

# Epidemiological approach to the explanation of social differentiation in mortality: The Whitehall Studies<sup>1</sup>

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Since statistics were gathered in this way, in England and Wales, there have been social class differences in mortality. Improvement in mortality has taken place across the whole of society, but social class differences remain<sup>1</sup>. National data are crucial in describing differences across the whole of society, and in charting trends. Investigations of reasons for social inequalities in mortality must also include specially conducted studies. This paper starts with national data in England and Wales and then uses data from the two Whitehall studies of British Civil Servants to investigate possible explanations of social class differences in mortality and morbidity.

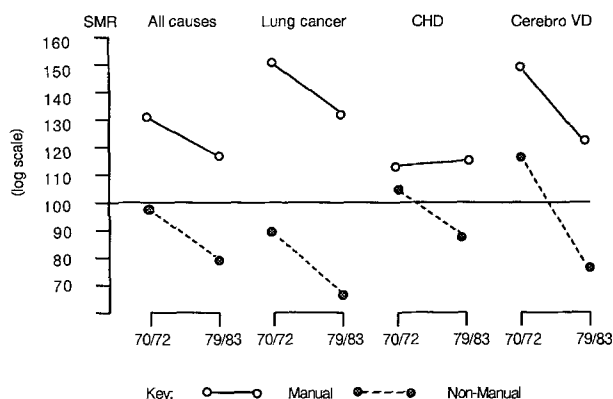
## Mortality trends in England and Wales

Figure 1 shows trends in mortality in England and Wales between the years around the 1971 Census and the 1981 Census<sup>1</sup>. Men are classified according to occupation into manual and non-manual, and married women are classified by husband's occupation. The data show that mortality ratios declined between 1971 and 1981, but declined more steeply for men and women in non-manual groups than in manual. The consequence is that social class differences in mortality increased over the decade.

There has been a debate as to whether apparent inequalities in mortality are increasing, decreasing or unchanging. The argument has taken various forms. There may be differences in the way social classes are assigned at census and at death. These differences, and the resulting bias, may have changed between 1971 and 1981. This problem is avoided by using the broad groupings of manual and non-manual as in the above analysis.

A second objection has been that the persisting higher mortality in lower social classes applies to fewer people as the employment structure of the

a. Men aged 20-64



b. Married women aged 20-54, classified by husband's occupation

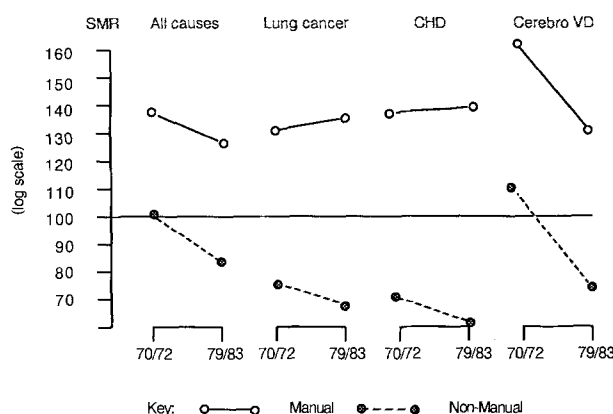


Fig. 1. Changes in standardised mortality ratios by manual groups for selected diseases, Great Britain, 1970/72 to 1979/83. Source: Marmot MG, McDowell ME.

society changes, and unskilled manual jobs become fewer. The analysis of manual and non-manual above largely avoids this problem: in 1971 60% of men were in manual occupations; in 1981, 55% were. The widening social class differential could not easily be explained by „migration“ of the healthier 5% from manual to non-manual occupations.

LeGrand and Illesley have also suggested taking individuals rather than social classes as the unit of analysis. They take reduction in the variation in age of death as indicating a reduction in inequality between individuals<sup>2</sup>. Whether or not this is the case, this does not change the fact that when

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Tab. 1. Morbidity prevalence by Civil Service grade of employment (age-adjusted figures) in the Whitehall II Study (1985–88).

	Sex	Employment grade <sup>+</sup>						Total sample	Test for trend
		1	2	3	4	5	6		
Number of men and women in grades	M	1026	1627	1228	1496	881	642	6900	
	F	122	264	198	480	660	1690	3414	
Age (mean)	M	46.9	44.2	43.5	42.5	43.4	44.6	6900	***
	F	44.1	43.0	42.1	42.9	45.5	46.7	3414	***
Probable ischaemia on ECG (%)	M	1.3	0.9	1.1	1.2	1.4	2.1	6896	(*)
	F	0.0	0.0	0.7	0.1	0.7	1.1	3412	*
Probable/possible ischaemia on ECG (%)	M	6.4	4.9	5.0	6.5	6.7	10.5	6896	***
	F	3.6	3.3	3.0	6.5	7.8	7.3	3412	**
Angina by questionnaire (%)	M	1.7	2.4	2.5	3.1	1.9	2.9	6835	ns
	F	1.8	1.6	2.9	3.3	5.8	4.0	3351	*
Probable/possible ischaemia on ECG or angina (%)	M	7.6	7.0	7.3	9.3	8.4	12.3	6835	***
	F	4.5	5.0	5.5	9.8	13.3	11.1	3357	***
History of Diabetes (%)	M	0.3	0.6	0.8	0.8	1.7	1.7	6852	***
	F	0.9	0.6	0.0	0.0	0.8	1.4	3386	*
Mean number of symptoms	M	2.1	2.4	2.5	2.5	2.6	2.6	5151	***
	F	3.2	3.3	3.1	3.1	3.2	3.0	2442	ns
Self-rated health average or worse (%)	M	15.3	19.5	21.5	22.8	27.5	33.7	6874	***
	F	26.2	25.5	28.7	28.9	34.4	42.1	3404	***
Regular cough with phlegm in winter (%)	M	6.7	7.3	6.9	9.2	11.0	10.9	6850	***
	F	4.2	6.1	10.3	6.4	6.5	8.6	3364	(*)
Long standing illness (%)	M	29.9	30.4	30.1	31.6	31.8	36.4	5157	**
	F	30.2	35.8	26.7	33.7	31.6	30.5	2485	ns
Any health problems last year (%)*	M	69.0	68.0	67.3	67.7	66.5	70.7	5148	ns
	F	69.8	70.6	73.5	72.3	75.3	75.6	2463	*
Drug therapy for hypertension (%)	M	2.1	2.1	2.1	2.7	4.8	5.2	6673	***
	F	3.7	4.4	4.1	2.9	3.5	4.3	3338	ns
Pre-menstrual "bloating" (%)	F	2.2	8.6	9.6	10.9	16.8	19.6	1939	***

<sup>+</sup> Grade categories

Grade 1 – Unified Grades 1–6

Grade 2 – Unified Grade 7

Grade 3 – Senior Executive Officer and  
Grade 4 – Higher Executive Officer } professional  
Grade 5 – Executive Officer } equivalents

Grade 6 – Clerical Officer/Office Support

*P-values*

ns  $P > 0.10$

(\*)  $0.05 < P \leq 0.10$

\*  $0.01 < P \leq 0.05$

\*\*  $0.001 < P \leq 0.01$

\*\*\*  $P \leq 0.001$

individuals are grouped into social classes on the basis of occupation, there remain substantial differences in mortality among them. These differences have not narrowed with time, and may even have increased.

#### *Persistence of social class differences in morbidity – the Whitehall Studies*

Because of relative lack of data, there has been less study of social class differences in morbidity than of mortality. We have conducted two large studies of British Civil Servants: The Whitehall studies. The first examined 18 000 men aged 40–69 in 1967–1969 and has followed the cohort for mortality. The Whitehall II study examined 10 314 men and

women aged 35–55 in 1985–1988, nearly 20 years later. In Whitehall, the indicator of social class that we have used is grade of employment. This is a precise social classification. It corresponds closely to salary and is related to position in the employment hierarchy.

Table 1 shows the prevalence rate of various indicators of morbidity in the Whitehall II study in different employment grades<sup>3</sup>. The two top levels, here labelled 1 and 2 are the top administrative ranks of the civil service and correspond to what was labelled administrators in the original Whitehall Study. In general, the lower the grade, the higher the prevalence of ischaemic heart disease. Women report higher prevalence of angina than men, despite the lower prevalence of ischaemic ECGs. The excess of abnormal ECGs in men is

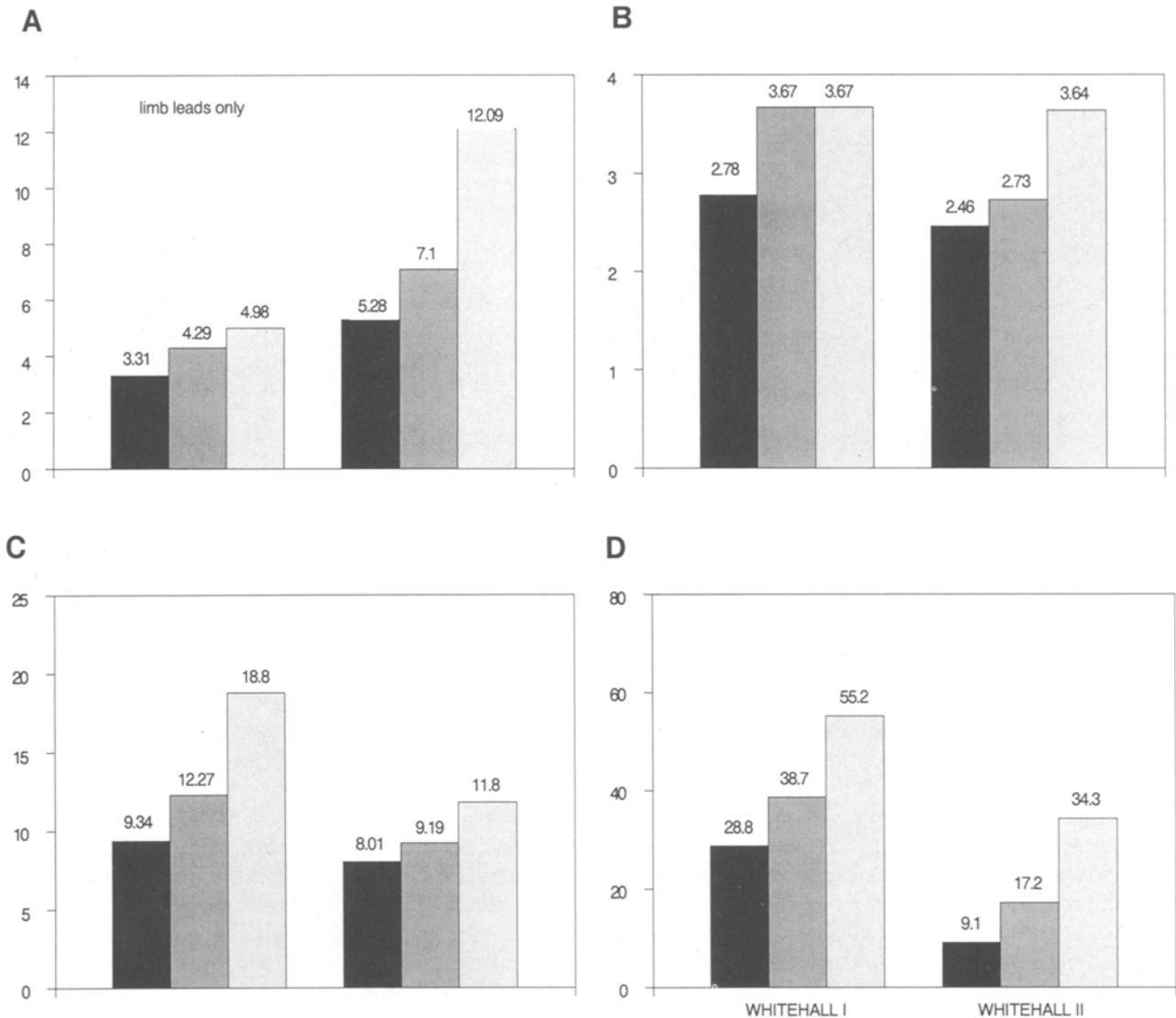


Fig. 2. Prevalence of cardiorespiratory disease and smoking among men aged 40–54 in the Whitehall I (1967–69) and Whitehall II (1985–88) studies (age-adjusted percentages)

(A) Probable and possible ECG ischaemia, (B) angina pectoris, (C) chronic bronchitis, (D) current cigarette smokers.

greater for probable ischaemia, Q waves, than it is for possible ischaemia, S-T and T wave changes. Among men, there is an inverse association between grade and: number of symptoms reported in the last fourteen days; health problems in the last year; likelihood of rating health as “average” or “poor”, as opposed to “good” or “very good”; a prior diagnosis of hypertension or diabetes. This is in addition to the inverse association with prevalence of ischaemia and of cough and phlegm.

Women, in general, have a higher level of reported morbidity than men. The relation with grade was less consistent. In addition to a higher prevalence of premenstrual bloating, lower grade women were more likely to report premenstrual irritability and breast tenderness (data not shown).

For comparison with the Whitehall results from 1967–1969, data are restricted to men, aged 40–54, and grades grouped into three broad classes. Figure

2 shows prevalence rates for ECG abnormalities, angina pectoris, chronic bronchitis, and smoking in these two cohorts of civil servants separated by twenty years.

In Whitehall, limb leads only were used for ECGs, hence a lower prevalence of ischaemia would be expected compared with the full 12 lead ECGs used in Whitehall II<sup>3</sup>. There is no suggestion of a diminution in the grade difference in prevalence of ischaemia over the twenty years separating Whitehall and Whitehall II<sup>3</sup>. The relative difference between clerical officers and administrators appears to be greater. For angina pectoris, the questionnaire was identical in the two studies: the difference between grades has changed little in the twenty years.

For chronic bronchitis, i.e. cough with phlegm production, the prevalence rate for men aged 40–54 is considerably lower in Whitehall II than in the

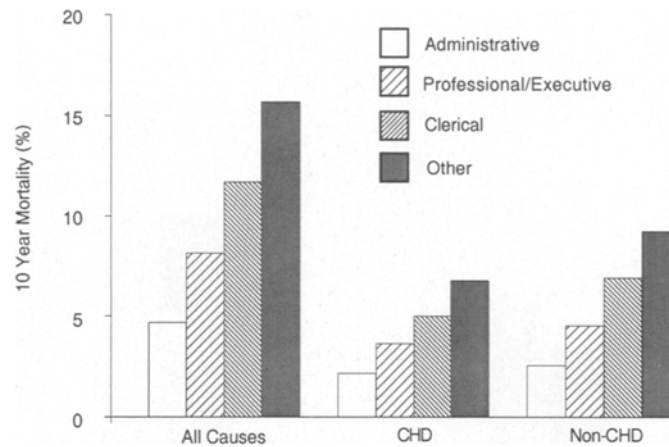


Fig. 3. Age adjusted mortality rates (%) by grade of employment for Civil Servants aged 40–64, in the Whitehall Study.

previous, Whitehall study, but the relative difference between the grades is similar.

Both the grade difference in chronic bronchitis and the diminution in prevalence rates between the 1960's and the 1980's is likely to be related to smoking. Figure 2 also shows that smoking prevalence among civil servants has decreased but the striking inverse association with grade of employment persists.

Whitehall data on mortality are shown in Figure 3. Over the 10 years of follow up, the lower the grade, the higher the mortality rate<sup>4</sup>. This 3 fold difference in mortality rates between lowest and highest grades is greater than the differences seen nationally with Registrar-General's social classes. We have argued that Civil Service grade is a more precise classification than national social classes: homogeneity is greater within grades than within social classes and the distinction between grades is sharper<sup>4</sup>. It makes the British Civil Service an ideal natural experiment to investigate causes of social class differences in health.

The data in Figure 3 are particularly relevant to the debate on poverty or inequality<sup>5</sup>. There is little doubt that poverty, or deprivation, is likely to be bad: for health among other things. These data suggest that something else is at work here. Each grade has worse health and higher mortality rates than the grade above it. Executive grade civil servants are not poor by any absolute standard yet they have higher mortality rates than administrators. Even clerical officers who are far from well-off, with earnings at or below the national average, are not poor by comparison with England at an earlier period in history, or with developing countries.

This social gradient in mortality suggests the operation of factors across the whole of society. It may perhaps be relative deprivation or relative access to fruits of a wealthy society. It is to search for the links between social position and health that the Whitehall II study was set up. Data from these two

Whitehall studies will be used to illustrate this search.

### Explanations for social inequalities in health

#### Health Selection

The argument here is that health may determine social position rather than the reverse. This was one of the arguments considered by the Black report and rejected as a major cause of social inequalities in health<sup>6</sup>. It is unlikely that differential social mobility caused by differences in health could account for the Whitehall findings. It is true that ill-health appears to be more common lower down the grade hierarchy. In Whitehall I, however, the gradient in mortality by grade of employment was in evidence in people free from manifest disease at the time of entry into the study<sup>4</sup>. If ill-health were a barrier to promotion within the civil service, it might be expected that the effect of ill health in producing social inequalities in health would increase with age. The longer the study progressed, or the older the age of the participants, the wider should be the social class difference in mortality. Figure 4 shows this not to be the case for length of follow-up. Plotting cumulative probability of death, on a log scale, shows that the relative difference in mortality among grades changes little over the ten year period<sup>4</sup>. There is, similarly, little difference in the gradient in mortality by age at entry into the study. The relative risk of death for men in the lowest grade (office support), compared to the highest was 4.6 for men aged 40–49 at entry to the study, and 4.8 for men aged 60–64.

#### General Susceptibility or specific causes

A striking feature of social class differences in health is the generalisability of the findings across diverse pathological conditions. In the Whitehall

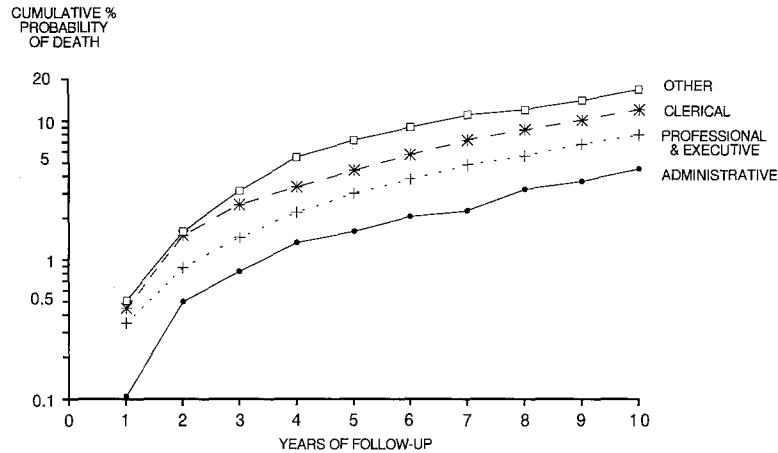


Fig. 4. 10 year Mortality in Whitehall.

study, the higher risk of death among lower grades applied to deaths from lung cancer, other cancers, CHD, cerebrovascular disease, other cardiovascular disease, chronic bronchitis, other respiratory disease, gastro-intestinal disease, genito-urinary disease, accidents and violence<sup>4</sup>. This is summarised in Figure 3 for all cause, coronary heart disease, and other diseases. Findings such as these, suggesting that there may be common factors operating that cut across known causes of disease have prompted the speculation that there may be factors that increase general susceptibility to ill-health<sup>7,8</sup>.

An alternative to a general susceptibility hypothesis, is that a variety of specific factors are operating to explain social class differences in mortality. Supporters of this view point to the fact that some cancers, most notably those of the colon, brain, prostate, haematopoietic system, breast and melanoma do not show the same social class variation as the causes listed above<sup>9</sup>.

When posed with two conflicting alternatives such as these, a reasonable working hypothesis is that they are both correct. A general susceptibility hypothesis implies that certain groups will be at higher risk of death whatever causes are operating. It does not deny the operation of specific causes. Diseases linked to smoking, such as chronic bronchitis and lung cancer, show a particularly strong social class gradient – stronger than cancers not linked to smoking. But the latter do show a social class gradient as do other diseases not linked to smoking. Put another way, the general susceptibility hypothesis means that there are factors operating that cut across our current system of classifying diseases. These will increase risk of death in addition to the effect of known factors such as smoking. This can account for the fact that an administrator who smokes 20 a day has a lower risk of lung cancer mortality than a lower grade civil servant smoking the same amount<sup>4</sup>, even after pack-years and tar content of cigarettes is taken into

account; and for the gradient in mortality that occurs for CHD even among non-smokers.

This is assuming that the susceptibility is operating at a biological level. It may also act at a social level. Social position may lead to differential exposure to a range of specific influences on health. Some of these specific influences are the object of study in Whitehall II.

#### *Health related behaviours and biological risk factors*

Table 2 presents data from Whitehall II on biological and behavioural risk factors by grade of employment<sup>3</sup>. Plasma cholesterol levels do not differ by grade, and the small inverse association between grade and blood pressure level in men observed in the Whitehall study is still present but now even smaller. There was a significant inverse trend of mean body mass index (weight/height<sup>2</sup>) by grade but, especially in men, the differences were small. The distribution is different, however. The prevalence of obesity (BMI > 30) is greater in lower grades, strikingly in the clerical grade. As in Whitehall, the higher the grade, the taller the man, and the woman.

The most striking risk factor difference among grades was in smoking (see also Fig. 2). Women have higher prevalence of smoking than men in all but the lowest (clerical and office support) grade. The proportion of men and women not taking moderate or vigorous exercise in their leisure time was higher in lower grades. As a rough indicator of dietary pattern, consumption of skimmed and semi-skimmed milk, wholemeal bread and fresh fruit and vegetables were higher in higher grades. Average alcohol consumption is reported to be higher among the higher grades of men and, more strikingly, of women. Reports of parents having had a heart attack were more frequent in higher grades; a positive family history among siblings was more common in lower grades.

Tab. 2. Physiological measurements, health behaviours and family history by grade of employment (age-adjusted figures) in the Whitehall II Study.

	Sex	Employment grade <sup>†</sup>						Total sample	Test for trend
		1	2	3	4	5	6		
<i>Physiological measurements</i>									
Mean cholesterol	M	6.05	5.97	5.93	6.02	6.00	6.00	6865	ns
	F	5.79	5.85	5.80	5.80	5.90	5.86	3375	ns
Mean systolic blood pressure	M	124.3	124.6	123.9	124.8	125.4	125.4	6886	**
	F	117.6	120.5	120.6	119.2	119.7	119.5	3413	ns
Mean diastolic blood pressure	M	77.6	77.5	77.6	77.9	78.8	79.1	6886	***
	F	74.0	75.2	75.3	74.3	74.8	74.9	3412	ns
Mean body mass index	M	24.6	24.4	24.6	24.5	24.8	25.1	6888	***
	F	23.7	23.7	24.3	24.1	24.5	25.3	3412	***
Obese (%)	M	4.1	3.7	4.6	5.1	6.0	10.7	6888	***
	F	7.4	4.6	7.9	7.8	10.3	12.2	3412	***
Mean height	M	177.8	177.1	176.9	174.3	174.3	172.9	6890	***
	F	165.5	165.1	165.3	163.1	162.8	160.7	3413	***
<i>Health behaviours</i>									
Current smokers (%)	M	8.3	10.2	13.0	18.4	21.9	33.6	6892	***
	F	18.3	11.6	15.2	20.3	22.7	27.5	3408	***
Mean units of alcohol in last 7 days	M	14.6	12.6	12.9	12.9	11.6	10.1	6845	***
	F	12.1	9.8	9.3	7.0	5.2	3.6	3375	***
No moderate or vigorous exercise (%)	M	5.1	5.4	4.9	7.5	16.2	30.5	6662	***
	F	12.0	14.7	10.8	13.2	19.7	31.1	3221	***
Usually use skimmed or semi-skimmed milk (%)	M	44.2	39.3	35.1	31.8	27.8	21.2	6869	***
	F	39.5	48.3	49.8	46.2	40.5	34.4	3389	***
Mainly wholemeal bread (%)	M	47.7	45.2	43.6	37.2	37.5	32.2	6867	***
	F	57.2	52.9	58.2	55.4	43.8	35.5	3380	***
Eat fresh fruit or veg less than daily (%)	M	34.0	39.6	40.6	47.9	52.5	61.7	6881	***
	F	17.7	20.4	28.4	29.7	36.4	43.6	3400	***
<i>Family history</i>									
Parent had heart attack (%)	M	26.1	28.1	26.1	26.1	24.0	22.5	6649	**
	F	39.2	36.4	24.7	29.8	22.6	24.5	3234	***
Sibling had heart attack (%)	M	2.0	2.3	2.7	3.2	4.4	3.8	5496	**
	F	0.8	1.7	1.0	4.3	4.8	6.4	2804	***

<sup>†</sup> See footnote to table 1.

There are thus a range of candidates to account for grade differences in mortality. Only some of these were measured in the first Whitehall study. As implied above, the grade differences in smoking were insufficient to account for differences by grade in mortality from smoking-related diseases<sup>4</sup>. There were only small differences in blood pressure between grades, and plasma cholesterol levels were higher in higher grades. The main coronary risk factors could account therefore for little of the gradient in mortality by grade of employment. It is possible that some of the other factors listed in Table 2 may provide part of the explanation.

#### Material conditions

The Black Report<sup>6</sup> emphasised the importance of material conditions as an explanation for social

inequalities in health. In the working population that make up the Whitehall cohort, grade is a guide to material conditions as it is a proxy for salary, which in turn relates to circumstances outside work. It is not surprising, Table 3, that the lower the grade in Whitehall II, the greater the frequency of reported financial problems.

In the OPCS longitudinal study<sup>10</sup>, independent of social class based on occupation, other measures predicted mortality: among them, housing tenure (ownership), and household access to cars. In the Whitehall study, car ownership predicted mortality, independent of grade of employment (Fig. 5)<sup>11</sup>. Car ownership is a measure of wealth as well as access to transport. In addition, men who reported they indulged in the great British pastime of gardening had lower mortality than other men. The link between gardening and lower mortality is open to a

Tab. 3. Psychosocial characteristics by grade of employment (age-adjusted figures) in the Whitehall II Study.

	Sex	Employment grade <sup>+</sup>						Total sample	Test for trend
		1	2	3	4	5	6		
<i>Work characteristics (upper tertile of distribution)</i>									
High control (%)	M	59.3	49.7	43.1	31.6	24.7	11.8	6877	***
	F	51.2	45.4	47.1	31.2	20.1	10.2	3341	***
Varied work (%)	M	70.5	52.1	41.9	27.1	18.2	3.9	6875	***
	F	71.2	55.2	40.5	31.7	14.0	4.7	3356	***
Fast pace (%)	M	58.0	43.6	34.7	27.9	20.8	15.8	6878	***
	F	60.9	50.3	43.7	31.1	29.7	18.0	3356	***
High satisfaction (%)	M	58.2	38.7	34.1	29.5	29.4	29.8	6865	***
	F	57.5	42.2	40.3	36.6	41.6	47.7	3337	ns
<i>Social network/activities</i>									
See at least 3 relatives per month (%)	M	22.1	24.8	29.0	27.2	29.7	30.6	6426	***
	F	18.9	23.7	21.1	24.1	30.4	44.9	3187	***
See at least 3 friends per month (%)	M	65.3	61.3	58.5	58.6	56.4	50.2	5162	***
	F	71.1	62.8	67.1	63.6	52.9	49.0	2473	***
No hobbies (%)	M	12.4	12.9	12.7	15.0	23.0	25.4	6453	***
	F	12.5	15.4	11.3	11.9	18.3	27.5	3044	***
<i>Social support from closest person (upper tertile of distribution)</i>									
Confiding/emotional support (%)	M	31.3	33.7	28.3	28.3	34.6	26.1	5021	(*)
	F	37.3	33.8	33.0	32.5	32.9	31.8	2380	ns
Practical support (%)	M	41.1	40.0	37.2	33.0	36.4	29.1	5022	***
	F	21.8	25.9	26.8	17.1	24.0	28.0	2384	(*)
Negative aspects of support (%)	M	25.0	28.4	31.3	30.9	38.1	39.0	5010	***
	F	33.0	32.5	28.3	36.4	28.3	33.8	2379	ns
<i>Events and difficulties</i>									
2 or more major life events (%)	M	29.6	31.6	35.1	37.9	39.9	41.9	6758	***
	F	41.1	43.6	35.5	42.8	46.5	49.2	3247	***
Sometimes not enough money (%)	M	7.0	12.6	21.5	26.4	34.4	37.2	4977	***
	F	7.7	6.9	9.6	13.2	34.4	34.4	2282	***
Some difficulty paying bills (%)	M	11.0	16.2	22.8	24.7	29.6	29.6	5167	***
	F	15.2	13.2	11.8	15.7	18.1	26.9	2490	***
<i>Other</i>									
Type A (defined as upper tertile) (%)	M	51.3	40.2	36.9	27.8	20.4	12.8	6729	***
	F	62.6	54.6	44.0	39.0	29.0	17.6	3228	***
Hostility score	M	9.7	10.2	10.9	11.3	12.7	14.7	4266	***
	F	9.5	9.5	9.4	10.1	10.4	12.3	1772	***
Believe one can reduce risk of heart attack (%)	M	71.6	72.2	70.8	66.8	65.5	52.4	5136	***
	F	58.1	61.6	69.7	68.4	65.0	53.7	2487	***

<sup>+</sup> See footnote to table 1.

variety of interpretations. Among them is that possessing a house with a garden is a measure of wealth.

These data are consistent with the link between deprivation and mortality shown in geographic-based studies. For example, we have followed the approach taken by Townsend and Phillimore<sup>12</sup> and classified local areas electoral wards, according to four simple items available in the Census: unemployment, crowding, housing tenure and access to cars. There is a strong relationship between this deprivation index and mortality<sup>13</sup>. Deprivation is not a good term as the relationship with mortality extends right across the range of deprivation, e. g.

Fig. 6. Wards in the second best quintile of deprivation scores have a higher mortality than those in the best quintile. This may be because the second best quintile contains more deprived wards than the best. Alternatively, it may suggest that deprivation is a graded phenomenon, analogous to grade of employment. It may therefore be more informative to consider relative deprivation.

#### *Factors operating early in life*

People are not assigned randomly to social classes. They bring with them into adulthood the results of influences from earlier in life. These may be genetic,

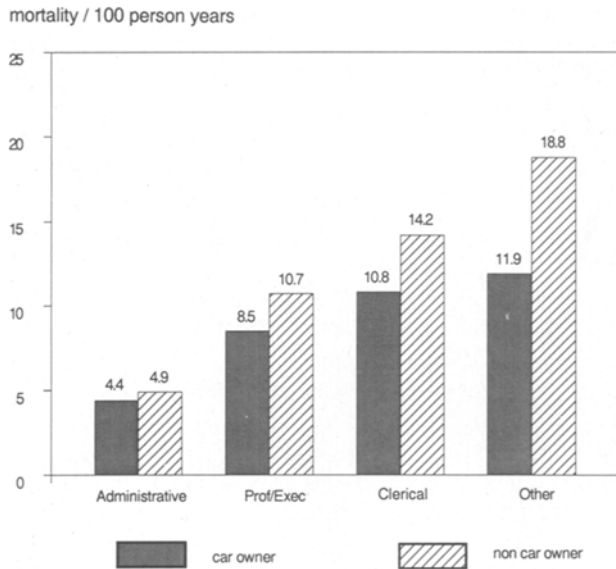


Fig. 5. All cause mortality by grade and car ownership.

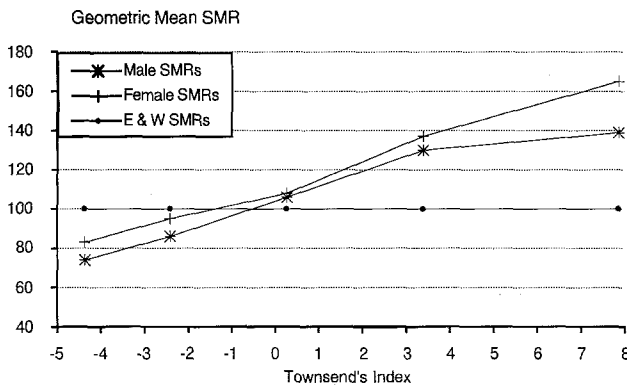


Fig. 6. Coronary heart disease in Merseyside. Mean male and female mortality by quintiles of Townsend's Index.

biological results of early experiences, educational, cultural, psychological, social. Some would go so far as to say that the major influences on health in adulthood all operate early in life<sup>14</sup>. This position has been criticised precisely because influences from early life shape the lives people lead and the social environments in which they live and work<sup>15</sup>. This can be illustrated from Whitehall with data on height. Height is influenced not only by genes, but also by environment. As Table 2 shows, height is related to social status as measured by grade. Short height predicts adult mortality independent of grade of employment<sup>4</sup>. It is reasonable to speculate that the relation between short height and mortality is in part a reflection of a persisting influence from early life. Grade of employment, which is some measure of current social influences, predicts mortality independent of height. This can be interpreted as two sets of influences influencing mortality, factors from early life and current influences. As indicated, this is to oversimplify: people's current social situation is influenced by their prior experiences. Nevertheless it is important to attempt to

distinguish these two sets of influences. Will changing conditions of adults change inequalities in health?

#### *Psycho-social factors as potential explanations*

Table 3 shows differences in psycho-social characteristics. Fewer of the lower grades report control over their working lives, having varied work, or having to work at a fast pace. Overall, fewer of the lower grades express themselves satisfied with their work situation.

Social relations can be expressed quantitatively, as extent of social networks, and qualitatively, as the nature of social supports. More of the lower grades report visiting relatives once a month or more; more of the higher grades visit friends. Fewer of the lower grades were involved in hobbies. Among men, fewer of the lower grades have a confidante in whom they can entrust their problems; fewer receive practical support; more report negative reactions from persons close to them. Patterns were less clear in women.

More of the lower grades were likely to have reported two or more from a list of eight major potentially stressful life events in the previous year, and to report difficulties paying bills or with money in general.

Despite their lower rate of heart disease, more of the higher grade participants have the Type A behaviour pattern. It has been suggested that the major component of Type A behaviour responsible for the link to CHD risk is hostility. The lower grades have higher scores on the Cook-Medley Hostility scale.

As one measure of perceived control over their health, fewer of the lower grades reported that they believed it was possible to reduce the risk of heart attack.

#### **An explanation for social inequalities in health?**

The reason for research on inequalities in health is ultimately to determine if they can be changed. One approach to this problem is political. Reduce social inequalities and inequalities in health will be reduced. This may or may not follow. What is required is a better understanding of the links between social position and health.

The Whitehall studies throw up a number of possible explanations. There is only a unifying explanation to the extent that social position is related to a number of factors: differences in early life experience, differences in behaviour, in material conditions and in psycho-social factors. Although there may be multiple factors operating, one is drawn back to the observation that the social class differences apply to most causes of death. The magnitude of the social gradients vary for different causes, presumably because of the operation of

specific factors for specific diseases. The generality of the findings across cause of death groups suggest that there may be factors operating that increase tendency to a variety of diseases.

### Summary

A consistent feature of mortality statistics in England and Wales are the social class differences which have even widened in the decade from 1971 to 1981. Two large studies of British Civil Servants, the Whitehall and Whitehall II studies, add to the understanding of social class differences in mortality and morbidity. Some of their results are presented to illustrate current concepts of social class differences in health. There is no evidence for an effect of health selection. The magnitude of social class differences vary for different causes of death, presumably as a sign of the effect of specific factors for specific disease. The observation that social class differences apply to most causes of death, however, suggest that factors like early life experience, difference in behaviour, material and psychosocial conditions act in an unspecific way.

### Résumé

#### Epidémiologie des différences sociales de la mortalité: L'étude de Whitehall

Les différences sociales de la mortalité parcourent comme un fil rouge les statistiques des causes de mort en Angleterre et au Pays de Galles. Ces différences sont devenues plus importantes entre 1971 et 1981. Au cours de deux études, l'étude Whitehall et Whitehall II, les employés du gouvernement britannique ont été examinés. Ces études permettent de mieux comprendre les différences sociales de la mortalité et la morbidité. A l'aide de quelques résultats, les explications actuelles de ces différences sociales en matière de santé sont discutées. Il n'y a pas d'éléments de preuve en faveur d'une «sélection de santé». La grandeur de différences sociales varie selon les maladies comme l'expression de facteurs spécifiques sur des maladies définies. Mais l'existence de différences sociales qui sont pratiquement identiques pour toutes les causes de mort suggère un effet non-spécifique de facteurs comme l'enfance, la situation matérielle et psychosociale, et les différences de comportement.

### Zusammenfassung

#### Epidemiologische Aspekte der sozialen Unterschiede in der Mortalität: Die Whitehall Studie

Sozialschicht-Unterschiede in der Sterblichkeit ziehen sich wie ein roter Faden durch die Todesursachenstatistik von England und Wales. Die Unterschiede sind zwischen 1971 und 1981 sogar grösser geworden. In zwei grossen Studien, der Whitehall-

und der Whitehall-II-Studie, wurden britische Regierungsbeamte untersucht. Diese Studien erlauben es, die Sozialschicht-Unterschiede in Mortalität und Morbidität besser zu verstehen. Anhand ausgewählter Resultate werden die gängigen Erklärungen für die Sozialschicht-Unterschiede in Bezug auf die Gesundheit diskutiert. Hinweise auf einen Effekt einer „Gesundheits-Selektion“ finden sich nicht. Als Ausdruck der Wirkung spezifischer Faktoren für bestimmte Krankheiten variiert das Ausmass der Sozialschicht-Unterschiede für verschiedene Krankheiten; die Beobachtung aber, dass sich Sozialschicht-Unterschiede für praktisch alle Todesursachen finden, spricht für eine unspezifische Wirkung von Faktoren wie die Lebensbedingungen in der Kindheit, materielle und psychosoziale Lage und Unterschiede im Verhalten.

### References

- 1 Marmot MG, Mc Dowell ME. Mortality decline and widening social inequalities. *Lancet* 1986; ii:274–276.
- 2 Illsley R, LeGrand J. The measurement of inequality in health. No Journal Name.
- 3 Marmot MG, Davey Smith G, Stansfeld S, et al. Health inequalities among British civil servants: the Whitehall II Study. *Lancet* 1991; 337:1387–1393.
- 4 Marmot MG, Shipley MG, Rose G. Inequalities in death – specific explanations or a general pattern? *Lancet* 1984; i:1003.
- 5 Wilkinson G. Stress: another chimera. *Br Med J* 1991; 302:191–192.
- 6 Black D, Morris JN, Smith C, Townsend P, Whitehead M. Inequalities in health: The Black report; The health divide. London: Penguin Group, 1988.
- 7 Berkman LF, Syme SL. Social networks, host resistance and mortality: a nine-year follow-up of Alameda County residents. *Am J Epidemiol* 1979; 109:186–204.
- 8 Cassel JC. The contribution of the social environment to host resistance. *Am J Epidemiol* 1976; 104:107–123.
- 9 Davey Smith GG, Leon D, Shipley MJ, Rose G. Socioeconomic Differentials in Cancer Among Men. *Int J of Epidem* 1991; 20:339–345.
- 10 OPCS. Occupational Mortality 1970–1972. London: H. M. S. O., 1978.
- 11 Davey Smith G, Shipley MJ, Rose G. Magnitude and Causes of Socioeconomic Differentials in Mortality: Further Evidence from the Whitehall Study. *J Epidem Comm Health* 1990; 44:265–270.
- 12 Townsend P, Phillimore P, Beattie A. Health and Deprivation: Inequality and the North. London: Croom Helm, 1988.
- 13 Eames M, Ben Shlomo Y, Marmot MG. Area Deprivation and Mortality. 1992; (unpublished).
- 14 Barker DJP, Winter PD, Osmond C, Margetts B, Simmonds SJ. Weight in infancy and death from ischaemic heart disease. *Lancet* 1989; ii:577–580.
- 15 Ben Shlomo Y, Davey Smith G. Deprivation in infancy or adult life: which is more important for mortality risk? *Lancet* 1991; 337:530–534.

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