

Justice at Work and Reduced Risk of Coronary Heart Disease Among Employees

The Whitehall II Study

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Background: Justice is a fundamental value in human societies, but its effect on health is poorly described. We examined justice at work as a predictor of coronary heart disease (CHD).

Methods: Prospective occupational cohort study of 6442 male British civil servants aged 35 to 55 years without prevalent CHD at baseline in phase 1 (1985-1988). Baseline screening included measurements of conventional risk factors. Perceived justice at work and other work-related psychosocial factors were determined by means of questionnaire at phases 1 and 2 (1989-1990). Follow-up for CHD death, first nonfatal myocardial infarction, or definite angina occurring from phase 2 through 1999 was based on medical records (mean follow-up, 8.7 years).

Results: Cox proportional hazard models adjusted for age and employment grade showed that employees who

experienced a high level of justice at work had a lower risk of incident CHD than employees with a low or an intermediate level of justice (hazard ratio, 0.65; 95% confidence interval, 0.47-0.89). The hazard ratio did not materially change after additional adjustment for baseline cholesterol concentration, body mass index, hypertension, smoking, alcohol consumption, and physical activity. Although other psychosocial models such as job strain and effort-reward imbalance predicted CHD in these data, the level of justice remained an independent predictor of incident CHD after adjustment for these factors.

Conclusion: Justice at work may have benefits for heart health among employees.

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SOME OF THE MOST FUNDAMENTAL questions concerning social relations and the organization of society have been suggested to be concerned with equity, altruism, and a sense of fairness.¹⁻⁴ Negative reactions to injustice have been shown to prevail in human societies and even in cooperative nonhuman primates, such as monkeys.^{5,6} One line of research in this field focuses on workplaces and the concept of justice at work.^{7,8}

Employees' interactions with their supervisors, on whom they may be highly dependent for resources and rewards, can be important for well-being.⁹⁻¹¹ An indicator of justice at work is whether people believe that their supervisor considers their viewpoints, shares information concerning decision-making, and treats individuals fairly and in a truthful manner.⁸ A high level of justice in such managerial treatment has been related to increased employee motivation and cooperation and decreased levels of psychological distress, negative emotions, and sickness absence

(J.E.F., M.K., J.H., M.J.S., and M.G.M., unpublished data, December 2004).¹²⁻¹⁴

There are plausible mechanisms connecting justice to CHD, as a high level of justice may reduce the risk of chronic stress characterized by adverse neuroendocrine changes, alterations of autonomic functioning, development of the metabolic syndrome and insulin resistance, and disturbances in coagulation and inflammatory and immune responses.¹⁵⁻¹⁸ Indeed, data concerning employees with multiple supervisors show smaller blood pressure elevations on days worked under a supervisor perceived as fair as compared with days worked under one perceived as unfair.¹⁹ In addition, a cross-sectional observational study found reduced heart rate variability for those reporting a low level of justice at work (Marko Elovainio, PhD, M.K., Sampsa Puttonen, MA, Harri Lindholm, MD, Tiina Pohjonen, PhD, and Timo Sinervo, PhD, unpublished data, February 2004). Although high blood pressure and reduced heart rate variability are indicators of car-

diac dysregulation,²⁰ no previous study, to our knowledge, has examined whether justice at work is associated with the onset of CHD.

Data from the Whitehall II Study of British civil servants, an ongoing large-scale prospective occupational cohort study,²¹ have enabled our examination of the association between perceived justice and morbidity and mortality. A strength of the study is the possibility of determining incidence of CHD for the entire cohort based on comprehensive medical records of CHD death, nonfatal myocardial infarction (MI), and definite angina during a long period. A further advantage is that the data include measurements of conventional risk factors and major work-related psychosocial factors such as job strain and effort-reward imbalance.²²⁻²⁴ These data enable us to determine whether the addition of justice would add to risk estimates based on other risk factors. In the present study, we examined whether justice at work predicted incidence of new CHD among employees and whether this association was independent of coronary risk factors, including cholesterol concentration, hypertension, body mass index (BMI), smoking, alcohol consumption, physical inactivity, and other psychosocial characteristics of the work environment.

METHODS

PARTICIPANTS

The target population of the Whitehall II Study was all office staff based in London, England, aged 35 to 55 years, in 20 civil service departments.²¹ With a 73% participation rate, the baseline cohort included 6895 men and 3413 women. The present study included those 6442 men (93% of all male participants) who responded to the justice questions at phase 1 or 2 and had no history of CHD at phase 2. All of these men were followed up for CHD after phase 2. The 453 men excluded were older (39.3% \geq 50 years vs 23.1% among included men; $P < .001$), and they were more likely to be in the lowest employment grade (15.5% vs 8.9%; $P < .001$). We restricted the analyses to men, as there were insufficient incident CHD events among women ($n=85$).

DESIGN

The Whitehall II Study is a prospective observational cohort study. Justice at work, job strain, and effort-reward imbalance were measured at phases 1 (1985-1988) and 2 (1989-1990). Follow-up for incident CHD was from 1990 (end of phase 2) to the end of 1999. Conventional risk factors for CHD, tested as potential confounders, were measured at phase 1.

ASSESSMENT OF JUSTICE AT WORK

We used a self-reported justice scale, which tapped the relational component of organizational justice⁸ (5 items; Cronbach $\alpha = .72$ at phases 1 and 2), as in earlier studies using the Whitehall II Study cohort (J.E.F., M.K., J.H., M.J.S., and M.G.M., unpublished data, December 2004).²⁵ The following items were included: (1) Do you ever get criticized unfairly (reverse scored)? (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 participant, we averaged the scores of the 5 items at phases 1 and 2 and then calculated the mean of these averaged scores (Cronbach α for repeated measurements, .54). For those with missing justice scores in 1 of the 2 phases, we used information from 1 phase only. All participants were divided into 3 groups based on the distribution of the mean scores. The bottom third (mean scores 1.00-2.99) indicated a low level of justice; the middle third (3.00-3.39), an intermediate level; and the top third (3.40-4.00), a high level of justice.

ASSESSMENT OF INCIDENT CHD

The incidence of CHD was defined as a CHD death, a first nonfatal MI, or definite angina. To assess fatal CHD, participants were flagged at the National Health Service Central Registry, which provided information on the date and cause of death (of the 10 308 men and women employees in the Whitehall II Study cohort, 10 300 were successfully flagged). Coronary deaths were defined by the *International Classification of Diseases, Ninth Revision*, codes 410 through 414 as underlying causes of death. Potential new cases of nonfatal MI were ascertained by questionnaire items on chest pain²⁶ and the physician's diagnosis of heart attack. Confirmation of MI according to MONICA criteria (Multinational Monitoring of Trends and Determinants in Cardiovascular Disease)²⁷ was based on electrocardiograms, markers of myocardial necrosis, and chest pain history from the medical records. Assessment of angina was based on the participant's reports of symptoms with corroboration in medical records or abnormalities on a resting electrocardiogram, an exercise electrocardiogram, or a coronary angiogram.

ASSESSMENT OF RISK FACTORS

We measured the following demographic characteristics and conventional risk factors: age group (35-39, 40-44, 45-49, and 50-55 years), ethnicity (white vs other; missing values were replaced by data collected in 1997-1999), marital status (married or cohabiting vs other), educational level (aged <17 , 17-18, and >18 years when left full-time education), employment grade (administrative, executive, or clerical), serum cholesterol concentration, BMI, hypertension (use of antihypertensive medication or systolic/diastolic blood pressure $\geq 140/90$ mm Hg vs others), smoking (current smoker vs others), alcohol consumption (0, 1-21 and >21 U of alcohol per week), and physical activity (vigorous, moderate, or mild).²¹

Job strain and effort-reward imbalance were measured using self-reported job demands (4 items, Cronbach $\alpha = .67$), job control (15 items; Cronbach $\alpha = .84$), efforts (5 items; Cronbach $\alpha = .72$), and rewards (7 or 10 items; Cronbach $\alpha = .78$). Job strain is a continuous variable derived from the difference between the demand and control scores. Effort-reward imbalance is the ratio of effort (numerator) to reward (denominator). For each participant, we calculated the means of job strain (Cronbach α for repeated measurements, .64) and effort-reward imbalance scores across phases 1 and 2 (Cronbach $\alpha = .71$). For those with a missing job strain or effort-reward score in 1 of the 2 phases, we used information from 1 phase only. All of the participants were divided into 3 groups in job strain and 3 groups in effort-reward imbalance based on the distributions of mean scores. The bottom third indicated a low

Table 1. Characteristics of Participants by Levels of Organizational Justice*

Variable	No. of Participants (N = 6442)	Level of Justice at Work			P Value for Trend
		Low (n = 1954)	Intermediate (n = 2242)	High (n = 2246)	
Mean age, y	6442	43.6	43.7	44.2	<.001
Ethnicity, %					
White	5926	91.6	93.5	91.8	.82
Other	464	8.4	6.5	8.2	
Marital status, %					
Married or cohabiting	5181	78.1	82.2	82.7	<.001
Other	1243	21.9	17.8	17.3	
Age when left full-time education, %					
<17 y	1257	25.1	26.9	26.2	<.001
17-18 y	1328	31.4	27.2	25.2	
>18 y	2255	43.5	45.9	48.5	
Employment grade, %					
Administrative	2497	34.9	40.7	43.5	<.001
Executive	3374	53.9	51.7	48.2	
Clerical	571	11.2	7.6	8.3	
Mean serum cholesterol level, mg/dL	6436	231.3	230.9	230.1	.95
Mean BMI	6442	24.8	24.6	24.3	<.001
Hypertension, %					
No	5920	90.4	92.9	91.3	.40
Yes	519	9.6	7.1	8.7	
Smoking, %					
Nonsmoker	5392	85.5	86.4	86.1	.60
Current smoker	881	14.5	13.6	13.9	
Alcohol consumption, %					
None	806	13.2	12.1	12.8	.42†
Moderate	4387	67.3	70.2	68.9	
Heavy	1196	19.5	17.7	18.3	
Physical activity, %					
Vigorous	1680	24.8	26.8	26.5	.14
Moderate	3191	50.9	49.0	50.6	
None/mild	1502	24.3	24.2	22.9	
Job strain, %					
Low	2203	22.1	33.0	46.8	<.001
Moderate	2092	29.5	35.3	32.4	
High	2133	48.4	31.7	20.8	
Effort-reward imbalance, %					
Low	2153	15.5	32.2	50.4	<.001
Moderate	2151	28.2	37.1	34.2	
High	2138	56.3	30.7	15.4	

Abbreviation: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters).

SI conversion factor: To convert cholesterol to millimoles per liter, multiply by 0.0259.

*Data are adjusted for age.

†Calculated using the test for heterogeneity.

level and the top third a high level in job strain and effort-reward imbalance.

DATA ANALYSIS

We fitted Cox proportional-hazard models to study age- and employment grade-adjusted associations between conventional risk factors, psychosocial factors, and the level of justice and incident CHD. The time-dependent interaction terms between each predictor and logarithm (follow-up period) were all nonsignificant, confirming that the proportional hazards assumption was justified. For justice, we made additional adjustments for conventional risk factors and psychosocial factors. For the adjustments, cholesterol concentration and BMI were fitted as continuous variables, and the other covariates were fitted as categorical variables. The statistical significance of interactions among justice, psychosocial factors, and employment grade were tested by including interaction terms in the models. All *P* values are 2 tailed, and *P* values below .05 were considered to indicate

statistical significance. All the analyses were performed using the SAS software, version 8.2 (SAS Institute, Cary, NC).

RESULTS

Table 1 shows characteristics of the participants by level of perceived justice. A higher level of justice was associated with older age. After adjustment for age, men who perceived higher levels of justice were more likely to be married and have a higher educational level, higher employment grade, and lower BMI compared with those who perceived lower levels of justice. A higher level of justice was also associated with lower job strain and lower effort-reward imbalance. The level of justice was not significantly associated with cholesterol level, hypertension, smoking, alcohol consumption, or physical activity.

Table 2. Associations of Conventional Risk Factors and Justice at Work With Incident CHD

Variable	No. of Participants* (No. of Events)	Hazard Ratio (95% CI)	
		Adjusted for Age and Employment Grade	Adjusted for Age, Employment Grade, and All Predictors Shown
Cholesterol level	6128 (237)	1.41 (1.27-1.56)	1.34 (1.20-1.49)
BMI	6128 (237)	1.12 (1.09-1.15)	1.11 (1.07-1.14)
Smoking			
No	5262 (193)	1.00	1.00
Yes	866 (44)	1.54 (1.11-2.15)	1.56 (1.12-2.17)
Hypertension			
No	5645 (194)	1.00	1.00
Yes	483 (43)	2.29 (1.64-3.21)	1.95 (1.39-2.75)
Alcohol consumption			
None	765 (31)	1.07 (0.73-1.58)	1.12 (0.76-1.65)
Moderate	4230 (163)	1.00	1.00
Heavy	1133 (43)	1.10 (0.79-1.54)	0.87 (0.62-1.22)
Physical activity			
Vigorous	1617 (50)	1.00	1.00
Moderate	3086 (124)	1.23 (0.88-1.71)	1.13 (0.81-1.57)
None/mild	1425 (63)	1.35 (0.93-1.96)	1.18 (0.81-1.72)
Justice at work			
Low	1854 (78)	1.00	1.00
Intermediate	2133 (97)	1.05 (0.78-1.41)	1.12 (0.83-1.51)
High	2141 (62)	0.65 (0.47-0.91)	0.71 (0.51-0.99)

Abbreviations: BMI, body mass index; CHD, coronary heart disease; CI, confidence interval.
*Only the 6128 men with no missing data in any of the predictors were included in these models.

Two hundred fifty employees had an incident CHD event during the mean follow-up of 8.7 years. **Table 2** shows Cox proportional hazard models for associations between conventional risk factors, justice at work, and incident CHD among the 6128 men with no missing values. After adjustment for age and employment grade, higher cholesterol level, higher BMI, smoking, and hypertension were associated with higher incidence of CHD. For alcohol consumption and physical inactivity, the associations did not reach statistical significance. High justice was associated with a lower risk of incident CHD than low and intermediate justice before and after adjustment for risk factors, in addition to age and employment grade. Adjustment for ethnicity, marital status, and education had no effect on the association between justice and incident CHD (hazard ratio for high vs low justice, 0.67; 95% confidence interval [CI], 0.45-0.98 before and 0.46-0.98 after this adjustment; n=4814 with 180 incident cases).

Table 3 shows Cox proportional hazard models for associations between incident CHD and psychosocial factors and justice at work. After adjustment for age and employment grade, higher job strain, and, to a lesser extent, higher effort-reward imbalance, were associated with higher risk of incident CHD. As previously shown, a high level of justice at work was associated with lower risk of incident CHD. This association remained in a model additionally adjusted for the other psychosocial

Table 3. Associations of Psychosocial Factors and Justice at Work With Incident CHD

Variable	No. of Participants* (No. of Events)	Hazard Ratio (95% CI)	
		Adjusted for Age and Employment Grade	Adjusted for Age, Employment Grade, and All Predictors Shown
Job strain			
Low	2203 (71)	1.00	1.00
Intermediate	2092 (81)	1.23 (0.89-1.69)	1.18 (0.85-1.64)
High	2133 (98)	1.52 (1.12-2.07)	1.44 (1.01-2.05)
Effort-reward imbalance			
Low	2147 (73)	1.00	1.00
Intermediate	2148 (88)	1.25 (0.91-1.72)	1.06 (0.76-1.48)
High	2133 (89)	1.31 (0.95-1.80)	0.95 (0.65-1.40)
Justice at work			
Low	1952 (84)	1.00	1.00
Intermediate	2232 (100)	1.00 (0.75-1.34)	1.03 (0.76-1.40)
High	2244 (66)	0.65 (0.47-0.89)	0.69 (0.49-0.98)

Abbreviations: CHD, coronary heart disease; CI, confidence interval.
*Only the 6428 men with no missing data for either of the psychosocial factors were included in these models.

work characteristics. For further analyses, we combined the categories of low and intermediate levels of justice, as these groups did not differ in terms of CHD risk. In a fully adjusted model including all conventional risk factors and psychosocial factors, a high level of justice at work, compared with low and moderate levels, remained a statistically significant predictor of incident CHD (hazard ratio, 0.70; 95% CI, 0.51-0.94 [data not shown]).

Table 4 shows the associations of job strain and effort-reward imbalance with incident CHD by level of justice. Job strain and effort-reward imbalance seemed to interact with the level of justice, although these interactions did not reach statistical significance ($P=.06$ and $.26$, respectively). Among employees with low or intermediate levels of justice, job strain and effort-reward imbalance were associated with a higher risk of CHD. In contrast, there was no association between job strain or effort-reward imbalance and incident CHD among employees with a high level of justice.

Finally, we studied whether the association between the level of justice and CHD was dependent on employment grade. This was not the case ($P=.94$ for interaction); the age-adjusted hazard ratios for incident CHD associated with a high level of justice were similar across the grades, ie, 0.64 (95% CI, 0.41-0.97) in the administrative grade, 0.67 (95% CI, 0.45-1.00) in the executive grade, and 0.54 (95% CI, 0.18-1.60) in the clerical grade.

COMMENT

This is the first study, to our knowledge, that demonstrates that justice at work may protect against CHD. In men who perceived a high level of justice, the risk of in-

Table 4. Associations of Psychosocial Factors at Work With Incident CHD by Level of Justice*

Variable	Low or Intermediate Justice Level		High Justice Level	
	No. of Participants (No. of Events)	Hazard Ratio (95% CI)	No. of Participants (No. of Events)	Hazard Ratio (95% CI)
Job strain				
Low	1156 (38)	1.00	1047 (33)	1.00
Intermediate or high	3028 (146)	1.57 (1.10-2.25)	1197 (33)	0.87 (0.54-1.42)
Effort-reward imbalance				
Low	1021 (38)	1.00	1132 (35)	1.00
Intermediate or high	3175 (146)	1.31 (0.90-1.89)	1114 (31)	0.90 (0.54-1.48)

Abbreviations: CHD, coronary heart disease; CI, confidence interval.

*Data are adjusted for age and employment grade.

cident CHD was 30% lower than among those who perceived a low or an intermediate level of justice. This finding was not accounted for by baseline factors such as age, ethnicity, marital status, educational attainment, socioeconomic position, cholesterol level, obesity, hypertension, smoking, alcohol consumption, and physical activity. The association between the level of justice and CHD was also independent of other psychosocial factors at work, as indicated by the 2 leading stress models, job strain and effort-reward imbalance.²²⁻²⁴ Our evidence was based on a large well-characterized cohort, a 9-year follow-up, and repeated measurements of justice. All components of the outcome, including CHD deaths, first nonfatal MIs, and definite angina, were confirmed by medical records.

The link between the level of justice and development of CHD was not unexpected, considering the strong associations between social relations and health^{4,10,28} and the central role of concerns about justice and equity in all societies.¹⁻³ Furthermore, other studies suggest that a low or declining level of justice at work is associated with increased risk for subsequent psychological distress, non-optimal health, and medically certified sickness absence,^{25,29,30} with all outcomes predictive of all-cause mortality and CHD incidence.³¹⁻³⁴ Our findings on justice and CHD are also compatible with small-scale studies on blood pressure and heart rate variability (Marko Elovainio, PhD, M.K., Sampsa Puttonen, MA, Harri Lindholm, MD, Tiina Pohjonen, PhD, and Timo Sinervo, PhD, unpublished data, February 2004).¹⁹

An important question is whether the addition of justice at work materially adds to a risk prediction based on the established theoretical models. The main theories in this field are the job strain model and the effort-reward imbalance model.²²⁻²⁴ The job strain model posits that a combination of high work demands and low job control at work, ie, job strain, is a health risk for employees. The effort-reward imbalance model considers the impact of labor market conditions on health in addition to more proximal job conditions. According to this model, health risk derives from the mismatch between efforts expended at work and rewards received in the form of money, social approval, job security, and career opportunities. Both job strain and effort-reward imbalance have been shown to be the key psychosocial predictors of CHD

and other health outcomes in the Whitehall II Study and a number of other investigations.³⁵⁻⁴⁴

There is a large body of theoretical and empirical research on justice at work as a determinant of organizational behaviors,^{7-9,11-13} but the association between justice and health has only recently been demonstrated.^{25,29,30} Unlike the job strain model and the effort-reward imbalance model, the justice approach is directly focused on managerial treatment and managerial procedures.^{7,11} Within this focus, it covers all kind of unfairness, not only that arising from disproportionate demands in relation to decision latitude and organizational rewards.^{5,7,11} We found that a high level of justice at work was associated with lower job strain and a more favorable match between efforts and rewards. Despite this, the association between justice and CHD was not explained by associations between these psychosocial factors, and the level of justice remained an independent predictor of CHD risk after adjustment for the other psychosocial factors. Moreover, there was an indication that a high level of justice might buffer part of the adverse effects of job strain and effort-reward imbalance. All these findings suggest that the addition of justice at work adds to a risk prediction based on the established theoretical models.

Questions have been raised regarding covariation between work perceptions and occupational position.⁴⁵ Socioeconomic position is a major correlate of some psychosocial work characteristics and a marker of many risk factors across the life course.^{46,47} In the present study, a high level of perceived justice was more common among well-educated men and those in higher employment grades. However, adjustment for employment grade or education did not abolish the effect of the level of justice on CHD risk, and a subgroup analysis confirmed that the hazard ratios for administrative, executive, and clerical grades did not materially differ from each other. This evidence supports the possibility that the association between the level of justice and CHD is not due to socioeconomic confounding.

Several potential limitations merit careful consideration. First, as CHD develops during a long time span, long-term rather than short-term levels of justice are assumed to affect CHD incidence. We used averaged scores from repeated assessments during a 3-year period to determine levels of justice, job strain, and effort-reward im-

balance. However, the stability of these measurements over time was only moderate and, despite use of the averaged scores, the observed effects of justice and other psychosocial factors might be underestimated. In addition, all comparisons in the predictive strength among the level of justice, job strain, and effort-reward imbalance should be interpreted cautiously, as the operationalization of these concepts may not be equally successful in every case.⁴⁸

Second, as the level of justice was self-reported, it is unclear whether actual managerial treatment or the characteristics of the respondent determined it. Previous research suggests that self-reported justice levels reflect organizational reality, because there is a high degree of congruence between subordinates' perceptions of their supervisors across multiple measurement points and between the perceptions of supervisors by their peers⁴⁹ and superiors.⁵⁰ Moreover, individual-level justice scores and more objective work unit aggregated scores have been shown to be equally predictive of health.³⁰ Organizational reality may influence health through employees' appraisal processes and perceptions,⁵¹ but increasing the level of justice with which organizational policies, practices, and procedures are applied may provide a more pragmatic way to influence health.

Third, although work is central in adult life, other social environments that people inhabit may also be important. Various positive aspects of society, family life, and relations with significant others have been found to be protective of health.^{4,10,28,39} It is possible that such health-promoting resources also mitigate the harm caused by a low level of justice at work. On the other hand, just treatment at work might be particularly important during times of uncertainty or for minority groups and vulnerable individuals with limited coping resources.^{36,52} Further studies with larger sample sizes are needed to examine these and other potential modifiers of the effects of justice on heart health.

Finally, as our evidence was based on male civil servants, further research is needed to determine whether the effect of justice on heart health is generalizable to women, in other contexts, and across ethnic groups.

CONCLUSIONS

Most people care deeply about just treatment by authorities. Just treatment may communicate status and value, whereas lack of justice may be a source of oppression, deprivation, and stress. Justice, equity, and altruism have been the drivers of benign developments in human societies according to a wide range of studies across a broad spectrum of disciplines. Our findings on CHD, the leading cause of death in all Western societies, suggest that organizational justice is also a topic worthy of consideration in health research.

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