Socioeconomic Status, Structural and Functional Measures of Social Support, and Mortality: The British Whitehall II Cohort Study, 1985-2009.

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Abstract

This study examines the associations of social support with socioeconomic status (SES) and mortality, and its role in explaining SES differences in mortality. Analyses were based on 9333 participants from the British Whitehall II study, a longitudinal cohort established in 1985 among London-based civil servants, aged 35-55y at baseline. SES was assessed using the employment grade at baseline and social support was assessed 3 times over a follow-up for mortality of 24.4 years. In men, marital status and to a lesser extent network score (but not low perceived support or high negative aspects of close relationships) predicted all-cause and cardiovascular mortality. Measures of social support were not associated with cancer mortality. Men in the lowest SES had an increased risk of death compared to those in the highest (HR=1.59; 95%CI=1.21,2.08 for all-cause and HR=2.48; 95%CI=1.55,3.92 for cardiovascular mortality). Network score and marital status explained 27% (95%CI=14%;43%) and 29%(95%CI=17%;52%) of the association between SES and all-cause and cardiovascular mortality, respectively. In women, there was no consistent association between social support indicators and mortality. This study suggests that in men, social isolation is not only an important risk factor for mortality but is also likely to contribute to explaining socioeconomic differences in mortality.

Abbreviations:

BCa Bias Corrected Accelerated

CI Confidence Interval

CHD Coronary Heart Disease

CVD Cardiovascular Disease

HR Hazard Ratio

OR Odds Ratio

SES Socioeconomic Status

SRH Self-rated Health

Running Head:

Socioeconomic status, social support and mortality

Introduction

Since the late 1970s evidence has accumulated on the importance of social support in relation to mortality (8, 11, 17, 20, 39, 41, 53). A much-cited review from the late 1980s (19) compared the strength of the social relationships-health association to that of cigarette smoking. Subsequent observational studies have shown adverse effects of lack of social support on mortality (7, 40) and a variety of other health outcomes, including coronary heart disease (37), mental health (44, 46), self-rated health (34), and prognosis after myocardial infarction (6, 35).

Structural/quantitative measures of social support, such as network size and participation in group activities, have often been used to assess social support (7, 8, 20, 22, 39, 41). A number of studies have also focused on the relational content of social interactions using functional measures (6, 11, 17), such as emotional or instrumental support, or negative aspects of close relationships (9, 13, 47).

Measures of social support have been shown to be associated with socioeconomic status (SES), in the sense that individuals in higher socioeconomic groups are more likely to be married, have more friends, and report higher levels of social support (21, 49). This has led researchers to consider the different availability of social support between socioeconomic groups as one of the mechanisms through which socioeconomic circumstances "get under the skin" to influence health (16, 31, 33, 37, 49). However, few studies have attempted to evaluate the contribution of social support to socioeconomic differences in health, and those that have done so have produced inconsistent results (33).

In this study we use data from the Whitehall II Study to examine the extent to which a number of structural and functional measures of social support are related to SES and the extent to

which they are associated with all-cause and cause-specific mortality. We additionally examine the contribution of these factors to explaining socioeconomic differences in all-cause and cardiovascular mortality.

Data and Methods

Study Population

The Whitehall II study was established in 1985 among 10 308 London-based civil servants (6 895 men and 3 413 women) aged 35-55 years (30). Baseline examination (Phase 1) took place during 1985-1988, and involved a clinical examination and a self-administered questionnaire containing sections on demographic characteristics, health, lifestyle factors, work characteristics, social support and life events.

Socioeconomic status (SES)

SES was assessed using occupational position at baseline (Phase 1). This information is obtained by asking the participants to give their civil service grade title (15, 32). Participants are then classified using the civil service employment grade classification and then grouped into three categories: high (administrative), intermediate (professional or executive) and low (clerical or support) grades. This measure is a comprehensive marker of socioeconomic circumstances and is related to salary, level of responsibility at work, and education (14, 32).

Social support (see online supplemental material)

Comprehensive measurements of functional and structural aspects of social support were available at Phase 2 (1989-1990), Phase 5 (1997-1999) and Phase 7 (2002-2004) of the study.

Functional measures of social support

We assessed three functional measures of social support, confiding/emotional, practical and negative aspects of close relationships, using the Close Persons Questionnaire (45). This assesses the support received from the person nominated as "closest person" by the participant. *Confiding/emotional support* (7-items) measures wanting to confide, confiding, sharing interests, boosting self-esteem and reciprocity. *Practical support* (4-items) is a measure of practical help received *and negative aspects of close relationships* (4-items) measures adverse exchanges and conflicts within a relationship. Each item was evaluated on a 4-point Likert scale with higher scores indicating higher support or greater negative aspects. The Likert-scaled responses for the items of each social support scale were summed and then grouped into quartiles. The Cronbach α for the scales was 0.63 for negative aspects of close relationships, 0.85 for confiding/emotional support, and 0.82 for practical support. Test-retest reliability over a 4-week interval was 0.72 for negative close relationships, 0.71 for practical support and 0.88 for confiding/emotional support (45).

Structural measures of social support

We used two structural measures, marital status and a measure of social network. The *social network* measure was obtained from questions a) on the frequency of contacts with relatives, friends, and colleagues and frequency of participation in social or religious activities and b) on the total number of relatives or friends seen once a month or more. The scaled responses were summed and the overall number was divided into quartiles. *Marital status* was coded as married/cohabiting versus never married, separated, divorced, and widowed, combined together.

As preliminary analyses revealed that only participants in the lowest quartile of social support (or highest for negative aspects) were at higher risk for mortality, in all analyses measures of

social support were dichotomized and the lowest quartile (or highest for negative aspects) was compared to the other three quartiles.

Missing data on social support

We used primarily Phase 2 rather than Phase 1 data as the social support questions were introduced to the study midway through Phase 1. For missing data at Phase 2 (between 16% and 18% depending on the measure) we used data from Phase 1. At Phases 5 or 7, we applied multiple multivariate imputation based on sex, age, occupational grade and social support or network score at the preceding phase to impute missing values on social support and network score. Missing data on marital status were replaced with data from the previous phase. 28% of participants at Phase 5 and 13% at Phase 7 had at least one missing value imputed.

Mortality

10 297 (99.9%) respondents were successfully followed-up for mortality through the national mortality register kept by the National Health Services Central Registry, using the National Health Service identification number. Participants were followed-up from Phase 1 until 31th January, 2010; a total of 24.4 years (mean= 20.8 years). We examined all-cause mortality and cancer and cardiovascular disease (CVD). The International Classification of Disease (ICD) codes were used to define cancer (ICD-9 140.0-209.9 and ICD-10 C00-C97) and CVD mortality (ICD-9 390.0-458.9, ICD-10 I00-I99).

Statistical Analysis

All analyses were performed separately in men and women. The association of SES with measures of social support was examined using age-and SRH-adjusted logistic regressions with SES entered as a 3-level categorical variable.

We examined the association of each measure of social support, used as time dependent variable, and all-cause, cardiovascular and cancer (results not shown) mortality using age-adjusted Cox regressions. We subsequently introduced adjustment for SES and SRH. Then, we estimated Hazard Ratios (HR) and their 95% confidence intervals (CIs) for the association between SES and mortality. As this association in women was not significant at conventional levels (age-adjusted HR=1.34, 95%CI=0.89,2.01 for lowest versus highest grade) and as there was no socioeconomic gradient in cancer mortality in this study (age-adjusted HR=1.18, 95%CI=0.77,1.81 for lowest versus highest grade in men), further analysis involving SES and mortality were based only on men and restricted to all-cause and CVD mortality. These analyses examined the extent to which the social support measures explained the association between SES and all-cause and CVD mortality. As tests did not suggest departure from a linear trend, we used the measure of SES as a continuous 3-level variable. The HR associated with a unit change in SES was squared to yield the hazard in the lowest versus to the highest socioeconomic group (a two unit change) under the assumption of linearity of association between SES and mortality. The Cox regression was first age-adjusted (Model 1). Then, the association of SES with mortality was further adjusted for SRH (Model 2). Subsequently, the social support items assessed longitudinally through the follow-up were entered individually and then simultaneously into Model 2. The contribution of social support in explaining the association between SES and mortality was determined by the % reduction in the SES coefficient after inclusion of the indicator in question to Model 2, using the formula "100 x ($\beta_{\text{Model 2}} - \beta_{\text{Model 2+ social support(s)}}$)/($\beta_{\text{Model 2}}$)". We finally calculated a 95% CI around the % attenuation using a bias corrected accelerated (BCa) bootstrap method with 2000 resamplings.

In the Cox regressions, participants with complete data, after imputation, on all measures at all intervals preceding death or the end of follow-up were censored at their date of death or at

end of follow-up. The remaining participants were censored, after imputation, at the last date at which they had complete data on all measures for all preceding phases.

Measures of social support and of self-rated health were assessed as time dependent variables with the episode splitting method. SES was entered as assessed at baseline in all analyses, as allowing SES to vary over time would introduce reverse causation biases. The proportional hazard assumptions for Cox regression models were tested using Schoenfeld residuals and found not to be violated (all p-values ≥ 0.05).

Results

A total of 976 participants were excluded from the analysis because of missing data on one or more measures of social support at baseline (965 participants) or for mortality (11 participants). The analysis was based on the remaining 9 333 participants (6 339 men and 2 994 women). Those excluded tended to be from the lowest socioeconomic group at baseline ($P<0.001$). For nine participants, the cause of death was not known and they were excluded from the cause-specific analyses.

Table 1 shows characteristics of the study population. In men, there was a marked social gradient in mortality, self-rated health, and all indicators of social support (all $P<0.01$), such that high status men had better health and a better social support profile. In women, there was no linear association between SES and mortality ($P=0.162$). High SES women reported low practical support ($P=0.002$) and were more likely to live alone ($P<0.001$) but had a higher network score ($P<0.001$).

Odds ratios (OR) showing the association between SES and social support are presented in Table 2. At baseline (Phases 1/2), men in the lowest SES were more likely to report lower support, more negative aspects of close relationships, a low network score and were over 5-

times more likely not to be married/cohabiting than those in the highest. Women in the highest SES had in general a lower social support profile than those in the lowest. The SES-social support association differed by gender for all indicators (all $P<0.05$) apart from network score at baseline ($P=0.14$) and negative aspects of close relationships at the last follow-up ($P=0.15$).

Table 3 shows the association between indicators of social support and all-cause and CVD mortality. For all-cause mortality in men, low network score (HR=1.27; 95% CI=1.07,1.52) and being unmarried were associated with mortality (HR=1.77; 95% CI=1.45,2.16). The association of network score with all-cause mortality was reduced to borderline significance after adjustment for SES and self-rated health (HR=1.18; 95% CI=0.99,1.40), while there remained a 51% excess risk (HR=1.51; 95% CI=1.23,1.86) of death for participants not married/cohabiting. In women, those reporting low confiding/emotional support had a lower mortality risk in the SES and self-rated health adjusted model. The structural measures of social support were not associated with mortality in women. For CVD mortality, in men the SES and self-rated health adjusted associations of low network score (HR=1.66; 95% CI=1.22,2.26) and living alone (HR=2.16; 95% CI=1.55,3.03) were stronger to those observed for all-cause mortality. None of the measures of social support was related to cancer mortality (results not shown).

As only structural measures of social support were associated with both SES and mortality, we examined their contribution to explaining socioeconomic differences in all-cause and CVD mortality (Table 4) in men only, due to lack of associations in women. The age and self-rated health adjusted HR for mortality in the lowest SES group compared to the highest was 1.59 (95%CI=1.21, 2.08) for all-cause and 2.48 (95%CI=1.56, 3.92) for CVD mortality. Network score and marital status explained, overall, 27% (95%CI=14%; 43%) of the

association of SES with all-cause mortality and 29% (95%CI=17%; 52%) of that with CVD mortality.

Discussion

In this study, we examined several indicators of social support for their association with SES and mortality and estimated their contribution to explaining SES differences in all-cause and cardiovascular mortality. Our results show that in men both structural and functional measures of social support are socially patterned, in that higher status men report better social support. Furthermore, structural (small social network or not being married /cohabiting) but not functional aspects of support (lack of perceived support) predicted all-cause and cardiovascular mortality, and explained about one-fourth of the association between SES and mortality. In women, those in the higher socioeconomic groups did not have better social support and there was no consistent association between social support indicators and mortality.

Social support and mortality

Social support is hypothesised to affect health mainly through providing resources that can be used to avoid the risk of disease, minimize their consequences or influence health-promoting or health-damaging behaviours (5). In addition, social support might have a direct effect on a range of physiologic systems such as immune, neuroendocrine, and cardiovascular activity (40). In our study, poor social integration in men, particularly not being married/cohabiting, was an important predictor of all-cause and cardiovascular mortality. Most previous work on social support has been based on the elderly or general population settings where individuals in "marginal" positions could be driving the association with mortality (8, 11, 20, 22, 48, 53). Our results showing the same to be true in a white-collar cohort of men across a wide age

range (from 35 to 55 years at study entry) add to the evidence that social support may play an important role in men's health. Overall, marital status more strongly predicted mortality than the other indicators of social support examined, as reported previously (20, 39, 41). The association between network score and all-cause mortality was no longer significant after adjustment for SES and self-rated health, suggesting that part of the effect of social networks on health is either mediated or confounded by these two factors. The association of network score with cardiovascular mortality was also attenuated after adjustment for SES and self-rated health but there remained a 66% increased risk of death for participants with a low network score.

Although much of the evidence linking social support to mortality is based on studies using structural measures (19, 29), functional measures are often thought to be better indicators of social support under the hypothesis that the actual support provided by the social network rather than its mere existence matters for health (40). A recent meta-analysis (18) showed functional measures of support to be associated with a 46% greater odds of survival. Our findings are in contrast with this result, as even in men we did not observe an association between mortality and perceived confiding/emotional support or practical support. In women, an inverse association was found, such that low confiding/emotional support and low practical support were associated with a lower mortality risk. However, low perceived emotional support and high negative aspects of close relationships have been related to increased psychiatric distress and heart disease in the present cohort (46, 50).

Reverse causation bias could in part explain the protective effect of low levels of perceived support on mortality, as morbidity might be associated both with an increased support received and higher mortality risk. In our study, in order to account for reverse causation, all analyses were adjusted for self-rated health, a valid measure of health (43). Further, analyses

for the association of measures of social support with mortality were rerun excluding the deaths occurred within one year after the assessment of social support at each phase. These analyses yielded largely similar results to those presented here (results not shown).

Another possible explanation of the protective effect of low levels of perceived support on mortality is that residual confounding by SES may still persist even if all analyses were adjusted for occupational position. However, further adjustment for education and income did not much change the results (results not shown). Finally, it is possible that while perceived support is related to morbidity, it is the structural aspects of support which matter for mortality. Indeed, the correlation between structural and functional measures of social support was generally low.

Social support was not associated with cancer mortality in this study. Previous results have been inconsistent (3, 4, 23, 25, 36). A recent meta-analysis concluded that high levels of perceived social support, larger social networks, and being married are associated with decreased cancer mortality among cancer patients (36). However, the evidence linking social support to cancer mortality is less consistent among non-patient populations, such as the Whitehall II study (23, 52). It is thus possible that social support plays a role only in patient survival after cancer diagnosis, an effect that cannot be detected in our study.

Gender differences in social support

In this study, the social patterning of social support differed by gender, in that men of higher SES reported higher levels of perceived support, had a higher network score and were more frequently married while women of higher SES had lower level of support and were more frequently unmarried. In this cohort, this pattern might be related to the 'marriage bar' rule, that until the late 1960s-early-1970s forced women civil servants to resign if they got married

(10). This meant that married women were unlikely to be in the civil service long enough to be promoted into the higher grades, as also shown by the different distribution of men and women across the socioeconomic categories in this cohort (Table 1). Results on women in Whitehall II might thus not be generalizable to other occupational cohorts more recently established or to the general population of working women.

Structural measures of social support, SES and mortality

Social support and social connectedness have been suggested as possible "fundamental social causes" of social inequalities in health (27). However, very few studies have examined the mediating role of social support in the association between SES and health, and those that have done so have produced inconsistent results (1, 2, 16, 26, 28, 51). Some studies found no evidence that social support, either measured through structural measures, functional measures or both, contributes to the association between SES and mortality after acute myocardial infarction (1), self-rated health and hypertension (16), or stroke risk (26). Instead, Avendano et al. (2) and Liu et al. (28) both used structural measures of social support and found them to contribute to about a third of the socioeconomic gradient in stroke risk or mortality, respectively. In our study, the structural measures of support (social network size and marital status) explained 27% and 29% of the socioeconomic gradient in all-cause and cardiovascular mortality in men. The greater attenuation occurred after adjustment for marital status.

Strengths and weaknesses

This study has three major strengths. First, unlike most previous study we used both structural and functional measures of social support in the same study. Second, we used repeated measurements of social support over the follow-up to account for changes which may have

occurred during the study period. Third, we provide a confidence interval for the contribution of social support to explaining the association between SES and mortality, allowing us to add a degree of precision around the estimate of the attenuations.

This study also has several limitations. First, functional measures of social support were self-reported and they may thus be dependent on personality characteristics of the respondents (45). Moreover, they were based on the support received from the closest person only, while other sources of support have not been examined. However, these measures were derived from a well validated questionnaire (45) and have been associated with other health outcomes in previous studies (13, 46). In addition, we focused on domestic social support and did not examine social support at work, which is also likely to contribute to socioeconomic differences in health (42). Second, a comprehensive measurement of social support was not available at study baseline (Phase 1).

Another limitation relates to the fact that the SES-mortality association in women was not statistically significant at conventional levels, whether SES was assessed as a continuous or a categorical variable, and the contribution of social support to socioeconomic differences in mortality could be examined in men only. Previous studies have reported lower social inequalities in mortality in women than men when women's own occupation is used as an indicator of SES instead of partner's occupation or indicators of social advantage of the household (12, 24, 38). It is thus possible that the measure of SES used in this study, civil service employment grade, does not correctly classify women's SES. It is also possible that SES differences in mortality are not detected in women as almost half of the sample is in the lowest SES category, leaving a relatively small number of women (and deaths) in the higher SES-groups. Finally, it is important to consider that the Whitehall II study is a *white collar*

cohort of civil servants with stable jobs; findings might not be generalizable to the general population.

Conclusions

These data suggest that in men not being married or cohabiting is not only an important risk factor for mortality, but it also contributes to explaining the association between socioeconomic status and mortality.

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Table 1. Baseline Characteristics of the Population Included in the Study, Whitehall II Study, 1985 - 2009.

	MEN (N=6339)							**WOMEN** (N=2994)						
Occupational position	High		Intermediate		Low		P*, **	High		Intermediate		Low		P*, **
N ,%	2454	38.7	3338	52.7	547	8.6		343	11.5	1210	40.4	1441	48.1	
Mortality (N, Rate[a])	195	3.3	250	3.9	73	6.7	<0.001*	20	3.4	82	3.5	121	3.9	=0.162*
Cardiovascular mortality (N, Rate[a])	57	1.0	77	1.2	34	3.1	<0.001*	0	0.0	13	0.5	31	1.0	=0.004*
Cancer mortality (N, Rate[a])	92	1.6	106	1.7	19	1.7	=0.439*	13	2.2	52	2.3	63	2.1	=0.962*
Low confiding/emotional support [b] (N, %[c])	531	21.6	855	25.6	165	30.2	<0.001**	76	22.2	244	20.2	272	18.9	=0.350**
Low practical support [b] (N, %[c])	494	20.1	860	25.8	172	31.4	<0.001**	124	36.2	455	37.6	449	31.2	=0.002**
High negative aspects of close relationships [b] (N, %[c])	730	29.8	1108	33.2	224	41.0	<0.001**	110	32.0	375	31.0	498	34.6	=0.140**
Low network score [b] (N, %[c])	658	26.8	1004	30.1	181	33.1	=0.002 **	69	20.1	395	32.6	452	31.4	<0.001**
Not married/cohabiting [b] (N, %[c])	254	10.4	688	20.6	216	39.5	<0.001**	131	38.2	538	44.5	469	32.6	<0.001**
Poor self-rated health (N, %[c])	60	2.4	136	4.0	40	7.3	<0.001**	12	3.5	92	7.6	114	7.9	=0.020**

* Test for linear trend across occupational groups
** Pearson's Chi-square test for heterogeneity across occupational groups
[a] Standardized mortality rate per 1000-person years
[b] Categories based on quartiles
[c] Column %

Table 2. The Association Between Occupational Position at Baseline and Social Support at Baseline and at last Follow-up in Men (N=6339) and Women (N=2994) of the Whitehall II Study, 1985 - 2009.

	MEN		WOMEN		
	OR[a]	95%CI	OR[a]	95%CI	*P*[*]
BASELINE					
Low Confiding/Emotional support	1.48	1.20, 1.82	0.74	0.55, 0.99	<0.001
Low Practical support	1.79	1.46, 2.20	0.77	0.60, 0.99	<0.001
High Negative aspects	1.52	1.25, 1.84	1.11	0.86, 1.44	=0.040
Low Network score	1.30	1.06, 1.59	1.68	1.25, 2.24	=0.140
Not married/cohabiting	5.19	4.17, 6.45	0.70	0.54, 0.90	<0.001
LAST FOLLOW-UP[b]					
Low Confiding/Emotional support	1.96	1.53, 2.50	0.85	0.64, 1.14	<0.001
Low Practical support	1.90	1.48, 2.44	0.97	0.74, 1.28	<0.001
High Negative aspects	1.43	1.09, 1.89	1.02	0.74, 1.42	=0.150
Low Network score	1.74	1.35, 2.23	0.80	0.61, 1.06	<0.001
Not married/cohabiting	5.39	4.10, 7.09	0.87	0.66, 1.16	<0.001

CI= Confidence Interval; OR= Odds ratio

* P for interaction between sex and occupational position

[a] Occupational position was entered as a 3-level categorical variable; the OR in the lowest compared to the highest occupational position is reported here.

[b] Phase 7, last phase at which social support was collected

Table 3. The Association Between Measures of Social Support Entered as Time-dependent Variables and All-cause (Men=6339 and Women=2994) and Cardiovascular Mortality (Men =6334 and Women N=2990) in the Whitehall II Study, 1985 - 2009.

		ALL-CAUSE Mortality				CVD Mortality			
		MEN (deaths=519)		WOMEN (deaths=225)		MEN (deaths=168)		WOMEN (deaths=44)	
		HR	95%CI	HR	95%CI	HR	95%CI	HR	95%CI
Confiding/Emotional support									
Quartiles 1,2 & 3		1.00		1.00		1.00		1.00	
Lowest quartile[a]	age adjusted	0.97	0.80, 1.17	0.68	0.50, 0.93	1.18	0.85, 1.63	0.76	0.38, 1.52
	+ SES and SRH	0.89	0.74, 1.08	0.68	0.49, 0.93	1.07	0.77, 1.48	0.79	0.40, 1.56
Practical support									
Quartiles 1,2 & 3		1.00		1.00		1.00		1.00	
Lowest quartile[a]	age adjusted	1.05	0.87, 1.27	0.73	0.55, 0.96	1.36	1.00, 1.87	0.88	0.48, 1.63
	+ SES and SRH	1.01	0.84, 1.22	0.76	0.58, 1.01	1.27	0.92, 1.74	1.02	0.55, 1.88
Negative aspects									
Quartiles 2, 3 & 4		1.00		1.00		1.00		1.00	
Highest quartile[a]	age adjusted	0.85	0.69, 1.05	0.94	0.69, 1.27	1.05	0.74, 1.49	0.74	0.35, 1.54
	+ SES and SRH	0.76	0.62, 0.95	0.84	0.62, 1.14	0.91	0.64, 1.30	0.61	0.29, 1.27
Network score									
Quartiles 1,2 & 3		1.00		1.00		1.00		1.00	
Lowest quartile[a]	age adjusted	1.27	1.07, 1.52	1.20	0.92, 1.57	1.85	1.36, 2.51	1.40	0.77, 1.55
	+ SES and SRH	1.18	0.99, 1.40	1.18	0.90, 1.53	1.66	1.22, 2.26	1.40	0.77, 1.54
Marital status									
Married or cohabiting		1.00		1.00		1.00		1.00	
Not married/cohabiting	age adjusted	1.77	1.45, 2.16	1.14	0.87, 1.48	2.69	1.95, 3.71	1.52	0.84, 2.76
	+ SES and SRH	1.51	1.23, 1.86	1.14	0.88, 1.49	2.16	1.55, 3.03	1.66	0.92, 3.01

CI= Confidence Interval; HR= Hazard Ratio; SES= Socioeconomic Status; SRH=Self-rated Health

* None of the measures of social support was related to cancer mortality (results not shown)

[a] Results are for the lowest quartile (or highest for negative aspects) compared to the other three quartiles grouped together, which are the reference category (see Methods section).

Table 4. The Role of Measures of Social Support in Explaining the Association Between Occupational Position and Mortality in Men of the Whitehall II Study, 1985 - 2009.

	All-cause mortality (N=6339, d=519)				CVD mortality (N=6334, d=168)			
	HR[a]	95%CI	% change[b]	95%CI[c]	HR[a]	95%CI	% change[b]	95%CI
Model 1 (age adjusted)	1.96	1.50, 5.56			3.12	1.98, 4.92		
Model 2 (age and SRH adjusted)	1.59	1.21, 2.08			2.48	1.56, 3.92		
Model 2 (+ network score)	1.56	1.19, 2.04	-4%	-12, -2%	2.33	1.47, 3.69	-7%	-15, -3%
Model 2 (+ marital status)	1.43	1.08, 1.87	-23%	-35, -10%	1.98	1.24, 3.16	-23%	-42, -12%
Model 2 (+ marital status & network score)	1.40	1.07, 1.85	-27%	-43, -14%	1.86	1.16, 2.98	-29%	-52, -17%

CI= Confidence Interval; d=deaths; HR= Hazard Ratio; SRH= Self-rated Health

[a] Hazard Ratio for lowest versus highest occupational position, obtained squaring the coefficient associated to SES (see methods section)

[b] % attenuation in log HR= 100 x ($\beta_{\text{Model 2}} - \beta_{\text{Model 2+ social support (s)}}$)/($\beta_{\text{Model 2}}$), where β=log(HR)

[c] Bias corrected accelerated bootstrap 95% Confidence Interval