Published in final edited form as:
Occup Environ Med. 2010 May ; 67(5): 330–334. doi:10.1136/oem.2009.048470.

Do family history of CHD, education, paternal social class, number of siblings and height explain the association between psychosocial factors at work and coronary heart disease? The Whitehall II study

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Abstract

Objectives—To examine whether the association between psychosocial factors at work and incident coronary heart disease (CHD) is explained by pre-employment factors such as family history of CHD, education, paternal social class, number of siblings and height.

Methods—A prospective cohort study of 6435 of British men aged 35–55 years at phase 1 (1985–1988) and free from prevalent CHD at phase 2 (1989–1990) was conducted. Psychosocial factors at work were assessed at phases 1 and 2 and mean scores across the two phases were used to determine long-term exposure. Selected pre-employment factors were assessed at phase 1. Follow-up for coronary death, first non-fatal myocardial infarction or definite angina between phase 2 and 1999 was based on clinical records (250 events, follow-up 8.7 years).

Results—Pre-employment factors were associated with risk for CHD: hazard ratio, HRs (95% CI) were 1.33 (1.03 to 1.73) for family history of CHD, 1.18 (1.05–1.32) for each quartile decrease in height, and marginally 1.16 (0.99–1.35) for each category increase in number of siblings. Psychosocial work factors predicted CHD: 1.72 (1.08–2.74) for low job control and 1.72 (1.10–2.67) for low organisational justice. Adjustment for pre-employment factors changed these associations by 4.1% or less.

Conclusions—In this well-characterised occupational cohort of British men, the association between psychosocial factors at work and CHD was largely independent of family history of CHD, education, paternal education and social class, number of siblings and height.

Keywords

coronary heart disease; job control; organisational justice; pre-employment factors

Introduction

A recent meta-analysis of observational cohort studies suggests an average 50% excess risk for coronary heart disease (CHD) among employees reporting stressful psychosocial factors at work, such as high demands, low control and low organisational justice.[1] The extent to

which these associations reflect causal effects arising from the workplace or are spurious due to bias and residual confounding remains a matter of controversy. One largely neglected source of bias is the fact that people are not randomly allocated to stressful jobs. For example, socioeconomic disadvantage in childhood, a risk factor for CHD, has been linked to lower socioeconomic position in adulthood[2–4] and hazardous exposure to psychosocial work factors.[5–13] Several other pre-employment factors are also related to increased risk of CHD and could potentially underlie the association between psychosocial factors at work and CHD. These include family history of CHD (a predictor of offsprings' CHD);[11] large number of siblings (a predictor of unfavourable developmental endpoints, CHD and mortality);[14] and short height (a proxy for unfavourable infancy and childhood circumstances).[15]

The Whitehall II study of British civil servants has been one of the leading investigations on psychosocial factors at work and CHD.[8,16–20] In this secondary analysis, we examined the extent to which the previously reported associations between psychosocial factors at work and CHD are in fact explained by pre-employment factors.

Methods

Participants

The Whitehall II study is a prospective cohort study of London office workers aged 35–55 years in 20 civil service departments at study inception. The baseline cohort included 6895 men and 3413 women the response rate being 73%.[21] Of these, 6435 men, 93% of all Whitehall II study male participants, responded to questionnaires on job demands, job control and organisational justice at phase 1 (1985–1988) or phase 2 (1989–1990), and had no history of CHD at phase 2. The incidence of CHD was followed up from phase 2 to phase 5 (1999) as in previous Whitehall II studies establishing the association between psychosocial factors at work and CHD.[8,18,20] The analyses were restricted to men only because there were insufficient incident CHD events during this follow-up period among the women. Each phase of the Whitehall II study has received ethical approval from the research ethics committee of University College London Hospitals, and all participants gave written informed consent.

Assessment of psychosocial factors at work

We measured job demands (4 items, Cronbach's α =0.67) and job control (15 items, Cronbach's α =0.84) with the Karasek's Job Content Questionnaire[22] and organisational justice with the same proxy measure of five items (Cronbach α =0.72) as in all previous studies from Whitehall II.[20,23,24] For each scale, we calculated mean score across phases 1 and 2 to assess long-term exposure. The organisational justice scale includes the following items: (1) 'Do you ever getcriticised unfairly?', (2) 'Do you get consistent information from line management (your superior)?', (3) 'Do you get sufficient information from line management (your superior)?', (4) 'How often is your superior willing to listen to your problems?' and (5) 'Do you ever get praised for your work?'. Participants rated their response to each of these items on a 4-point scale (1 indicates never, 2 seldom, 3 sometimes, and 4 often). For each scale, we calculated mean score across phases 1 and 2 to assess long-term exposure.

Assessment of incident coronary heart disease

The incidence of CHD was defined as a CHD death, a first non-fatal MI, or definite angina. Coronary deaths were defined by the International Classification of Diseases, the Ninth Revision (codes from 410 to 414). New cases of non-fatal MI were ascertained both by questionnaire on a chest pain[25] and the physician's diagnosis of heart attack. Confirmation

of MI was obtained according to the MONICA criteria.[26] Assessment of angina was based on either participant's reports with corroboration in medical records or abnormalities on a resting electrocardiogram, an exercise electrocardiogram, or a coronary angiogram.

Assessment of pre-employment factors

The participants were asked whether either of their parents or both had suffered a stroke, a heart attack or angina. Family history of CHD was considered positive if either of the parents had suffered from any of these outcomes and negative otherwise. Father's education was defined as the age when he left full time education. Father's social class was coded according to the Registrar General's classification based on question "what is/was your father's main job?" and an additional questions about training, employment status and supervisory responsibility.[27] A three level variable for father's social class was formed by combining managerial and professional occupations into a category of high social class, clerical and skilled manual occupations into a category of intermediate social class, and semi-skilled and unskilled manual occupations into a category of low social class. The number of siblings was divided into 5 categories (0, 1–2, 3–4, 5–6, 7+).[14] Height was clinically measured in centimetres following standard guidelines, and expressed in quartiles (<172.9, 173.0–175.9, 176.0–180.9, 181.0+ cm).

Data analysis

We used maximum number of participants in all analyses. The only exception was when testing of the contribution of pre-employment factors to the association between psychosocial factors at work and CHD. To retain comparability between models, this was based on the same cohort of 3412 men (53% of the eligible participants) with no missing data in any variables included in the models. These men did not differ from the 3023 excluded men in terms of age (p=0.22), education (p=0.10), job demands (p=0.98), organisational justice (p=0.90) or incidence of CHD (p=0.34), and differences in employment grade (administrative grade 39.8% vs 37.6%, p<0.001) and job control (69.8 vs 67.9, p<0.001) were small. In regard to the separate pre-employment factors, the included participants did not differ from the excluded ones in family history of CHD (p=0.35) and differences in father's education (included=3412 vs excluded=972: 1.3 vs 1.4, p=0.009), number of siblings (included=3412 vs excluded=1930: 1.6 vs. 1.7, p=0.26) and in height (included=3412 vs excluded=2997: 176.7 vs. 176.2, p=0.001) were small.

The associations between pre-employment factors and psychosocial work factors (job demands, job control and organisational justice) were examined by calculating mean scores of psychosocial factors at work for each category of pre-employment factor. For further analyses, participants' scores for each scale were divided into three groups: the lowest third representing low; the middle third the intermediate level, and the highest third high level of job demands, job control and organisational justice. The associations of pre-employment and psychosocial work factors with incident CHD were computed by using Cox proportional-hazard regression analysis. Hazard ratios (HR) and their 95% confidence intervals (95% CI) are reported. The time-dependent interaction terms between each predictor and the logarithm (follow-up period) were all non-significant. Thus, the proportional hazards assumption was justified. The contribution of pre-employment factors to the association between psychosocial factors at work and incident CHD was determined by comparing models with and without these variables as covariates. All the analyses were performed using SPSS 14.0.

Results

Table 1 presents the descriptive statistics for the participants. As shown in Table 2, family history of CHD was associated with high job demands and high job control. Lower

educational level, father's low education, father's low social class, greater number of siblings and short height were related to low job control. Lower educational level, father's low social class, greater number of siblings and short height were related to low job demands. Lower educational level was related to low organisational justice (table 2).

Several pre-employment factors predicted development of CHD (table 3). The HR for incident CHD was 1.33 (95% CI 1.03–1.72) for individual with a family history of CHD, 1.16 (95% CI 0.99–1.35) for each category increase in number of siblings and 1.18 (95% CI 1.05–1.32) for each quartile decrease in height. Years of participant's education, years of education and social class of the father were not associated with incident CHD.

When analysing the contribution of pre-employment factors to the association between psychosocial factors at work and CHD, 3412 men (53% of the eligible participants) with no missing data were included. The extent to which the pre-employment factors explained the association between psychosocial work factors and CHD is in shown in table 4. Job demands were not related to incident CHD in this sample, so the results are shown only for job control and organisational justice. The age, ethnicity- and employment grade-adjusted hazard ratios for incident CHD were 1.72 (95% CI 1.08–2.74) for those with low job control, and 1.72 (95% CI 1.10–2.67) for those with low organisational justice at work. Adjustment for the separate pre-employment factors attenuated these associations by less than 0.9%. Adjustment for all pre-employment factors simultaneously increased these hazard ratios by 4.1% and 0.9% respectively and left the associations statistically significant.

Discussion

Among men participating in the Whitehall II study, the association between psychosocial factors at work and the incidence of CHD was not explained by pre-employment factors such as family history of CHD, education, father's education and social class, the number of siblings and height. Those who reported low job control and low organisational justice during a period of three years had approximately a 1.7-fold increased risk for incident CHD. Adjustment for pre-employment factors changed these associations by 4.1% and 0.9%, respectively.

To our knowledge, this is the first large-scale study to examine a wide range of pre-employment exposures in relation to psychosocial factors at work and CHD. Our findings are in agreement with a smaller-scale Finnish study of industrial employees that reported that father's occupation and height had modest effect on the association between psychosocial work stress and cardiovascular mortality.[28] However, a register study of Swedish men aged 40–53 years found that increased risk of CHD among employees with low job control was reduced substantially, 42%, after controlling for pre-employment risk factors.[9] Methodological differences between the studies may have contributed to these contradictory findings. In the Whitehall II study and Finnish studies, psychosocial factors at work were assessed individually by a questionnaire whereas the Swedish study imputed scores based on occupational title. As such scores strongly reflect socioeconomic position and fail to capture any variation in psychosocial work factors between employees who belong to the same occupational group, the role of socially patterned pre-employment factors might have been overestimated.

A modest contribution of pre-employment factors to the association between psychosocial factors at work may result from imprecise measurement of pre-employment factors. Although these factors were measured retrospectively in the present study, we believe measurement imprecision is an unlikely explanation for our findings. First, imprecision would have affected all associations but in this study pre-employment factors were

associated with CHD, thus replicating findings from previous studies.[11,14,15] Second, the measurement of height was precise but still adjustment for height had only little effect on the association between psychosocial factors at work and CHD. Third, our findings are consistent with previous evidence suggesting only a modest contribution of prospectively-assessed pre-employment factors on the association between psychosocial factors at work and carotid intima-media thickness, a valid indicator of atherosclerosis and pre-clinical CHD.[11,29] We cannot rule out the possibility of selection bias in our results as only 53% of the participants had complete data in all pre-employment measurements. However, the differences between the included participants and the excluded in were relatively small in absolute terms, and thus the likelihood of a major bias due to selective sample retention seems small, although such bias cannot fully be ruled out given the relatively high number of participants excluded from the analysis.

In conclusion, data from the Whitehall II study provide no evidence for the hypothesis that the association between psychosocial factors at work and CHD would be largely explained by pre-employment influences. Further research is needed to examine whether this association is causal. Our findings should motivate the development of systematic intervention strategies for large-scale intervention studies to test whether giving employees a stronger say in decisions about their work and treating them in a righteous manner might reduce CHD.

Acknowledgments

TH was supported by the Finnish Cultural Foundation and Academy of Finland, Work Consortium projects 124399 and 124332, JV and MK by Academy of Finland, projects 117604, 124332, 124327, 129262; LKJ by Academy of Finland, Work Consortium project 124399; MJS by the British Heart Foundation and MGM is supported by an MRC research professorship. The Whitehall II study has been supported by grants from the British Medical Research Council (MRC); the British Heart Foundation; the British Health and Safety Executive; the British Department of Health; the National Heart, Lung, and Blood Institute (grant HL36310); the National Institute on Aging (grant AG13196); the Agency for Health Care Policy and Research (grant S06516); and the John D. and Catherine T. MacArthur Foundation Research Networks on Successful Midlife Development and Socioeconomic Status and Health.

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Table 1

Descriptive statistics for the participants.

		Participants	%	Mean (S.D.)
Age		6435		43.9 (6.0)
Ethnicity	White	5919	92.7	
	Other	464	7.3	
Education	≤ 16 years	1325	27.4	
	17 to 18 years	1256	26.0	
	≥ 19 years	2254	46.6	
Grade	Administrative	2495	38.8	
	Executive	3371	52.4	
	Clerical	569	8.8	
Family history of CHD	No	3516	55.8	
	Yes	2782	44.2	
Father’s education	until 16 years of age	3466	79.1	
	17 to 18 years	444	10.1	
	≥ 19 years	474	10.8	
Father’s social class	I	443	10.0	
	II and III non-manual	2171	48.8	
	III manual, IV and V	1836	41.3	
Number of siblings	0	1135	21.2	
	1–2	3093	57.9	
	3–4	784	14.7	
	5–6	205	3.8	
	7+	125	2.3	
Height	< 172.9	1878	29.3	176.4 (6.7)
	173.0 – 175.9	1089	17.0	
	176.0 – 180.9	1820	28.4	
	> 181.0	1622	25.3	
Job demands		6432		61.3 (17.7)
Job control		6423		68.9 (13.9)
Organisational justice		6435		71.0 (15.0)
Incidence CHD		250	3.9	
Follow-up, years				8.7 (2.5)

Table 2

Associations between pre-employment factors and psychosocial factors at work.

		Job demands	p for trend	Job control	p for trend	Organisational justice	p for trend
Family history of CHD	No	61.0		68.5		70.8	
	Yes	61.9	0.04	69.7	0.001	71.2	0.34
Education level	≤ 16 years	57.1		65.2		69.7	
	17–18 years	61.6		68.5		71.1	
	≥ 19 years	62.1	<.001	71.3	<.001	71.6	0.001
Father's education	≤ 16 years	61.0		69.1		70.8	
	17–18 years	61.5		69.8		71.6	
	≥ 19 years	61.4	0.64	70.5	0.05	71.7	0.26
Father's social class	I	62.7		70.3		71.3	
	II and III non-manual	61.1		69.6		71.4	
	III manual, IV and V	59.6	0.001	67.9	0.002	70.0	0.10
Siblings	0	62.4		70.2		71.2	
	1–2	62.1		69.6		71.4	
	3–4	61.2		68.2		69.6	
	5–6	58.1		64.6		70.2	
	7+	52.0	<.001	61.6	<.001	70.1	0.37
Height	<172.9	59.5		67.1		70.7	
	173.0–175.9	61.7		69.2		71.3	
	176.0–180.9	61.6		69.3		70.7	
	> 181.0	63.0	<.001	70.6	<.001	71.4	0.48

Occup Environ Med. Author manuscript; available in PMC 2011 November 30.

Table 3

Age-, grade- and ethnicity-adjusted associations between pre-employment factors and coronary heart disease.

Pre-employment factor	HR*	95% CI	p-value (trend)
Family history of CHD	1.33	1.03–1.73	0.03
Low education	1.17	0.97–1.41	0.11
Father's low education	1.07	0.84–1.37	0.58
Father's low social class	1.11	0.87–1.41	0.42
Number of siblings	1.16	0.99–1.35	0.07
Short height	1.18	1.05–1.32	0.004

* Hazard ratio are per category change

Occup Environ Med. Author manuscript; available in PMC 2011 November 30.

Table 4

Age-, grade- and ethnicity-adjusted associations of job control and organisational justice with coronary heart disease with before and after adjustments for pre-employment factors. Hazard ratios (and 95% CI) of Cox regression models.

		Adjustment in addition to age, ethnicity and occupational grade							
	Participants (cases)	**None**	**Family history of CHD**	**Education**	**Father's education**	**Father's social class**	**Number of siblings**	**Height**	**All**
		HR (95% CI)	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**	**HR (95% CI)**
Job control									
low	1011 (50)	1.72 (1.08–2.74)	1.76 (1.10–2.80)	1.73 (1.09–2.76)	1.72 (1.08–2.74)	1.71 (1.08–2.73)	1.74 (1.09–2.77)	1.71 (1.07–2.73)	1.76 (1.10–2.81)
intermediate	1201 (53)	1.56 (1.01–2.39)	1.57 (1.02–2.42)	1.57 (1.02–2.41)	1.55 (1.01–2.39)	1.55 (1.01–2.38)	1.57 (1.02–2.41)	1.54 (0.99–2.55)	1.58 (1.02–2.43)
high	1200 (37)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
change % *			+3.9%	+0.7	0.0%	0.0%	+1.8%	−0.9%	+4.1%
Organisational justice									
low	1029 (48)	1.72 (1.10–2.67)	1.73 (1.11–2.70)	1.71 (1.10–2.67)	1.72 (1.10–2.67)	1.71 (1.10–2.67)	1.72 (1.10–2.68)	1.72 (1.11–2.68)	1.73 (1.11–2.69)
intermediate	1247 (58)	1.66 (1.08–2.53)	1.67 (1.09–2.55)	1.65 (1.08–2.53)	1.66 (1.08–2.53)	1.66 (1.09–2.54)	1.67 (1.08–2.52)	1.67 (1.09–2.55)	1.68 (1.10–2.57)
high	1136 (34)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
change % *			+1.5 %	−0.6	0.0%	0.0 %	0.0%	+0.4%	+0.9%

* based of formula unstandardized B(fully adjusted) - B(age-, ethnicity- and grade-adjusted)/B(age-, ethnicity- and grade-adjusted) * 100