Change in health inequalities among British civil servants: the Whitehall II study

J E Ferrie, M J Shipley, G Davey Smith, S A Stansfeld, M G Marmot

Study objective: Despite an overall decline in mortality rates, the social gradient in mortality has increased over the past two decades. However, evidence on trends in morbidity and cardiovascular risk factors indicates that socioeconomic differences are static or narrowing. The objective of this study was to investigate morbidity and cardiovascular risk factor trends in white collar British civil servants.

Design: Self rated health, longstanding illness, minor psychiatric morbidity (General Health Questionnaire (GHQ) 30 score, GHQ caseness and GHQ depression subscale), cholesterol, diastolic and systolic blood pressure, body mass index, alcohol over the recommended limits, and smoking were collected at baseline screening (1985–88) and twice during follow up (mean length of follow up 5.3 and 11.1 years). Employment grade gradients in these measures at each phase were compared.


Participants: White collar women and men aged 35–55, employed in 20 departments at baseline screening. Analyses included 6770 participants who responded to all three phases.

Results: Steep employment grade gradients were observed for most measures at second follow up. In general, there was little evidence that employment grade gradients have increased over the 11.1 years of follow up, but marked increases in the gradient were observed for GHQ score (p<0.001) and depression (p=0.05) in both sexes and for cholesterol in men (p=0.01).

Conclusions: There is little evidence of an increase in inequality for most measures of morbidity and cardiovascular risk factors in white collar civil servants over the 11.1 years to 1998. Inequalities have increased significantly for minor psychiatric morbidity in both sexes and for cholesterol in men.

The first Whitehall study of British civil servants, begun in 1967, demonstrated a steep inverse association between socioeconomic position, assessed by grade of employment, and mortality after 10 years of follow up. Although less steep after retirement, this grade gradient remained highly significant after 25 years. Between 1985 and 1988 the Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Against a backdrop of overall declines in mortality rates, analyses of population data have shown that the social gradient in mortality has increased. However, although socioeconomic gradients in various measures of morbidity and health related behaviour are well documented, there has been comparatively little research examining trends in these measures over time. The evidence to date has concentrated mainly on traditional risk factors for cardiovascular disease and indicates that socioeconomic differences are static or narrowing.

Using the Whitehall II study, this paper investigates changes in the socioeconomic gradient in morbidity and cardiovascular risk factors among white collar workers over a period of 11 years from the late 1980s.

METHODS

Participants

The target population for Whitehall II was all London based civil servants: the Whitehall II study. The Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity. A new cohort of civil servants, the Whitehall II study, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Between 1985 and 1988 the Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Against a backdrop of overall declines in mortality rates, analyses of population data have shown that the social gradient in mortality has increased. However, although socioeconomic gradients in various measures of morbidity and health related behaviour are well documented, there has been comparatively little research examining trends in these measures over time. The evidence to date has concentrated mainly on traditional risk factors for cardiovascular disease and indicates that socioeconomic differences are static or narrowing.

Using the Whitehall II study, this paper investigates changes in the socioeconomic gradient in morbidity and cardiovascular risk factors among white collar workers over a period of 11 years from the late 1980s.

The first Whitehall study of British civil servants, begun in 1967, demonstrated a steep inverse association between socioeconomic position, assessed by grade of employment, and mortality after 10 years of follow up. Although less steep after retirement, this grade gradient remained highly significant after 25 years. Between 1985 and 1988 the Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Against a backdrop of overall declines in mortality rates, analyses of population data have shown that the social gradient in mortality has increased. However, although socioeconomic gradients in various measures of morbidity and health related behaviour are well documented, there has been comparatively little research examining trends in these measures over time. The evidence to date has concentrated mainly on traditional risk factors for cardiovascular disease and indicates that socioeconomic differences are static or narrowing.

Using the Whitehall II study, this paper investigates changes in the socioeconomic gradient in morbidity and cardiovascular risk factors among white collar workers over a period of 11 years from the late 1980s.

The target population for Whitehall II was all London based civil servants: the Whitehall II study. The Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity. A new cohort of civil servants, the Whitehall II study, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

The first Whitehall study of British civil servants, begun in 1967, demonstrated a steep inverse association between socioeconomic position, assessed by grade of employment, and mortality after 10 years of follow up. Although less steep after retirement, this grade gradient remained highly significant after 25 years. Between 1985 and 1988 the Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Against a backdrop of overall declines in mortality rates, analyses of population data have shown that the social gradient in mortality has increased. However, although socioeconomic gradients in various measures of morbidity and health related behaviour are well documented, there has been comparatively little research examining trends in these measures over time. The evidence to date has concentrated mainly on traditional risk factors for cardiovascular disease and indicates that socioeconomic differences are static or narrowing.

Using the Whitehall II study, this paper investigates changes in the socioeconomic gradient in morbidity and cardiovascular risk factors among white collar workers over a period of 11 years from the late 1980s.

The target population for Whitehall II was all London based civil servants: the Whitehall II study. The Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity. A new cohort of civil servants, the Whitehall II study, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

The first Whitehall study of British civil servants, begun in 1967, demonstrated a steep inverse association between socioeconomic position, assessed by grade of employment, and mortality after 10 years of follow up. Although less steep after retirement, this grade gradient remained highly significant after 25 years. Between 1985 and 1988 the Whitehall II study, a new cohort of civil servants, was established to investigate the degree and causes of the social gradient in morbidity. Analyses of the baseline data found that in the 20 years separating the two studies there had been no diminution in socioeconomic difference in morbidity.

Against a backdrop of overall declines in mortality rates, analyses of population data have shown that the social gradient in mortality has increased. However, although socioeconomic gradients in various measures of morbidity and health related behaviour are well documented, there has been comparatively little research examining trends in these measures over time. The evidence to date has concentrated mainly on traditional risk factors for cardiovascular disease and indicates that socioeconomic differences are static or narrowing.

Using the Whitehall II study, this paper investigates changes in the socioeconomic gradient in morbidity and cardiovascular risk factors among white collar workers over a period of 11 years from the late 1980s.
senior executive officer, higher executive officer, executive officer, clerical officer, and clerical assistant. Other professional and technical staff were assigned to these grades on the basis of salary. For analysis, unified grades 1–6 were combined into six categories; category 1 represents the highest grade (Grade 1), and presented these in the tables.

At Phases 1 and 3, health over the past year was self rated as fair or poor was compared with good, very good, and excellent. Smoking prevalence was defined as current smokers using either manufactured or hand rolled cigarettes. Analyses compared smokers with non-smokers, with adjustment for prevalence and number of cigarettes smoked per day at baseline.

At the screening examination, blood pressure (mm Hg) was measured twice with the participant seated after a five minute rest, using a Hawksley random-zero sphygmomanometer. Blood was taken and serum cholesterol concentration (mmol/l) measured using the cholesterol oxidase/peroxidase colorimetric method (BCL kit). Weight (wt) in kilograms and height (ht) in metres were recorded. Body mass index (BMI) was calculated from these two measures as wt/ht². Further details of all these measures have been reported previously.1 10

Ethical approval
Ethical approval for the Whitehall II study was obtained from the University College London Medical School committee on the ethics of human research.

Study sample and statistical analysis
Of the 10 308 respondents who participated in the baseline screening 8354, 81%, participated at Phase 3 (5.3 years follow up) and 7824, 76%, at Phase 5 (11.1 years follow up). Analyses were restricted to the 6770 respondents (2013 women and 4757 men) who participated in all three Phases.

The aim of the analysis was to compare the employment grade gradient at baseline for each measure of morbidity or cardiovascular risk factor, based on baseline grade, for the same measure at 5.3 and 11.1 years. The analyses produce a regression line, which represents the increase in risk for a unit increase in the employment grade. We have used this employment grade gradient to estimate the odds ratio (OR) or difference (Diff) in risk (and 95% confidence intervals) between respondents in the lowest (Grade 6) and respondents in the highest grade (Grade 1), and presented these in the tables.

---

### Table 1  Age adjusted morbidity prevalence and cardiovascular risk factors (means and percentages) after 11.1 years of follow up by civil service employment grade category—women

<table>
<thead>
<tr>
<th>Health measure</th>
<th>Employment grade category (N)</th>
<th>1 (high)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6 (low)</th>
<th>p Value test for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>self rated health fair or poor (SF36)</td>
<td>2013</td>
<td>10.0%</td>
<td>11.3%</td>
<td>10.8%</td>
<td>14.6%</td>
<td>19.0%</td>
<td>23.6%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>GHQ score</td>
<td>1533</td>
<td>52.3%</td>
<td>55.6%</td>
<td>50.0%</td>
<td>51.6%</td>
<td>58.6%</td>
<td>54.9%</td>
<td>p=0.31</td>
</tr>
<tr>
<td>GHQ caseness</td>
<td>1935</td>
<td>21.0%</td>
<td>20.0%</td>
<td>18.2%</td>
<td>14.3%</td>
<td>13.4%</td>
<td>11.4%</td>
<td>p=0.01</td>
</tr>
<tr>
<td>depression (10 units/week)</td>
<td>1733</td>
<td>5.85%</td>
<td>6.12%</td>
<td>5.87%</td>
<td>5.96%</td>
<td>6.04%</td>
<td>5.97%</td>
<td>p=0.03</td>
</tr>
<tr>
<td>smoking</td>
<td>1972</td>
<td>39.1%</td>
<td>30.5%</td>
<td>23.3%</td>
<td>19.5%</td>
<td>11.1%</td>
<td>6.8%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>% of participants in each grade*</td>
<td>4.5%</td>
<td>9.8%</td>
<td>7.4%</td>
<td>16.3%</td>
<td>20.5%</td>
<td>41.4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These percentages vary slightly for each measure.

---

### Table 2  Age adjusted morbidity prevalence and cardiovascular risk factors (means and percentages) after 11.1 years of follow up by civil service employment grade category—men

<table>
<thead>
<tr>
<th>Health measure</th>
<th>Employment grade category (N)</th>
<th>1 (high)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6 (low)</th>
<th>p Value test for trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>self rated health fair or poor (SF36)</td>
<td>4757</td>
<td>8.9%</td>
<td>9.5%</td>
<td>9.0%</td>
<td>11.2%</td>
<td>16.6%</td>
<td>21.9%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>GHQ score</td>
<td>3683</td>
<td>44.7%</td>
<td>45.8%</td>
<td>46.9%</td>
<td>45.2%</td>
<td>53.8%</td>
<td>54.1%</td>
<td>p=0.007</td>
</tr>
<tr>
<td>GHQ caseness</td>
<td>4696</td>
<td>17.5%</td>
<td>20.2%</td>
<td>18.3%</td>
<td>19.8%</td>
<td>24.3%</td>
<td>21.2%</td>
<td>p=0.003</td>
</tr>
<tr>
<td>depression (15 units/week)</td>
<td>4697</td>
<td>0.79%</td>
<td>0.84%</td>
<td>0.80%</td>
<td>0.93%</td>
<td>1.36%</td>
<td>1.44%</td>
<td>p=0.001</td>
</tr>
<tr>
<td>smoking</td>
<td>4717</td>
<td>5.4%</td>
<td>8.4%</td>
<td>12.3%</td>
<td>10.4%</td>
<td>11.8%</td>
<td>6.4%</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>% of participants in each grade*</td>
<td>4.5%</td>
<td>9.8%</td>
<td>7.4%</td>
<td>16.3%</td>
<td>20.5%</td>
<td>41.4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These percentages vary slightly for each measure.
Table 3  Age adjusted odds ratios or differences in morbidity between the lowest compared with the highest employment grade at baseline, 5.3, and 11.1 years, and test for change in the gradient over 11.1 years—women

<table>
<thead>
<tr>
<th>Health measure</th>
<th>N</th>
<th>OR/ Diff</th>
<th>Gradient at baseline OR or Diff (95% CI)</th>
<th>Gradient at 5.3 years OR or Diff (95% CI)</th>
<th>Gradient at 11.1 years OR or Diff (95% CI)</th>
<th>p Value for change in gradient over 11.1 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>self rated health</td>
<td>2013</td>
<td>OR 2.30</td>
<td>(1.6 to 3.2)***</td>
<td>2.00 (1.4 to 2.8)***</td>
<td>1.58 (1.2 to 2.1)***</td>
<td>p=0.56</td>
</tr>
<tr>
<td>(from SF36 question)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Baseline–5.3 years)</td>
</tr>
<tr>
<td>longstanding illness</td>
<td>1533</td>
<td>OR 0.83</td>
<td>(0.6 to 1.2)</td>
<td>0.89 (0.6 to 1.3)</td>
<td>0.90 (0.7 to 1.1)</td>
<td>p=0.06</td>
</tr>
<tr>
<td>GHQ score</td>
<td>1950</td>
<td>Diff -1.58</td>
<td>(-0.7 to -2.4)***</td>
<td>-0.88 (-1.0 to -1.7)</td>
<td>-0.90 (-1.1 to -1.7)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>GHQ caseness</td>
<td>1950</td>
<td>OR 0.57</td>
<td>(0.4 to 0.8)</td>
<td>0.59 (0.4 to 0.8)</td>
<td>0.60 (0.4 to 0.8)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>depression</td>
<td>1959</td>
<td>Diff 0.12</td>
<td>(0.2 to 0.4)</td>
<td>0.18 (-0.1 to 0.5)</td>
<td>0.18 (-0.2 to 0.4)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>cholesterol (mmol/l)</td>
<td>1733</td>
<td>Diff 0.01</td>
<td>(-0.2 to 0.2)</td>
<td>0.09 (-0.1 to 0.3)</td>
<td>0.09 (-0.2 to 0.2)</td>
<td>p=0.92</td>
</tr>
<tr>
<td>systolic blood pressure (mm Hg)</td>
<td>1791</td>
<td>Diff 0.12</td>
<td>(-0.2 to 0.4)</td>
<td>1.89 (-0.2 to 3.9)</td>
<td>1.89 (-0.2 to 3.9)</td>
<td>p=0.48</td>
</tr>
<tr>
<td>diastolic blood pressure (mm Hg)</td>
<td>1791</td>
<td>Diff 0.52</td>
<td>(-1.0 to 2.0)</td>
<td>1.65 (0.3 to 3.0)</td>
<td>1.65 (0.3 to 3.0)</td>
<td>p=0.23</td>
</tr>
<tr>
<td>body mass index (kg/m²)</td>
<td>1588</td>
<td>Diff 1.91</td>
<td>(1.3 to 2.6)***</td>
<td>1.89 (1.1 to 2.6)**</td>
<td>1.89 (1.1 to 2.6)**</td>
<td>p=0.64</td>
</tr>
<tr>
<td>Health related behaviour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>alcohol over the recommended limits</td>
<td>1971</td>
<td>OR 0.10</td>
<td>(0.1 to 0.2)***</td>
<td>0.08 (0.1 to 0.2)</td>
<td>0.09 (0.1 to 0.2)</td>
<td>p=0.60</td>
</tr>
<tr>
<td>smoking</td>
<td>2041</td>
<td>OR 2.04</td>
<td>(1.4 to 3.1)***</td>
<td>2.57 (1.6 to 4.1)**</td>
<td>2.68 (1.6 to 4.4)***</td>
<td>p=0.86</td>
</tr>
</tbody>
</table>

Test of significance of employment grade gradient: *p<0.05; **p<0.01; ***p<0.001.

Odds ratios above 1.0 and differences above 0.0 indicate an inverse grade gradient, that is, greater risk among the lower grades, while odds ratios below 1.0 and differences below 0.0 indicate a positive grade gradient, that is, greater risk among the higher grades. The p value for the change in the employment grade gradient over the 11.1 years from baseline was determined by calculating the difference between the regression coefficients for the gradient at each data collection point and testing this against a null hypothesis of no difference. Different grade gradients for women and men had already been demonstrated at baseline in the Whitehall II cohort, so analyses were conducted separately by sex. Data were analysed using SAS version 6.12 for Windows.17

RESULTS
Tables 1 and 2 show age adjusted morbidity and cardiovascular risk factor figures for each employment grade category after 11.1 years of follow up. Employment grade gradients at baseline, 5.3 and 11.1 years, and a test for change in the gradient over the 11.1 years are presented in tables 3 and 4.

At all three time periods there is consistent evidence of an inverse employment grade gradient for self rated health in both sexes, for BMI in women and for depression and diastolic blood pressure in men (p<0.01). BMI in men is also inversely related to grade, but the strength of the association at baseline and 5.3 years (p<0.01) has diminished by 11.1 years (p<0.05). There is little indication of a gradient in longstanding illness at baseline and 5.3 years, although by 11.1 years an inverse gradient has emerged, p<0.05 in men.

In both sexes a positive gradient in GHQ score and caseness at baseline has changed to an inverse association after 11.1 years. Among women these positive baseline gradients are statistically significant (p<0.001), but the strength of the association is diminished after 5.3 years, and by 11.1 years there is evidence of a steep inverse gradient in GHQ score (p<0.01). In men the positive gradients at baseline are weak, but after 11.1 years there is evidence of a steep inverse association with GHQ score (p<0.001) and GHQ caseness (p<0.05).

There is some indication of an inverse gradient in depression in women at baseline and 5.3 years, and evidence of a strong inverse association after 11.1 years (p<0.001).

In women there is little indication of a gradient in alcohol consumption and smoking over the recommended limits in both sexes. Among men the evidence of an inverse association at baseline has changed to a positive gradient after 11.1 years (p<0.05).

There is also evidence of an inverse
Concentration in men.

Minor psychiatric morbidity in both sexes and cholesterol in the highest has widened considerably for measures of between those in the lowest employment category and those years follow up of the Whitehall II study. Furthermore, the gap steep employment grade gradients in measures of morbidity and in systolic pressure at 11.1 years in men (p<0.01) (tables available on request). There was also a considerably positive among excluded men. There was also a considerably positive association with income among men in the Minnesota Heart Survey.

The latter findings are in direct contrast with our own, but this is possibly because men who participated in the study were aged 20–64 and the data come from two unrelated cross sectional studies.

Comparison of employment grade gradients at baseline for participants included and those excluded from the analyses indicate that, in general, gradients are steeper at baseline among excluded participants. In several cases, such as longstanding illness and systolic blood pressure in men, this loss to follow up explains the difference between the non-significant grade at baseline seen in these data and the statistically significant gradient reported by us previously. However, evidence of differences between those included and those excluded from further analysis, with the exception of depression and cholesterol in men, is weak. In both sexes there was no significant interaction between grade and health in the likelihood of being excluded from the analyses.

Use of employment grade at baseline to determine the grades means our measure of socioeconomic position is not contemporaneous with our morbidity and cardiovascular risk factor measures at 5.3 and 11.1 years. Baseline grade was chosen as it is available for all participants, and analyses using last known grade produced findings little different from those presented (data not shown). However, it was felt that use of last known grade as the measure of socioeconomic position posed problems in that it reflects mobility for those who remained in the civil service, but cuts short the trajectories of those who have retired early or left the civil service to take up employment elsewhere, 54% of participants by the 11.1 year follow up. Use of baseline grade also minimises the effect of reverse causality where the levels of morbidity at baseline may effect subsequent mobility and hence grade at 5.3 and 11.1 years.

Consistency with other studies

Most recent studies of risk factors for cardiovascular disease report that socioeconomic differences have remained unchanged, with the exception of an increase in the differential in smoking. However, a study among men, which included morbidity in addition to cardiovascular risk factors, showed that the degree of inequality for most measures tended to narrow between 1984 and 1993. Most of the changes were non-significant, but the decrease in inequality in diastolic blood pressure and GHQ caseness was marked (p<0.01). The latter findings are in direct contrast with our own, but this is possibly because men who participated in the study were aged 20–64 and the data come from two unrelated cross sectional studies.

Of particular note in our findings is the shift from a significant positive gradient in GHQ score for both sexes at baseline to a significant inverse gradient 11.1 years later, and the emergence of a significant positive gradient in cholesterol in men. Cholesterol concentration in other studies shows an inverse relation with education which has persisted over time, although there is some evidence of a non-significant positive association with income among men in the Minnesota Heart Survey. We hypothesised that the emergence of a significant, positive grade gradient in cholesterol concentration after 11.1 years.
years could be attributable to low cholesterol associated with ill health among participants in the lower grades. This would have been absent at baseline because of the healthy worker effect. Analyses comparing cholesterol concentrations for men with and without longstanding illness indicated that cholesterol was slightly lower among men with longstanding illness at 11.1 years (p=0.24), but analyses of self-rated health showed those in poorer health to have slightly higher cholesterol.

It is difficult to explain why there should have been such improvement in levels of minor psychiatric morbidity in the three highest employment grades. A validation study at baseline showed that the positive gradient in GHQ score in the Whitehall II cohort, which ran counter to most evidence in the literature, was attributable to under-reporting of minor psychiatric disorder on the GHQ amongst civil servants in the lower employment grades. Possibly there was also some over-reporting in the higher grades.

Generally, with increasing age, levels of psychological distress might be expected to diminish in this cohort. This might explain the decline in minor psychiatric morbidity in the higher grades. At the same time, new physical illness might develop with age, particularly affecting the lower employment grades. The increase in minor psychiatric morbidity in the lower grades might thus be subsequent to the development of physical illness. A further contributor to the increase in minor psychiatric morbidity among the lower grades at 11.1 years might have been the growing insecurity and deterioration in conditions of employment and income as participants from these grades were hived off to private sector employers or were shed from the workforce. There are two other potential explanations. It is possible there was some selective early retirement among higher employment grades with minor psychiatric morbidity after 5.3 years that led to an apparent improvement in minor psychiatric morbidity after 11.1 years. Early retirement was more of an option in higher grade employees. The other, less plausible explanation is a deterioration in working conditions and the increased likelihood of physical illness in the lower grades seem the most plausible and demand further analysis in the future.

ACKNOWLEDGEMENTS

The Whitehall II study has been supported by grants from the Medical Research Council; British Heart Foundation; Health and Safety Executive; Department of Health; National Heart Lung and Blood Institute (HL36310), US, NIH; National Institute on Aging (AG13196), US, NIH; Agency for Health Care Policy Research (HS06516); and the John D and Catherine T MacArthur Foundation Research Networks on Successful Midlife Development and Socio-economic Status and Health. FP was supported by the Economic and Social Research Council (L128251046) during the preparation of this paper. MM is supported by an MRC Research Professorship. MS is supported by a grant from the British Heart Foundation.

We thank all participating Civil Service departments and their welfare, personnel, and establishment officers; the Occupational Health and Safety Agency; the Council of Civil Service Unions; all participating civil servants in the Whitehall II study; and all members of the Whitehall II study team. The authors would like to thank Jenny Head for comments on an early draft of the paper.

Contributors

Jane Ferrie wrote the original and successive drafts of the paper and was involved in the data collection for Phase 3. Martin Shipley performed the analyses and advised on drafts of the paper. George Davey Smith was involved with the data collection at Phase 1 and commented on all drafts of the paper. Stephen Stansfeld was involved with the data collection and commented on drafts of the paper. Michael Marmot designed and directed the Whitehall II study and commented on drafts of the paper.

Authors’ affiliations

J E Ferrie, M J Shipley, M G Marmot, International Centre for Health and Society, Department of Epidemiology and Public Health, University College London Medical School, London, UK

G Davey Smith, Department of Social Medicine, University of Bristol, Bristol, UK

S A Stansfeld, Department of Psychiatry, Queen Mary University of London, London, UK

Conflicts of interest: none.

REFERENCES

Change in health inequalities among British civil servants: the Whitehall II study

J E Ferrie, M J Shipley, G Davey Smith, S A Stansfeld and M G Marmot

*J Epidemiol Community Health* 2002 56: 922-926
doi: 10.1136/jech.56.12.922

Updated information and services can be found at:
http://jech.bmj.com/content/56/12/922

These include:

**References**

This article cites 13 articles, 7 of which you can access for free at:
http://jech.bmj.com/content/56/12/922#BIBL

**Email alerting service**

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Topic Collections**

Articles on similar topics can be found in the following collections

- Epidemiologic studies (2838)
- Mortality and morbidity (1463)
- Health service research (832)
- Screening (epidemiology) (271)
- Screening (public health) (271)
- Cohort studies (794)
- Health education (1537)
- Health promotion (1711)
- Smoking (895)
- Smoking and tobacco (893)

**Notes**

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/