Urban and Rural
108	Walsall	15.85	Manufacturing
109	West Somerset	15.79	Coast and Countryside
110	Portsmouth	15.79	Mixed Economies
111	Rother	15.75	Resort and Retirement
112	Hounslow	15.73	Services and Education
113	North Cornwall	15.6	Coast and COuntryside
114	Wolverhampton	15.54	Manufacturing
115	Copeland	15.53	Coalfields
116	Cardiff	15.45	Coalfields
117	Sheffield	15.45	Ports and Industry
118	South Ribble	15.43	Most Prosperous
119	Blackpool	15.38	Resort and Retirement
120	Cleethorpes	15.32	Mixed Urban and Rural
121	The Wrekin	15.31	Mixed Economies
122	South Norfolk	15.29	Most Prosperous
123	Newcastle Under Lyme	15.26	Mixed Urban and Rural
124	Wear Valley	15.15	Coalfields
125	Wyre	15.11	Resort and Retirement
126	Delyn	15.05	Mixed Urban and Rural
127	Lancaster	14.97	Resort and Retirement
128	Islington	14.96	Inner London
129	Newark and Sherwood	14.94	Mixed Urban and Rural
130	Leeds	14.91	Mixed Economies
131	Nuneaton and Bedworth	14.9	Mixed Urban and Rural
132	Arfon	14.86	Coast and Countryside
133	Hereford	14.75	Mixed Economies
134	Alyn and Deeside	14.75	Mixed Urban and Rural
135	Barrow in Furness	14.75	Manufacturing
136	Coventry	14.7	Manufacturing
137	Havant	14.69	Mixed Urban and Rural
138	Chesterfield	14.58	Coalfields
139	Bury	14.56	Most Prosperous

140	Fylde	14.42	Coast and Countryside
141	Amber Valley	14.42	Mixed Urban and Rural
142	Monmouth	14.39	Coast and Countryside
143	Arun	14.29	Resort and Retirement
144	Craven	14.29	Coast and Countryside
145	Waltham Forest	14.17	Inner London
146	Oadby and Wigston	14.14	Most Prosperous
147	Lichfield	14.12	Most Prosperous
148	Trafford	14.11	Most Prosperous
149	Forest of Dean	14.06	Mixed Urban and Rural
150	Restormel	14.05	Coast and Countryside
151	Maidstone	13.95	Most Prosperous
152	Exeter	13.91	Services and Education
153	North Norfolk	13.87	Coast and Countryside
154	High Peak	13.87	Most Prosperous
155	Tendring	13.79	Resort and Retirement
156	Bassetlaw	13.78	Mixed Urban and Rural
157	Calderdale	13.67	Manufacturing
158	Gosport	13.64	Mixed Economies
159	Bristol	13.63	Mixed Economies
160	Kirklees	13.62	Manufacturing
161	Stockport	13.61	Most Prosperous
162	Brent	13.46	Inner London
163	Thanet	13.43	Resort and Retirement
164	East Yorkshire	13.38	Coast and COuntryside
165	Kensington and Chelsea	13.33	Inner London
166	Cannock Chase	13.29	Mixed Urban and Rural
167	Reading	13.25	Services and Education
168	Holderness	13.25	Mixed Urban and Rural
169	Breckland	13.21	Mixed Urban and Rural
170	Southampton	13.17	Mixed Economies
171	Poole	13.16	Most Prosperous
172	Ribble Valley	13.04	Most Prosperous
173	Sedgemoor	13.04	Mixed Urban and Rural
174	Bexley	13.03	Most Prosperous
175	Greenwich	13.03	Inner London
176	Havering	13.01	Most Prosperous
177	Basildon	13	Mixed Economies
178	Gillingham	12.95	Mixed Economies
179	Wandsworth	12.93	Inner London
180	Corby	12.9	Coalfields
181	Redditch	12.9	Mixed Economies
182	Lewisham	12.86	Inner London
183	Colchester	12.83	Most Prosperous
184	Ellesmere Port and Neeston	12.82	Mixed Urban and Rural
185	Caradon	12.82	Coast and Countryside
186	Harrogate	12.77	Coast and Countryside
187	Montgomeryshire	12.77	Coast and Countryside
188	South Shropshire	12.68	Coast and Countryside

189	Blyth Valley	12.67	Mixed Economies
190	South Kesteven	12.66	Mixed Urban and Rural
191	Watford	12.62	Mixed Economies
192	Crewe and Nantwich	12.58	Mixed Urban and Rural
193	Chorley	12.57	Most Prosperous
194	Southend on Sea	12.56	Resort and Retirement
195	Ashford	12.5	Mixed Urban and Rural
196	Staffordshire Moorlands	12.5	Mixed Urban and Rural
197	Derby	12.42	Manufacturing
198	Darlington	12.41	Mixed Economies
199	Teignbridge	12.34	Coast and Countryside
200	Northampton	12.33	Mixed Economies
201	Richmondshire	12.31	Most Prosperous
202	Redbridge	12.29	Services and Education
203	Stroud	12.28	Most Prosperous
204	Cotswold	12.28	Coast and Countryside
205	Bath	12.24	Services and Education
206	Alnwick	12.24	Scotland
207	Ipswich	12.21	Mixed Economies
208	Chester	12.21	Coast and Countryside
209	Dwyfor	12.2	Coast and COuntryside
210	Macclesfield	12.13	Growth
211	Brighton	12.11	Services and Education
212	Canterbury	12.1	Resort and Retirement
213	Gloucester	12.1	Mixed Economies
214	Dudley	12.1	Mixed Urban and Rural
215	Vale of Glamorgan	12.09	Coalfields
216	Chichester	12.08	Coast and Countryside
217	Hyndburn	12.07	Manufacturing
218	Torridge	12	Coast and Countryside
219	Oswestry	12	Mixed Urban and Rural
220	Castle Point	11.94	Most Prosperous
221	Scarborough	11.92	Resort and Retirement
222	West Lancashire	11.89	Mixed Urban and Rural
223	South Holland	11.88	Coast and COuntryside
224	Eastleigh	11.83	Most Prosperous
225	Rochester Upon Medway	11.76	Mixed Economies
226	Gravesham	11.72	Mixed Economies
227	Worcester	11.7	Most Prosperous
228	North Bedfordshire	11.68	Most Prosperous
229	Warwick	11.62	Most Prosperous
230	Enfield	11.61	Services and Education
231	Penwith	11.58	Coast and Countryside
232	Hambleton	11.57	Coast and Countryside
233	Torbay	11.56	Resort and Retirement
234	Oxford	11.54	Services and Education
235	South Staffordshire	11.54	Most Prosperous
236	Derbyshire Dales	11.54	Coast and COuntrside
237	North Kesteven	11.5	Coast and Countryside

238	East Devon	11.48	Resort and Retirement
239	Shepway	11.48	Resort and Retirement
240	York	11.48	Mixed Economies
241	Salisbury	11.46	Coast and Countryside
242	Wyre Forest	11.46	Mixed Urban and Rural
243	Erewash	11.45	Mixed Urban and Rural
244	Spelthorne	11.43	Most Prosperous
245	East Yorkshire Borough of Beverley	11.22	Growth
246	Ryedale	11.18	Caost and Countryside
247	Selby	11.18	Most Prosperous
248	South Somerset	11.15	Mixed Urban and Rural
249	Rugby	11.11	Most Prosperous
250	Dartford	11.11	Most Prosperous
251	West Wiltshire	11.11	Mixed Urban and Rural
252	Aylesbury Vale	11.11	Most Prosperous
253	South Herefordshire	11.11	Coast and Countryside
254	Crawley	11.01	Mixed Economies
255	Waveney	10.98	Resort and Retirement
256	Barnet	10.92	Services and Education
257	Hinckley and Bosworth	10.88	Most Prosperous
258	Braintree	10.86	Most Prosperous
259	West Devon	10.84	Coast and Countryside
260	Daventry	10.83	Most Prosperous
261	Taunton Deane	10.79	Coast and COuntryside
262	Welwyn Hatfield	10.79	Most Prosperous
263	South Derbyshire	10.79	Mixed Urban and Rural
264	Hastings	10.78	Resort and Retirement
265	Glyndwr	10.77	Coast and Countryside
266	South Lakeland	10.71	Coast and COuntryside
267	Charnwood	10.7	Most Prosperous
268	Bracknell Forest	10.69	Most Prosperous
269	Fenland	10.66	Mixed Urban and Rural
270	Bournemouth	10.64	Resort and Retirement
271	Blaby	10.49	Most Prosperous
272	Harlow	10.48	Mixed Economies
273	Hillingdon	10.46	Most Prosperous
274	Great Yarmouth	10.43	Mixed Economies
275	Dacorum	10.43	Most Prosperous
276	Epping Forest	10.42	Most Prosperous
277	Stafford	10.34	Most Prosperous
278	Woking	10.32	Most Prosperous
279	Eastbourne	10.31	Resort and Retirement
280	South Hams	10.2	Coast and Countryside
281	Rutland	10.2	Most Prosperous
282	Thamesdown	10.16	Mixed Economies
283	Broxtowe	10.07	Most Prosperous
284	Meirionnydd	10	Coast and Countryside
285	East Cambridgeshire	10	Mixed Urban and Rural
286	North Warwickshire	10	Mixed Urban and Rural

287	Merton	9.95	Services and Education
288	Bromsgrove	9.85	Most Prosperous
289	Tamworth	9.8	Mixed Economies
290	Vale Royal	9.79	Mixed Urban and Rural
291	Mid Devon	9.78	Coast and Countryside
292	Lewes	9.78	Coast and COuntryside
293	Mendip	9.72	Mixed Urban and Rural
294	North Wiltshire	9.68	Most Prosperous
295	Milton Keynes	9.68	Mixed Economies
296	Gedling	9.66	Most Prosperous
297	Basingstoke and Deane	9.62	Most Prosperous
298	Hove	9.62	Resort and Retirement
299	Worthing	9.6	Resort and Retirement
300	East Staffordshire	9.58	Mixed Urban and Rural
301	West Dorset	9.57	Coast and Countryside
302	East Hampshire	9.56	Most Prosperous
303	Glanford	9.56	Mixed Urban and Rural
304	Kings Lynn and West Norfolk	9.52	Mixed Urban and Rural
305	Cheltenham	9.52	Services and Education
306	Test Valley	9.52	Most Prosperous
307	Winchester	9.52	Growth
308	Ceredigion	9.52	Coast and Countryside
309	St Edmundsbury	9.42	Mixed Urban and Rural
310	Tunbridge Wells	9.4	Growth
311	Tewkesbury	9.38	Most Prosperous
312	Cherwell	9.2	Most Prosperous
313	Stevenage	9.17	Mixed Economies
314	Croydon	9.16	Services and Education
315	Kingston Upon Thames	9.14	Services and Education
316	East Hertfordshire	9.14	Most Prosperous
317	Purbeck	9.09	Coast and Countryside
318	Maldon	9.09	Most Prosperous
319	Broxbourne	9.03	Most Prosperous
320	Brentwood	9.02	Growth
321	Sevenoaks	8.99	Growth
322	Swale	8.98	Mixed Urban and Rural
323	Richmond Upon Thames	8.96	Services and Education
324	Bridgnorth	8.89	Most Prosperous
325	Slough	8.82	Manufacturing
326	Carlisle	8.82	Mixed Economies
327	Melton	8.82	Mixed Urban and Rural
328	Congleton	8.72	Most Prosperous
329	Epsom and Ewell	8.7	Growth
330	Wealdon	8.63	Coast and Countryside
331	Bromley	8.53	Services and Education
332	Mid Bedfordshire	8.47	Most Prosperous
333	Scunthorpe	8.42	Coalfields
334	Rochford	8.4	Most Prosperous
335	Waverley	8.28	Growth

336	Shrewsbury and Atcham	8.22	Coast and Countryside
337	Wansdyke	8.22	Most Prosperous
338	Tandridge	8.2	Growth
339	Uttlesford	8.18	Most Prosperous
340	Mid Suffolk	8.16	Mixed Urban and Rural
341	Elmbridge	8.16	Growth
342	Broadland	8.15	Most Prosperous
343	Kettering	8.11	Most Prosperous
344	South Northamptonshire	8.09	Most Prosperous
345	South Wight	8.05	Resort and Retirement
346	Sutton	8.03	Services and Education
347	Kingswood	8.03	Most Prosperous
348	South Bedfordshire	8	Most Prosperous
349	Solihull	7.98	Most Prosperous
350	Malvern Hills	7.95	Coast and Countryside
351	Reigate and Banstead	7.89	Growth
352	Windsor and Maidenhead	7.84	Growth
353	West Oxfordshire	7.81	Most Prosperous
354	Vale of White Horse	7.78	Most Prosperous
355	Wellingborough	7.77	Mixed Economies
356	Harrow	7.69	Services and Education
357	Harborough	7.69	Most Prosperous
358	Peterborough	7.65	Mixed Economies
359	Cambridge	7.61	Services and Education
360	Woodspring	7.6	Coast and Countryside
361	St Albans	7.53	Growth
362	East Dorset	7.44	Coast and Countryside
363	Babergh	7.44	Most Prosperous
364	Rushcliffe	7.43	Growth
365	Runnymeade	7.37	Most Prosperous
366	Leominster	7.35	Coast and Countryside
367	Castle Morpeth	7.32	Coast and COuntryside
368	North West Leicestershire	7.2	Mixed Urban and Rural
369	Tonbridge and Malling	7.19	Most Prosperous
370	Eden	7.06	Coast and Countryside
371	Hertsmere	7.02	Growth
372	East Northamptonshire	6.98	Mixed Urban and Rural
373	Guildford	6.97	Growth
374	South Bucks	6.96	Growth
375	Suffolk Coastal	6.79	Coast and Countryside
376	Fareham	6.72	Most Prosperous
377	New Forest	6.54	Coast and Countryside
378	Christchurch	6.45	Resort and Retirement
379	Horsham	6.43	Growth
380	Rushmoor	6.12	Most Prosperous
381	Northavon	6.02	Most Prosperous
382	Huntingdonshire	5.99	Most Prosperous
383	Wychavon	5.81	Most Prosperous
384	South Oxfordshire	5.65	Most Prosperous

385	Wokingham	5.53	Growth
386	Adur	5.38	Resort and Retirement
387	Chelmsford	5.34	Most Prosperous
388	South Cambridgeshire	5.23	Most Prosperous
389	Stratford on Avon	5.23	Most Prosperous
390	Hart	5.22	Growth
391	North Shropshire	5.13	Coast and Countryside
392	Chiltern	5.1	Growth
393	Wycombe	4.98	Most Prosperous
394	North Dorset	4.69	Coast and Countryside
395	Mid Sussex	4.67	Growth
396	North Hertforshire	3.66	Most Prosperous
397	Three Rivers	3.64	Growth
398	Forest Heath	3.45	Most Prosperous
399	Newbury	3.15	Most Prosperous
400	Mole Valley	2.8	Growth
401	Surrey Heath	0.82	Growth

Source: ONS Longitudinal Study