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EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

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Objective: To examine the effects of unfairness on incident coronary events and health functioning.
Design: Prospective cohort study. Unfairness, sociodemographics, established coronary risk factors (high serum cholesterol, hypertension, obesity, exercise, smoking and alcohol consumption) and other psychosocial work characteristics (job strain, effort–reward imbalance and organisational justice) were measured at baseline. Associations between unfairness and incident coronary events and health functioning were determined over an average follow-up of 10.9 years.
Participants: 5726 men and 2572 women from 20 civil service departments in London (the Whitehall II Study).
Main outcome measures: Incident fatal coronary heart disease, non-fatal myocardial infarction and angina (528 events) and health functioning.
Results: Low employment grade is strongly associated with unfairness. Participants reporting higher levels of unfairness are more likely to experience an incident coronary event (HR 1.55, 95% CI 1.11 to 2.17), after adjustment for age, gender, employment grade, established coronary risk factors and other work-related psychosocial characteristics. Unfairness is also associated with poor physical (OR 1.46, 95% CI 1.20 to 1.77) and mental (OR 1.54, 95% CI 1.19 to 1.99) functioning at follow-up, controlling for all other factors and health functioning at baseline.
Conclusions: Unfairness is an independent predictor of increased coronary events and impaired health functioning. Further research is needed to disentangle the effects of unfairness from other psychosocial constructs and to investigate the societal, relational and biological mechanisms that may underlie its associations with health and heart disease.

Fairness has been proposed as an important aspect of human behaviour, social relations and the organisation of society.[1–4] Although there are multiple definitions of fairness, the overarching concept refers to the quality of treating people equally or in a way that is right or reasonable.[5] Unfairness can be seen as an act that is negatively affecting people's dignity or self-respect,[6 7] which may have serious consequences for identity and self-esteem. This process can also result in a series of negative or stress-related reactions that increase the risk of poor mental and physical health.[8 9]

Studies examining the relationship between unfairness and health have been almost entirely limited to the organisational context. An indicator of justice at work is whether people believe that their supervisor considers their viewpoints, shares information concerning decision-making and treats individuals in a truthful manner.

Kivimäki *et al*[10] found that organisational justice was associated with reduced incidence of coronary heart disease (CHD) among employed men independent of established risk factors of CHD. A study by Kuper *et al*[11] found that a high ratio of efforts in relation to rewards, an indicator of distributive injustice at work, was related to increased incidence of all CHD and fatal CHD/non-fatal myocardial infarction (MI) during follow-up. Perceptions of unfairness have also been found to be related to CHD risk factors such as increased psychological distress[12] and raised blood pressure.[13]

Although work may be an important source of unfairness for employees, sources of unfairness outside the organisational context are likely to be important at the societal level. There is thus a need to investigate the relationship between unfairness and health by using measures that include injustices experienced in different areas of life. To date, we are not aware of any prospective investigation of the association between unfairness and health that has used such a general measure of unfairness.

In this study, using data from the Whitehall II Study of British civil servants, we examine characteristics associated with unfairness, and determine the effect of unfairness on incident coronary events and health functioning.

METHODS

Study population

The Whitehall II Study is a prospective cohort study, the target population of which was all non-industrial civil servants aged 35–55 years who worked in the London offices of 20 civil service departments at baseline (1985–8). Full details of the method are reported elsewhere.[14] For this investigation, phase 3 (1991–3) was taken as the baseline as this provided the data on unfairness. From this phase, we analysed data from 8298 civil servants (5726 men and 2572 women). Participants were followed up until the end of phase 7 (2003–4), with a mean length of follow-up of 10.9 years.

Unfairness

Unfairness was assessed by the following single-item question: ''I often have the feeling that I am being treated unfairly''. Participants rated their response on a six-point scale (1, strongly disagree; 2, moderately disagree; 3, slightly disagree; 4, slightly agree; 5, moderately agree; and 6, strongly agree). The variable was categorised into four levels of unfairness: responses 1 and 2 were combined into a new category, ''null'', responses 3 and 4 have become categories ''low'' and ''moderate'', respectively, and responses 5 and 6 were collapsed into a new category, ''high''.

Abbreviations: CHD, coronary heart disease; MI, myocardial infarction; SF-36, Short-Form 36 Health Survey

Table 1 Demographics, socioeconomic characteristics, established risk factors of coronary heart disease and other psychosocial factors by levels of unfairness in the Whitehall II Study

		Levels of unfairness				
	Total (n = 8298)	Null (n = 4330)	Low (n = 1293)	Moderate (n = 1858)	High (n = 817)	p Value for trend
Gender						<0.001
Male	5726	72.7	68.1	64.9	60.3	
Female	2572	27.3	31.9	35.1	39.7	
Mean age (years)	8298	49.86	49.24	49.26	49.99	0.275
Employment grade						<0.001
Administrative	3164	46.8	33.9	28.6	21.2	
Professional	3736	41.3	48.7	50.4	47.1	
Clerical	1390	11.9	17.4	21.1	31.7	
High serum cholesterol						0.460
No	3321	42.4	42.9	42.3	40.3	
Yes	4538	57.6	57.1	57.7	59.7	
Hypertension						0.017
No	7652	92.7	92.6	92.6	89.2	
Yes	638	7.3	7.4	7.4	10.8	
Obesity						<0.001
No	7134	91.7	89.8	89.3	87.1	
Yes	757	8.3	10.2	10.7	12.9	
Exercise						<0.001
Mild	3135	35.2	39.8	38.9	45.8	
Moderate	3652	46.0	42.5	42.4	39.7	
Vigorous	1511	18.8	17.7	18.8	14.6	
Smoking						0.001
No	7152	87.2	86.3	85.2	83.3	
Yes	1142	12.8	13.7	14.8	16.7	
Alcohol consumption						<0.001
Moderate	6001	75.1	71.8	70.5	63.2	
Abstinent	1617	16.1	20.4	22.3	29.8	
Heavy	673	8.8	7.8	7.2	7.0	
Job strain						<0.001
Low	2326	38.4	22.8	24.6	22.0	
Medium	2556	35.3	36.1	32.7	29.1	
High	2587	26.3	41.1	42.7	48.9	
Effort–reward imbalance						<0.001
Low	2406	36.6	29.3	29.0	24.9	
Medium	2380	33.4	33.6	30.5	27.7	
High	2604	30.0	37.1	40.4	47.4	
Organisational justice						<0.001
High	2508	49.6	35.0	24.7	20.6	
Medium	2018	31.2	30.7	34.3	24.5	
Low	1940	19.2	34.2	41.0	54.8	

Incident coronary events

The main outcome variable (total coronary events) was a measure of incident coronary events between phase 3 and the end of phase 7, the latest study phase for which events data are available. Total coronary events included clinically verified fatal MI, non-fatal MI and angina. To assess fatal MI, participants were flagged for mortality at the National Health Service Central Registry. Deaths due to MI were defined as International Classification of Diseases-9 codes 410–414.[15] Potential new cases of non-fatal MI were ascertained by questionnaire items on chest pain[16] and physician's diagnosis of heart attack. Details of physician diagnoses and investigation results were sought from medical records for all potential cases of MI. At phases 3 and 5, 12-lead resting ECG were performed (Siemens Mingorec, Siemens Medical Solutions, Erlingen, Germany) and assigned Minnesota Codes.[17] Based on all available data (from questionnaire, study ECGs, hospital acute ECGs and cardiac enzymes), non-fatal MI was defined following Multinational Monitoring of Trends and Determinants in Cardiovascular Disease Criteria.[18] Classification of MI was carried out blind to other study data independently by two trained coders, with adjudication by a third in the (rare) event of disagreement. Angina was initially assessed through participants' reports of symptoms,[19] and then corroborated by medical records or abnormalities on a resting ECG, exercise ECG or coronary angiogram. The outcome comprised of only clinically verified incident coronary events.

Health functioning

Health-related quality of life or functioning was assessed by the UK standard version of the Short-Form 36 Health Survey (SF-36).[20] Detailed information on the use of the SF-36 in the

Table 2 Cox proportional HRs of the associations between unfairness with incidence of coronary events over 10-years follow-up

		HR (95% CI)			
	Participants (n) (CHD events (n))	Adjusted for age and gender	Adjusted for age, gender and employment grade	Adjusted for age, gender, employment grade and established coronary risk factors*	Adjusted for age, gender, employment grade, established coronary risk factors* and other psychosocial factors†
Unfairness					
Null	3117 (174)	1.00	1.00	1.00	1.00
Low	966 (64)	1.24 (0.93 to 1.66)	1.22 (0.91 to 1.62)	1.22 (0.91 to 1.62)	1.28 (1.02 to 1.61)
Moderate	1368 (98)	1.31 (1.06 to 1.75)	1.33 (1.03 to 1.70)	1.31 (1.02 to 1.68)	1.36 (1.05 to 1.77)
High	567 (51)	1.76 (1.29 to 2.41)	1.69 (1.23 to 2.32)	1.57 (1.14 to 2.16)	1.55 (1.11 to 2.17)

CHD, coronary heart disease.
Only subjects free of prevalent coronary events at phase 3 with no missing data in any of the predictors were included in the models (n = 6018).
*Established coronary risk factors include high serum cholesterol, hypertension, obesity, exercise, smoking and alcohol consumption.
†Other psychosocial risk factors include job strain, effort–reward imbalance and organisational justice.

Whitehall II Study has been reported elsewhere.[21] The original eight scales of the SF-36 can be summarised into physical and mental functioning components by a method based on factor analysis.[22] Poor physical or mental functioning was defined as the lowest quartile of functioning on the basis of the score from the SF-36 questionnaire.

Sociodemographic factors

Information on sociodemographics was obtained from questionnaire at phase 3 and included age, gender and employment grade. Participants were assigned to one of the three employment grades: administrative (high), professional (middle) or clerical (low).

Established coronary risk factors and other psychosocial work characteristics

Established coronary risk factors included biological measures collected through medical screening and health-related behaviours collected from questionnaire at phase 3: high serum cholesterol (≥6.2 mmol/l), hypertension (diastolic blood pressure ≥95 mm Hg, systolic blood pressure ≥160 mm Hg or drug treatment for hypertension), obesity (body mass index ≥30 kg/m^2), exercise (vigorous, moderate or none/mild), cigarette smoking and alcohol consumption (abstainer, moderate drinker or heavy drinker). Vigorous exercise refers to subjects who reported ≥1.5 h of vigorous activity per week; moderate exercise refers to participants who reported ≥1.5 h of moderate activity per week, but <1.5 h of vigorous activity per week. Finally, none/mild exercise refers to subjects who reported <1.5 h of vigorous or moderate activity per week. Moderate drinkers were defined as those participants drinking between 1 and 21 units of alcohol per week for men and between 1 and 14 units of alcohol per week for women; heavy drinkers were those who consumed >21 units of alcohol per week for men and >14 units of alcohol per week for women.

Additional psychosocial risk factors at phase 3 included job strain, effort–reward imbalance and organisational justice. As measured in previous investigations, job strain was derived from the difference between the job demands (four items, α = 0.67) and job control (15 items, α = 0.64),[23] whereas effort–reward imbalance was measured as a ratio of effort (five items, α = 0.70) to reward (six items, α = 0.72).[11] Organisational justice was measured from the self-reported justice scale, as used in an earlier study using the Whitehall cohort[10] (five items, Cronbach's α = 0.66). However, we used information from phase 2 (1989–90) for the two items that were unavailable at phase 3. Participants were divided into three groups (high, medium and low) in each of the three psychosocial risk factors on the basis of the distributions of scores.

Statistical analysis

We conducted survival analyses using Cox proportional hazard models to determine whether unfairness predicted incident coronary events during follow-up after adjustment for age, gender, employment grade, established coronary risk factors and other workplace psychosocial characteristics. We then used logistic regression analyses to assess the relationship between baseline unfairness with physical and mental functioning at phase 7, adjusting for age, gender, employment grade, established and work-related psychosocial coronary risk factors and health functioning at phase 3. For the purpose of these analyses, the sexes were pooled. Although there may be important differences in determinants of unfairness between women and men, there was no significant interaction by gender in the relationship between unfairness and coronary events (p = 0.74) and physical (p = 0.42) and mental functioning (p = 0.33). Analyses of the relationship between unfairness and coronary events were performed on participants with no missing data in any of the predictors included in the models (n = 6018). All participants with prevalent coronary events at phase 3 (n = 257) were excluded from analyses of the relationship between unfairness and the coronary outcome. Analyses of health functioning included only subjects with no missing data on health functioning and any of the predictors of the models (n = 4835).

All statistical analyses were performed using the software package SPSS V.11.0.

RESULTS

Table 1 presents characteristics of participants by levels of unfairness. Age is not related to unfairness, whereas female sex increases the risk of being treated unfairly. Low employment grade is strongly associated with unfairness. Participants reporting higher levels of unfairness are more likely to be smokers, hypertensives, obese, sedentary and abstain from alcoholic beverages. Unfairness is not related to high serum cholesterol. When considering other psychosocial risk factors,

Table 3 Logistic regression-derived ORs of the associations between unfairness at baseline and poor functioning at follow-up

		OR (95% CI)			
	Poor physical functioning (n = 1094)		Poor mental functioning (n = 1199)		
	Participants (n)	Adjusted for age, gender and physical functioning at baseline	Adjusted for age, gender, physical functioning at baseline, employment grade, established coronary risk factors* and other psychosocial factors†	Adjusted for age, sex and mental functioning at baseline	Adjusted for age, gender, mental functioning at baseline, employment grade, established coronary risk factors* and other psychosocial factors†
Unfairness					
Null	2582	1.00	1.00	1.00	1.00
Low	768	1.48 (1.20 to 1.82)	1.38 (1.11 to 1.71)	1.41 (1.16 to 1.72)	1.31 (1.07 to 1.60)
Moderate	1075	1.59 (1.33 to 1.92)	1.46 (1.20 to 1.77)	1.53 (1.28 to 1.82)	1.40 (1.17 to 1.68)
High	410	1.53 (1.18 to 1.99)	1.32 (1.00 to 1.73)	1.76 (1.37 to 2.26)	1.54 (1.19 to 1.99)

Only subjects with no missing data in any of the predictors were included in the models (n = 4835).
*Established coronary risk factors include high serum cholesterol, hypertension, obesity, exercise, smoking and alcohol consumption.
†Other psychosocial risk factors include job strain, effort–reward imbalance and organisational justice.

unfairness is positively associated with higher job strain, higher effort–reward imbalance and lower organisational justice.

During the mean follow-up of 10.9 years, 528 incident cases of total coronary events (fatal MI, non-fatal MI and angina) occurred among 8041 participants who had been free from any coronary event at baseline.

Table 2 shows a dose–response association between unfairness and incident coronary events at follow-up. After adjustment for age and gender, participants who strongly or moderately agree that they are often treated unfairly are more likely to experience a coronary event than participants with low or medium levels of unfairness (hazard ratio (HR) 1.76, 95% CI 1.29 to 2.41). When including employment grade and established coronary risk factors in the analysis, the relationship between high unfairness and coronary events weakens, but remains significant. Additional adjustment for other work-related psychosocial risk factors has no effect on the relationship between high unfairness and incident CHD events (HR 1.55, 95% CI 1.11 to 2.17). Further adjustment for hostility, measured with the Cook–Medley Hostility Scale,[24] had little effect on the relationship between unfairness and coronary events (table available on request).

Table 3 shows that unfairness is associated with poor health functioning in a dose–response manner, but only in relation to mental functioning. When considering the effect on poor physical functioning adjusted for all covariates, moderate unfairness, not high unfairness, was the category associated with the highest risk (odds ratio (OR) 1.46, 95% CI 1.20 to 1.77). The lack of a dose–response relationship was attributable to adjustment for baseline physical functioning. A dose–response association between unfairness and poor physical functioning existed after adjustment for age, gender and grade, but this pattern partly disappeared after further adjustment for baseline physical functioning as there was a strong association between unfairness and poor physical functioning at baseline ($p<0.000$). However, when excluding participants in the lowest tertile of physical functioning at baseline, the ORs for the low, moderate and high unfairness categories were 1.29 (95% CI 0.95 to 1.75), 1.55 (95% CI 1.19 to 2.03) and 1.60 (95% CI 1.10 to 2.32), respectively.

When considering poor mental functioning, participants who report a high level of unfairness are at the highest risk of poor functioning, after adjustment for age, gender and mental functioning at baseline (OR 1.76, 95% CI 1.37 to 2.26). In the fully adjusted model, the association remains significant (OR 1.54, 95% CI 1.19 to 1.99).

Further analyses showed that adjustment for hostility did not reduce the effect size of the association between high unfairness and physical functioning, although the ratio became non-significant. The effects of ''low'' and ''moderate'' unfairness on physical functioning and all unfairness categories on mental functioning were reduced but remained strongly significant (table available on request).

DISCUSSION

This study shows that there is a dose–response association between unfairness and coronary events. The risk of incident coronary events among participants who strongly or moderately agreed that they were often treated unfairly was 55% higher than those who reported fair treatment, controlling for age, gender, employment grade, established coronary risk factors and other work-related psychosocial characteristics. Unfairness was also independently associated with poor physical and mental functioning at follow-up, controlling for baseline factors including health functioning.

Previous work demonstrating an association between justice and health[10 12] focused on the organisational context, and general unfairness has received little attention as a stress-producing mechanism. This study, by showing that a general measure of unfairness is associated with poor health, suggests that the negative health effects of unfair treatment can be generalised beyond the workplace. The association between unfairness and coronary events was not explained by organisational justice and other established work-related psychosocial risk factors such as job strain[23] and effort–reward imbalance.[11] Our measure of unfairness probably covers different experiences of unfairness, those arising from work, and also those originating from other social settings (eg, family, community and society).

There are a number of possible factors that may explain why unfairness is socially patterned. The experience of being treated unfairly seems to be connected with a threat or an attack to an individual's dignity. An important component of human dignity is determined by the degree of respect or ''public worth'' bestowed by others.[25] Low social status is a continuous source of unfairness probably because people in subordinate positions are more likely to be disrespected or treated as inferiors by others,[9] as well as being ignored or excluded from full participation in social life.[8]

Challenges to an individual's sense of personal value or self-worth[26] owing to unfairness may influence health through emotional and biological pathways. Emotional reactions include humiliation that may, in turn, result in inward-focused and/or outward-focused negative emotions depending on attributions of blame relative to acts of injustice. Inward-focused negative emotions occur when individuals, who are

treated unfairly, evaluate themselves negatively or make internal attributions of responsibility. Outward-focused negative emotions occur when individuals evaluate others and externalise blame for the acts of injustice.[27] Inward-focused affective responses to acts of unfairness may include feelings of being devalued or insecurity about personal worth that are precursors of depression and anxiety. Outward-focused affective responses may include anger and hostility, often used as a "face-saving strategy" to defend the loss of dignity.[28] Both categories of emotional reactions have been found to influence CHD.[29]

Potential mechanisms connecting unfairness and health may also include biological reactions such as alterations of autonomic functions, neuroendocrine changes, development of metabolic syndrome, insulin resistance, disturbances in coagulation, and inflammatory and immune responses.[30] These factors are precursors of CHD and other conditions that may impair physical health functioning.[31]

Obviously, further research is required. First, we need to establish whether the health effects of unfairness are independent of other psychosocial constructs unmeasured in the present study, such as negative emotions, happiness and social engagement. Second, we need to use repeated measurements of physical, socioeconomic and psychosocial factors to examine mediating mechanisms and to minimise the possibility of residual confounding.

This study presents some limitations. The unfairness measure we used was self-reported and may not necessarily reflect an objective evaluation of unfair treatment. However, such cognitive appraisals of environmental demands constitute an important element of the process leading to psychological and physiological responses.[32] Another limitation is that a standard measure of general sense of fairness is not available, and our results have relied on a single item. Although shorter instruments are more limited than longer measures, they have some important benefits for both research and policy, such as reduced burden for participants, lower costs and ease of interpretation.[33] Single-item measures have also been associated with coronary events in previous studies.[34] There are also potential limitations in our results owing to incomplete samples in the analyses. Owing to missing data of covariates, 25% of our baseline sample was not included in the analysis of unfairness and incident coronary events. This is a possible source of bias, because by repeating the analysis with full data (without covariates) the effect on the age- and grade-adjusted association weakened (HR 1.48, 95% CI 1.12 to 1.95). In the analysis of health functioning, sample attrition was greater (42%) owing to non-response to the follow-up survey. As the excluded individuals had slightly poorer health functioning at baseline than the included participants ($p<0.000$), sample attrition is a potential source of healthy survivor bias and may have underestimated the association between unfairness and health functioning. Finally, although this study shows that unfairness is an important predictor of health, British civil servants may not adequately represent the general population, especially as blue-collar workers are not included. More research is needed to assess whether the exclusion of the upper and lower tails of the social hierarchy might have affected our findings on the relative health effects of unfairness.

In conclusion, this is the first longitudinal study to show that a general sense of unfairness is associated with CHD and poor health functioning. Consistent with the hypothesis suggesting that fairness is a fundamental aspect of human behaviour, social relations and the organisation of society, the frequency with which people experience unfairness may influence their physical and mental health. Future research is needed to investigate the societal, relational and biological mechanisms that may underlie the effects of unfairness on health and heart disease.

What this study adds

- Unfairness is a predictor of coronary heart disease (CHD) independent of employment grade, established risk factors of CHD and other psychosocial characteristics of the work environment (organisational justice, job strain and effort–reward imbalance).
- Unfairness is associated with impaired physical and mental functioning, although the biological, psychological and behavioural mechanisms underlying this association remain unclear.

Policy implications

- Policies that promote fairness in the workplace, and also in other social settings (eg, family, community and society) are likely to result in improvements in health.

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RDV with JEF, TC, MK designed the hypothesis, analysed the data and wrote the paper. MGM reviewed the drafts of the paper and he is the director of the Whitehall II Study.

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