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Does social mobility affect the size of the socioeconomic mortality differential?: evidence from the Office for National Statistics Longitudinal Study

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Summary. The effect of social mobility on the socioeconomic differential in mortality is examined with data from the Office for National Statistics Longitudinal Study. The analyses involve 46980 men aged 45–64 years in 1981. The mortality risk of the socially mobile is compared with the mortality risk of the socially stable after adjustment for their class of origin (their social class in 1971) and class of destination (their social class in 1981) separately. Among those in employment there is some evidence that movement out of their class of origin is in the direction predicted by the idea of health-related social mobility. This evidence, however, seems strongest for causes of death which are least likely to have been preceded by prolonged incapacity. Movement into the class of destination, however, shows the opposite relationship with mortality. Compared with the socially stable members of their class of destination, the upwardly mobile tend to have higher mortality and the downwardly mobile tend to have lower mortality. This relationship with the class of destination, it is suggested, may explain why socioeconomic mortality differentials do not widen with increasing age.

Keywords: Gradient constraint; Mortality; Office for National Statistics Longitudinal Study; Social class; Social mobility; Social selection

1. Introduction

Social selection has long been considered as one of the processes by which social class differences in health are created (Ogle, 1885; Perrott and Collins, 1935; Lawrence, 1948; Perrott and Sydenstriker, 1955; Illsley, 1955; Meadows, 1961; Goldberg and Morrison, 1963; Black *et al.*, 1980; West, 1991). The notion is simple. An individual's health status is one of the factors influencing their chances of upward or downward social mobility. Individuals in good health are more likely to move up the social hierarchy, and those in poor health to move down, and this process of health-related social mobility creates or contributes to social class differences in health.

The social selection argument in fact contains two separate propositions. First, health status is related to the direction of social mobility. Second, health-related social mobility creates or widens social class differences in health. These two propositions are often

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conflated, so that the second is assumed to follow from a demonstration of the first. This reasoning finds its methodological form in analyses which emphasize the out-flows from the class of origin and neglect the in-flows into the class of destination. The out-flows are where health-related social mobility can be observed, but it is the in-flows which will determine the net effect of mobility on social gradients in health.

Attention has been drawn recently to the logical and methodological shortcomings in the traditional approach to health-related social mobility. Bartley and Plewis (1997) have pointed out that the upwardly mobile may be in better health than the socially stable members of their class of origin, but in worse health than the socially stable in their class of destination. Similarly, the downwardly mobile may be in worse health than the socially stable members of their class of origin but experience better health than the socially stable in their class of destination. This more complex relationship between health and social mobility, they suggest, would tend to constrain rather than to create or contribute to social class differences in health (Bartley and Plewis, 1997).

The present paper examines these issues, concentrating particularly on in-flows into the class of destination and the effect of these flows on the final socioeconomic mortality differential. Previous analyses (Goldblatt, 1989) of the Office for National Statistics (ONS), formerly the Office of Population Censuses and Surveys, Longitudinal Study (LS) data are extended by including deaths to 1992, by examining different categories of cause of death and by explicitly considering both the class of origin and the class of destination.

The literature suggested several ways of analysing these social mobility data. One set of methods has been developed to test the effects of social mobility on behaviours as diverse as fertility choices and political voting decisions (Hope, 1971; Sobel, 1981, 1985; De Graaf and Heath, 1992; Clifford and Heath, 1993). These methods are not the most suitable for the present analyses whose focus is the effect of social mobility on the distribution of premature death within the population, not the effect of social mobility on the behaviour (fertility or voting) of the subset of the population found within each cell of a social mobility table. The upward mobility of Conservative voters, for example, and the downward mobility of Labour voters is not considered the reason for social class differences in political allegiance, but a comparable upward mobility of the healthy and downward mobility of the sick is suggested as the reason for social class differences in health. And, to pursue the comparison, although social mobility may independently affect political allegiance, it is no longer considered to be a plausible influence on the chances of premature death.

Instead, the methods used in the present analyses are those developed by Fox (1990) and modified by Bartley and Plewis (1997) for previous studies of health and social mobility. These have much in common with the methods already discussed. Rather than collapsing the complete mobility table into mobility groups, a modelling approach is used which recognizes that some forms of social mobility, e.g. upward mobility from the most privileged stratum and downward mobility from the least privileged stratum, are impossible (Faresjo *et al.*, 1994). Fox (1990) advocated examining the three-way interaction between class of origin, class of destination and health, but we have followed Bartley and Plewis (1997) in examining the relationship of mortality to the direction of mobility, adjusting in separate models sequentially for the class of origin and the class of destination.

2. Methods

The ONS LS has been described in detail elsewhere (Fox and Goldblatt, 1982). It comprises a 1% sample of the population of England and Wales, about 600 000 individuals. Information at the 1971 and 1981 censuses, together with other routinely available data, including death

registration, is linked to LS members' records through the National Health Service Central Registry. It is therefore possible to examine social mobility between the two census points and to link this mobility to subsequent mortality between 1981 and 1992.

The analyses are limited to 46980 men aged 35–54 years in 1971. These comprise that subset of LS members whose social class in 1981 has been recoded to the classification extant in 1971. An analysis of this subset consequently avoids the problem of artefactual social mobility caused by changes in the classification of social class. The six occupational social class categories in the Registrar General's classification are used (I, II, IIIN, IIIM, IV and V), with social class I, professionals, dubbed the highest and social class V, unskilled manual workers, described as the lowest. Men have been classified as 'upwardly mobile' if their class in 1981 was at a higher level than their class in 1971, 'downwardly mobile' if their class was at a lower level and 'stable' if their class in 1981 was the same as in 1971.

A relationship between economic activity and mortality has long been recognized, so the employed and the unemployed were separated in these analyses. There were 43077 sample members employed at the time of the 1981 census and 3903 who were unemployed (defined as seeking work during the week before the census). Of the employed, 6836 died during the following 12 years (1981–1992), as did 897 of the unemployed.

Mortality among the employed is examined in relation to deaths due to all causes combined and, subsequently, causes which can be categorized plausibly as 'acute' (2771 deaths) or 'chronic' (957 deaths). Deaths in the chronic diseases category are more likely to have been preceded by prolonged incapacity and hence to have provided sufficient time to have consequences in terms of social mobility; any influence of health-related social mobility should be stronger in the chronic diseases category of deaths than in the acute diseases category.

The acute diseases category contains international classification of diseases (ninth revision) codes: 1620–1629 (carcinoma of the bronchus), 4100–4109 (acute ischaemic heart disease) and 8000–9999 (accidents, poisoning and violence, minus suicide which in this age group may have been preceded by major psychiatric illness). The chronic diseases category includes 4020–4029 (hypertensive heart disease), 4130–4149 (angina pectoris), 4280–4289 (chronic ischaemic heart disease), 4900–4939 (heart failure) and 5000–5059 (bronchitis, emphysema and the pneumoconioses).

On the basis of person-years at risk, standardized mortality ratios (SMRs) with 95% confidence intervals were calculated using age-specific death-rates, with all males in the LS present at both censuses as the standard. Results are first presented as a social mobility matrix: social class in 1971 (origin) against social class in 1981 (destination). The SMR in each cell of the matrix is a measure of the risk of mortality attached to a mobility status between the two time points.

The relationship between the direction of mobility and mortality was examined further, using Cox regression models. In their examination of the relationship between mobility and limiting long-term illness, Bartley and Plewis (1997) used the strategy of adjusting for the class of origin and class of destination in separate models. We used the same approach, with mortality as our binary outcome variable and adjusted for its variation by age by fitting age at entry to risk in 5-year age bands. Statistical interaction between the class of origin and mobility and between the class of destination and mobility were tested for in the models. The main analysis included social mobility as an independent variable with three categories: upwardly mobile, stable and downwardly mobile. A more detailed analysis was done using the fully expanded mobility variable but, because of the small number of deaths in some of the cells, this was done only for all-cause mortality and the social mobility categories with 25

deaths or more. Unlike Bartley and Plewis (1997), however, we used individual level records in the Cox regression analyses, so socially mobile individuals in social class I could only move downwards and in social class V could only move upwards. Hazard ratios with 95% confidence intervals were derived, using those who were socially stable as the reference group.

The models fitted were designed to test the sensitivity of the results to potential biases. The possibility of health selection into employment status was tested by the conventional method of excluding mortality during the first 5 years of follow-up. The possibility of differential health selection out of the labour market was tested by assigning those classified as inadequately described and unoccupied in 1981 to their 1971 social class, thus assuming that they were socially stable. The possibility of imprecise categorization of ischaemic heart disease as acute or chronic was tested by excluding ischaemic heart disease deaths from the acute and chronic disease groups described earlier.

3. Results

Table 1 presents the distribution of social mobility of those employed at the 1981 census. 65% of the individuals included were socially stable between 1971 and 1981 (these individuals occupy the six cells on the diagonal of the main part of Table 1). Those who changed social class between 1971 and 1981 are found in the off-diagonal cells: either the 15 cells above the diagonal (downwardly mobile) or the 15 cells below the diagonal (upwardly mobile). Of those assigned a social class in 1971, 15% were downwardly mobile by 1981 and 20% upwardly mobile. The bulk of social mobility is into adjacent or next adjacent cells and long-range mobility, e.g. movement from social class I in 1971 to social class V in 1981, is unusual. Only seven of the off-diagonal cells contain 10% or more of their respective 1971 class of origin.

Table 2 presents mortality due to all causes (number of deaths and SMRs) for each cell of Table 1. An incremental inverse mortality gradient is found among the men remaining in the same social class (matrix diagonal). About two-thirds of the subjects are located in these cells, and their mortality gradient resembles those of the entire classes of origin and destination. It is noticeable, however, that the mortality differential by class of destination (the lowest row) is narrower than that of the socially stable.

Table 3 presents the regression results for all-cause mortality among the employed during the whole period of follow-up. The first model adjusts for age at entry to the study and class of origin. After adjustment the inverse socioeconomic mortality gradient remains and, in relation to the socially stable (hazard ratio 1), the upwardly mobile have a lower but not

Table 1. Distribution of social class mobility between the 1971 and 1981 censuses for men aged 45–64 years and employed at the 1981 census

Social class of origin (1971)	*Numbers for the following social classes of destination (1981):*						*Unclassified*	*All*
	I	*II*	*IIIN*	*IIIM*	*IV*	*V*		
I	1759	553	141	130	22	2	4	2611
II	541	6901	861	824	367	60	28	9582
IIIN	248	1238	2562	346	308	56	17	4775
IIIM	293	1409	527	12054	1678	586	47	16594
IV	132	419	461	1779	3565	461	38	6855
V	37	53	88	582	569	813	17	2159
Unclassified	72	183	84	135	131	47	64	716
All	3082	10756	4724	15850	6640	2025	215	43292

Table 2. SMRs and 95% confidence intervals CI by social class in 1971 and 1981, follow-up 1981–1992, for men aged 45–64 years and employed at the 1981 census

Social class of origin (1971)		*Results for the following social classes of destination (1981):*						*Unclassified*	*All*
		I	*II*	*IIIN*	*IIIM*	*IV*	*V*		
I									
	SMR	65†	63†	75	59	71	—	—	65†
	CI	56–74	47–81	46–114	31–101	15–206			57–72
	Deaths	205	56	21	13	3	0	0	298
II									
	SMR	70†	70†	84†	84†	94	116	65	74†
	CI	54–89	66–75	71–99	70–99	74–118	67–189	18–166	70–78
	Deaths	67	927	146	132	74	16	4	1366
IIIN									
	SMR	71	71†	81†	80	91	128	141	80†
	CI	49–101	61–84	73–89	59–106	69–118	72–211	39–362	74–86
	Deaths	32	153	393	50	58	15	4	705
IIIM									
	SMR	67†	82†	73†	87†	95	105	147	87†
	CI	46–93	71–94	58–92	83–91	84–106	87–126	78–252	84–91
	Deaths	33	200	74	1906	309	118	13	2653
IV									
	SMR	62	104	100	95	94	110	136	96
	CI	35–103	82–130	81–123	85–106	87–101	90–134	65–251	91–101
	Deaths	15	75	93	303	663	101	10	1260
V									
	SMR	58	119	161†	103	127†	116	104	116†
	CI	16–147	57–220	102–242	84–125	106–150	100–134	21–303	106–127
	Deaths	4	10	23	102	132	187	3	461
Unclassified									
	SMR	66	61†	92	80	86	133	95	81†
	CI	26–135	36–97	47–160	48–125	52–134	66–237	38–195	66–99
	Deaths	7	18	12	19	19	11	7	93
All									
	SMR	66†	73	84†	88†	96	112†	114†	85†
	CI	60–73	69–77	78–90	84–91	91–102	102–123	82–154	83–87
	Deaths	363	1439	762	2525	1258	448	41	6836

†SMR significantly different from 100.

statistically significant risk of death and the downwardly mobile a higher risk of death ($p < 0.05$). The second model adjusts for age at entry to the study and class of destination. After adjustment a somewhat narrower inverse socioeconomic mortality gradient is found and, compared with the socially stable, the pattern is reversed: it is the upwardly mobile who have the higher risk of death ($p < 0.05$) while the downwardly mobile have the lower, but not statistically significant, risk.

Table 4 pursues these class-of-destination results by examining the fully expanded mobility variable. Even when the analysis is confined to the most general level (i.e. all-cause mortality), the numbers of deaths in some of the cells in the full social mobility table are small. Results are not presented for the nine cells which contain fewer than 25 deaths. All except one of the remaining upward mobility cells have a higher risk of mortality than the socially stable in their class of destination, and in the case of three of these cells the difference is statistically significant. Although none of the differences reach conventional levels of statistical significance, only two of the downward mobility cells have a risk of mortality which is higher than that of the socially stable in their destination class.

Table 3. Relationship between social class mobility and all-cause mortality gradient after adjusting for the class of origin and class of destination in separate models: hazard ratios and 95% confidence intervals CI, 1981–1992, for employed men in 1981

	Hazard ratio	*95% CI*
Model 1: social class of origin (1971)		
Age	1.69†	1.65–1.73
Class I	1.00	
Class II	1.16†	1.02–1.32
Class IIIN	1.28†	1.12–1.47
Class IIIM	1.39†	1.23–1.57
Class IV	1.57†	1.38–1.78
Class V	1.94†	1.67–2.26
Stable	1.00	
Up	0.96	0.90–1.03
Down	1.15†	1.08–1.23
Model 2: social class of destination (1981)		
Age	1.69†	1.65–1.73
Class I	1.00	
Class II	1.09	0.97–1.23
Class IIIN	1.27†	1.11–1.45
Class IIIM	1.35†	1.20–1.52
Class IV	1.52†	1.33–1.72
Class V	1.80†	1.54–2.09
Stable	1.00	
Up	1.15†	1.08–1.23
Down	0.96	0.89–1.03

†$p < 0.05$.

Two types of potential bias are examined in Table 5. The distribution of the risk of mortality is affected little either by excluding death during the first 5 years of follow-up or by treating the 1981 unclassified subjects as socially stable. The hazard ratios which result from these two sensitivity tests are very similar to those in Table 3. Most relevantly, the downwardly mobile retain higher risks of mortality than those who are stable in their class of origin, as do the upwardly mobile in relation to those who are stable in their class of destination.

Table 6 presents the regression results for the causes of death which have been categorized as acute or chronic. The relationship between the direction of social mobility and risk of mortality from acute diseases is very similar to that for deaths due to all causes. Compared with the socially stable in their class of origin the downwardly mobile have a higher risk of death ($p < 0.05$). Adjusted for their class of destination, however, it is the upwardly mobile who have the higher risk ($p < 0.05$). The risk of mortality from the chronic diseases shows a similar but weaker relationship with the direction of social mobility; none of the hazard ratios reaches conventional levels of statistical significance.

The analysis presented in Table 6 was repeated after deaths due to ischaemic heart disease had been excluded from both the acute and the chronic diseases categories (results not presented). The pattern of the relationship between the direction of mobility and risk of mortality remained largely unchanged by this sensitivity test. The risk of mortality from the remaining acute causes of death was higher in the downwardly mobile ($p < 0.05$) than in those who were socially stable in their class of origin; it was also higher in the upwardly mobile ($p < 0.05$) than in those who are socially stable in their class of destination. The number of deaths in the remaining chronic diseases category was small and none of the relationships with social mobility reached conventional levels of statistical significance.

Table 4. Relationship between social class mobility and class of destination mortality gradient: hazard ratios and 95% confidence intervals CI, 1981–1992, for employed men in 1981

	Hazard ratio	*95% CI*
Social class of destination (1981)		
Age	1.68†	1.65–1.73
Class I	1.00	
Class II	1.08	0.93–1.26
Class IIIN	1.24†	1.05–1.47
Class IIIM	1.34†	1.16–1.55
Class IV	1.45†	1.24–1.70
Class V	1.79†	1.47–2.18
Stable	1.00	
Upward mobility		
Class II to I	1.15	0.86–1.54
Class IIIN to I	1.31	0.89–1.93
Class IIIN to II	1.02	0.86–1.21
Class IIIM to II	1.16	0.99–1.35
Class IIIM to IIIN	0.91	0.71–1.17
Class IV to II	1.48†	1.17–1.88
Class IV to IIIN	1.24	0.99–1.55
Class IV to IIIM	1.09	0.97–1.23
Class V to IIIN	2.03†	1.33–3.09
Class V to IIIM	1.17	0.95–1.42
Class V to IV	1.36†	1.12–1.63
Downward mobility		
Class I to II	0.88	0.68–1.16
Class II to IIIN	1.02	0.85–1.24
Class II to IIIM	0.96	0.80–1.14
Class II to IV	1.00	0.79–1.27
Class IIIN to IIIM	0.94	0.71–1.25
Class IIIN to IV	0.98	0.75–1.29
Class IIIN to V	1.12	0.66–1.90
Class IIIM to IV	1.00	0.88–1.15
Class IIIM to V	0.91	0.72–1.14
Class IV to V	0.96	0.75–1.22

†$p < 0.05$.

4. Discussion

These results are based on the 47000 LS male subjects who were aged 35–54 years in 1971. Any change in their social class between 1971 (the origin) and 1981 (the destination) has been analysed in relation to their subsequent mortality during 1981–1992 (i.e. deaths at ages 45–75 years). The focus of interest has been the relationship between the risk of mortality and social mobility out of the class of origin and into the class of destination.

A third of the men changed social class between 1971 and 1981, mostly to adjacent or next adjacent classes. Deaths among the two-thirds who remained in the same occupational social class in 1971 and 1981 showed an inverse incremental gradient; among these socially stable men, the difference in the mortality rates of social class I and social class V was slightly larger than the corresponding difference among all men classified by their 1981 class.

The relationship between the risk of mortality and the direction of social mobility in the main analysis of deaths due to all causes showed a pattern which was broadly repeated in all the subsequent analyses. The downwardly mobile had a higher risk of mortality than those

Table 5. Sensitivity tests: allowing for health selection effects by excluding the first 5 years of follow-up, and allocating men who were unclassified at the 1981 census to their 1971 census class

	Results for first 5 years of follow-up excluded		*Results for unclassified men in 1981 allocated to their 1971 class*	
	Hazard ratio	*95% CI*	*Hazard ratio*	*95% CI*
Model 1: social class of origin (1971)				
Age	1.69†	1.64–1.74	1.69†	1.65–1.73
Class I	1.00		1.00	
Class II	1.16	1.00–1.35	1.16†	1.02–1.32
Class IIIN	1.22†	1.04–1.44	1.28†	1.12–1.47
Class IIIM	1.39†	1.20–1.60	1.39†	1.23–1.57
Class IV	1.56†	1.34–1.82	1.57†	1.38–1.78
Class V	1.95†	1.63–2.33	1.94†	1.67–2.26
Stable	1.00		1.00	
Up	0.98	0.90–1.06	0.96	0.90–1.03
Down	1.17†	1.08–1.27	1.15†	1.08–1.23
Model 2: social class of destination (1981)				
Age	1.69†	1.64–1.74	1.69†	1.65–1.73
Class I	1.00		1.00	
Class II	1.07	0.93–1.24	1.09	0.97–1.23
Class IIIN	1.20†	1.02–1.40	1.27†	1.12–1.46
Class IIIM	1.32†	1.15–1.52	1.35†	1.20–1.52
Class IV	1.52†	1.31–1.76	1.52†	1.34–1.73
Class V	1.73†	1.44–2.07	1.80†	1.54–2.09
Stable	1.00		1.00	
Up	1.17†	1.08–1.26	1.15†	1.08–1.23
Down	0.98	0.90–1.07	0.96	0.89–1.03

†$p < 0.05$.

whom they left behind (i.e. the socially stable in their respective class of origin) and the upwardly mobile had a higher risk of mortality than those whom they joined (i.e. the socially stable in their respective class of destination). Although the other parts of this pattern did not achieve conventional levels of statistical significance, their direction was consistent: the upwardly mobile had a lower risk than those whom they left and the downwardly mobile had a lower risk than those whom they joined.

It is unlikely that this patterned relationship is an artefact of the classification procedures. Alterations to the Registrar General's classification of occupations between 1971 and 1981 changed the assigned social class of a small proportion of occupations and would have produced some artefactual social mobility. This was avoided in the present analyses by examining only those LS members whose social class in 1981 had been recoded to the 1971 classification. There is also a recognized tendency for some Registrars at death registration to 'promote' the recently deceased and this is a second potential source of artefactual mobility. The LS avoids this problem by classifying individuals at death according to the occupation declared in the most recent census. Third, a proportion of the apparent mobility may be due to a misclassification of social class at either 1971 or 1981 and this random measurement error could have biased the estimates of the risk of mortality (Phillips and Davey Smith, 1991). The degree of bias, however, is highly dependent on the amount of measurement imprecision and significant levels of misclassification have not been found to occur in the LS (Goldblatt, 1988).

Table 6. Relationship between social class mobility and mortality gradients for acute and chronic diseases: hazard ratios and 95% confidence intervals CI, 1981–1992, for employed men in 1981

	Results for acute diseases		*Results for chronic diseases*	
	Hazard ratio	*95% CI*	*Hazard ratio*	*95% CI*
Model 1: social class of origin				
Age	1.69†	1.63–1.76	1.71†	1.60–1.82
Class I	1.00		1.00	
Class II	1.29	1.04–1.60	1.58	1.10–2.29
Class IIIN	1.58†	1.25–1.98	1.80†	1.21–2.66
Class IIIM	1.78†	1.45–2.19	1.69†	1.18–2.42
Class IV	2.07†	1.67–2.58	1.58†	1.08–2.33
Class V	2.23†	1.72–2.88	2.73†	1.78–4.18
Stable	1.00		1.00	
Up	0.91	0.81–1.01	0.97	0.83–1.18
Down	1.21†	1.09–1.34	1.03	0.85–1.23
Model 2: social class of destination				
Age	1.69†	1.63–1.76	1.71†	1.60–1.82
Class I	1.00		1.00	
Class II	1.24	1.00–1.53	1.36	0.97–1.92
Class IIIN	1.53†	1.22–1.92	1.57†	1.09–2.26
Class IIIM	1.79†	1.46–2.20	1.47†	1.05–2.04
Class IV	1.89†	1.52–2.34	1.49†	1.04–2.14
Class V	2.17†	1.68–2.80	2.13†	1.40–3.23
Stable	1.00		1.00	
Up	1.14†	1.03–1.26	1.11	0.94–1.32
Down	0.99	0.88–1.11	0.88	0.72–1.08

†$p < 0.05$.

The patterned relationship between the risk of mortality and the direction of social mobility proved resilient when its sensitivity was tested against two recognized issues of concern in LS analyses. The standard procedure for guarding against health selection into employment status is to allow for selection to wear off by omitting deaths during the first 5 years of follow-up. When only deaths occurring between 1986 and 1992 were included the already-described pattern between risk and mobility was maintained.

A second source of potential bias in this analysis derives from the exclusion of those subjects who were classified as inadequately described or unoccupied at the 1981 census; at certification of death most of these LS members were found to belong to social class IV or V. These unclassified subjects were integrated into the analysis by allocating them to their occupational social class as recorded at the 1971 census. Once again, the already-described relationship between the risk of mortality and mobility was maintained.

An attempt was made to go beyond statistical association and to assess whether health might have been a causal factor influencing the direction of any social mobility. Ideally, some measure of health status before social movement would have been available. Unfortunately, the 1991 census was the first in the 20th century to include a question on health (limiting long-term illness), so the LS is deficient in this respect. Identifying causes of death which can be categorized plausibly as acute or chronic is an established way around this problem (Blane, 1985). The length of time between the onset of debilitating symptoms and death is longer in the chronic than in the acute category. If health is a direct influence on social mobility, the relationship between mortality and social mobility should be stronger in the chronic diseases category because these causes of death allow sufficient time for debilitating symptoms to affect everyday life.

The results of this test do not support the hypothesis that health has a direct causal influence on social mobility. The relationship between the risk of mortality and the direction of social mobility was stronger for the acute causes of death than for the chronic, although this interpretation is complicated somewhat by the larger number of deaths in the former category. The problem of the smaller number of deaths in the chronic diseases category worsened when deaths due to ischaemic heart disease were removed from both the acute and the chronic diseases groups; this exclusion was designed to test the effect of imprecision in the distinction at registration of death between acute and chronic ischaemic heart disease. Nevertheless, the results after exclusion of ischaemic heart disease deaths showed that the relationship between mortality and direction of mobility remained stronger in the acute group.

4.1. Gradient constraint

Gradient constraint can be described as the process whereby social mobility moderates, rather than creates or widens, the size of the social class differential. The finding that the downwardly mobile have a higher risk of mortality than the socially stable remaining in their class of origin supports the idea of health-related social mobility. The finding that the upwardly mobile have a higher risk of mortality than the socially stable who already occupy their class of destination supports the idea of gradient constraint and shows that social mobility may moderate, rather than create or amplify, social class differences in health.

As the concept of gradient constraint has received little attention in the past, some elaboration may be worthwhile. Gradient constraint is plausible physiologically. Considerable attention has been given recently to the long-term effects on adult health of events *in utero* and during infancy and early life (Barker, 1992). These events are socially patterned (Bartley *et al*., 1994) and are translated into physiological changes which appear to be comparatively irreversible and carried through life (Kuh and Ben Shlomo, 1997). To some extent, therefore, an individual's physiological status reflects past experience (Blane *et al*., 1996; Davey Smith *et al*., 1997). In terms of life trajectories, the upwardly mobile may be advantaged in comparison with their class of origin, but in their class of destination they are compared with a population whose past was even more advantaged. The comparatively good health which aided their upward mobility may nevertheless be worse than the health of those with more advantaged pasts.

Gradient constraint is also plausible sociologically. Health is not absolute. It is judged against social norms which change and tend to become more demanding as one ascends the social hierarchy. Working-class populations tend to equate good health with being able to fulfil the demands of everyday life, whereas middle class populations expect, in addition, a feeling of well-being and a reserve of strength (Apple, 1960; Patterson and Blaxter, 1980; Herzlich, 1973; Pill and Stott, 1982). For the upwardly mobile, therefore, a level of health which appears better than normal when judged against the norms of their class of origin may appear worse than normal when judged against the norms of their class of destination, and conversely for the downwardly mobile.

The effects of gradient constraint may be of considerable interest. A paradox has long been recognized in relation to social class differences in health: their magnitude remains comparatively stable throughout life, but they are seen as being created by on-going processes of either health-related social mobility or the lifetime accumulation of risk. Gradient constraint offers a potential solution to this puzzle by suggesting a counterbalancing process. The size of social class differences in health may remain comparatively

stable throughout life because they are the net effect of disease-producing processes, which over time tend to widen the differences, counterbalanced by gradient constraint, which acts in the opposite direction.

These ideas may help to explain why the relationship between the risk of mortality and the direction of social mobility was not stronger in the chronic diseases group, where there was adequate time for incapacitating symptoms to interfere with life performance, than in the acute diseases group, where the onset of symptoms and death would typically occur close together. Several explanations are possible. Co-morbidity of a chronic disease with an acute cause of death, e.g. emphysema with lung cancer or alcoholism with violence, could account for significant health-related social mobility despite an acute cause of death. Second, social mobility, by affecting levels of environmental stressors and social support, may be an aetiological agent in the cause of death, rather than being purely a social consequence of a particular health status. Finally, the direction of social mobility and the chances of premature mortality may be causally unconnected components of more or less advantaged life trajectories. Of these three potential explanations it is the third which fits best with the present paper's emphasis on gradient constraint and the lifetime accumulation of risk.

Whatever the usefulness of the idea of gradient constraint, the main conclusion of this paper is clear. Earlier analyses of social mobility and mortality using the LS concluded that

> 'There is no evidence that downward mobility maintained (or still less increased) social class differences in mortality'

(Goldblatt (1989), p. 14). The present, updated, analyses do not provide any reason for modifying this conclusion.

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