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Justice at Work and Metabolic Syndrome: the Whitehall II Study

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Abstract

Objectives—Growing evidence shows that high levels of justice are beneficial for employee health, although biological mechanisms underlying this association are yet to be clarified. We aim to test whether high justice at work protects against metabolic syndrome.

Methods—A prospective cohort study of 20 civil service departments in London (the Whitehall II study) including 6123 male and female British civil servants aged 35 to 55 years without prevalent CHD at baseline (1985–1990). Perceived justice at work was determined by means of questionnaire on two occasions between 1985 and 1990. Follow-up for metabolic syndrome and its components occurring from 1990 through 2004 was based on clinical assessments on three occasions over more than 18 years.

Results—Cox proportional hazard models adjusted for age, ethnicity and employment grade showed that men who experienced a high level of justice at work had a lower risk of incident metabolic syndrome than employees with a low level of justice (hazard ratio 0.75; 95% confidence interval: 0.63–0.89). There was little evidence of an association between organizational justice and metabolic syndrome or its components in women (hazard ratio 0.88; 95% CI: 0.67–1.17).

Conclusions—Our prospective findings provide evidence of an association between high levels of justice at work and the development of metabolic syndrome in men.

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Contributors: MK and DG conceptualized the original idea. DG prepared the first draft and, together with MK, AT and MJS organized the strategy for the analyses. All authors contributed to manuscript revision, read and approved the final manuscript. MGM directs the Whitehall II study. All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals.

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Keywords

Coronary heart disease; Psychosocial factors; Risk factors; Epidemiology; Cohort; Work organization

INTRODUCTION

Growing evidence supports the hypothesis that the two components of justice at work,¹² that is, procedural justice (i.e., whether decision making procedures include input from affected parties, are consistently applied, suppress bias, are accurate, correctable, and ethical) and relational justice (i.e., the extent to which employees perceive that their supervisors consider their viewpoints, share information concerning decision-making, and treat individuals fairly and in a truthful manner),¹ may be important determinants of employee health.²⁻¹⁴ Independent cohort studies have shown that high justice at work is not only associated with a lower risk of psychiatric⁶¹⁵ and insomnia symptoms,⁴¹⁴ but also with a reduced incidence of medically-certified coronary heart disease (CHD) and cardiovascular mortality.⁸¹⁶ These associations were not accounted for by other baseline risk factors, such as socioeconomic position or health behaviours.

An important step forward in confirming or refuting the status of justice at work as a protective factor is the identification of biological mechanisms that may underlie the association between justice and employee health. High justice is assumed to be related to reduced work stress, implying that high justice at work might decrease the likelihood of hypothalamic-pituitary-adrenal (HPA) axis deregulation¹⁷ and thus be potentially related to a lower risk of developing metabolic syndrome. Metabolic syndrome is a cluster of risk factors for heart disease defined by at least three of the following: elevated blood pressure, elevated levels of fasting glucose and triglycerides, and sex-specific low levels of high density lipoprotein cholesterol and abdominal obesity as measured by waist circumference.¹⁸ Although there is some prior evidence of an association between prolonged exposure to work stress and metabolic syndrome,¹⁹²⁰ there are no previous studies that have examined whether justice at work protects people against developing the syndrome.

In this study from the Whitehall II cohort of British civil servants, we examined the association of justice at work with metabolic syndrome and its components over an extended follow-up period. To improve measurement accuracy, we took advantage of the repeated measurements collected in this well-characterized study. Thus, justice at work was measured on two occasions and metabolic syndrome on three occasions over more than 18 years.

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 Phase 1 cohort (1985-1988) included 6895 men and 3413 women. The present study (see Figure 1) included 6123 participants (59% of the original cohort), 4398 men (64% of all men) and 1923 women (56% of all women), with no history of CHD by phase 2 (1989-1990); having less than two of the following metabolic syndrome type components at phase 1: elevated total cholesterol, diabetes, obesity, elevated blood pressure (*see section on metabolic syndrome for details*); complete data on baseline characteristics, justice at work at phases 1 or 2; and at least one complete clinical assessment of metabolic syndrome and its components after phase 2. The participants were, at baseline, slightly younger (45.0 years versus 46.5 years, $p<0.0005$), more likely to be men (69.6% versus 62.3%, $p<0.0005$), white

(91.4 % versus 85.4%, $p<0.0005$) and from a high socioeconomic position (32.3% versus 24.7%, $p<0.0005$) than those excluded. After adjustment for age, sex, ethnicity and employment grade, those who were included in this study had a higher mean justice score than the excluded (78.6 vs. 77.7; $p<0.0005$).

Study design

The Whitehall II Study is a prospective observational cohort study with eight data collection phases to date. Odd-numbered phases include a clinical examination and a self-administered questionnaire, while even-numbered phases are questionnaire only.²¹ Justice at work was measured at phases 1 (1985-1988) and 2 (1989-1990), and metabolic syndrome and its components at phases 3 (1991-1993), 5 (1997-1999) and 7 (2002-2004), thus providing a maximum time at risk of 18.6 years. The University College London Medical School Committee on the Ethics of Human Research approved the protocol and informed consent was gained from all participants.

Assessment of justice at work

We used a self-reported 5-item scale (Cronbach $\alpha=0.72$ at phases 1 and 2) tapping the relational component of justice at work, as in earlier studies using the Whitehall II Study cohort.¹¹¹⁴⁻¹⁶ 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. A Bland-Altman plot indicated agreement for the justice scores measured in both phases with 94.7% of the scores inside the 2-SD limits.²² For those with missing justice scores in 1 of the 2 phases ($n=941$, 67.8% men), 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 metabolic syndrome

Cases of metabolic syndrome at phases 3, 5 and 7 were defined according to the ATPIII criteria,¹⁸ additionally including the AHA/NHLBI criteria on drug treatment,²³ by the presence of at least three of the following components: large waist circumference (men ≥ 102 cm [40 inches]; women ≥ 88 cm [35 inches]); elevated triglycerides (≥ 1.7 mmol/L [150 mg/dL] or on lipid lowering medication); reduced HDL cholesterol (men < 1.03 mmol/L [40 mg/dL]; women, < 1.3 mmol/L [50 mg/dL] or on lipid lowering medication); elevated blood pressure (systolic ≥ 130 or diastolic ≥ 85 mmHg or on antihypertensive drug treatment); and elevated fasting glucose (≥ 6.11 mmol/L [110 mg/dL] or on antidiabetic medication).

Metabolic syndrome components were not assessed prior to phase 3, so in order to detect potential cases of the syndrome at phase 1 we created a proxy measure defined by the presence of at least two of the following components: high total cholesterol (≥ 6.24 mmol/L [240 mg/dL]) according to ATPIII guidelines,¹⁸ self-reported diabetes or on drug treatment, obesity (body mass index ≥ 30 kg/m²) based on clinically assessed weight and height, and elevated blood pressure defined as above. All metabolic syndrome components were clinically assessed according to standard guidelines as previously described.²⁴²⁵

Assessment of follow-up time

For each participant, the start of follow-up was taken as the date of the last assessment of justice at work. As the end of the follow-up for cases we chose the midpoint date between the date of the clinical assessment at which a case was first detected and the date of the prior clinical assessment while for non-cases the date of their last clinical assessment was used. The time between these dates of entry and exit to follow-up was used as the follow-up time for each participant. Further, irrespective of their future classification regarding metabolic syndrome and its components, participants with a CHD event were censored at the date of this event. Depending on the outcome, between 200 and 569 participants had a CHD event before the outcome of interest.

Baseline covariates

The following baseline demographic characteristics were treated as covariates in the analysis: sex, age, ethnicity (white versus other), and Civil Service employment grade, a measure of education, income and employment relations, grouped as high (administrators), intermediate (executives, professionals and technical staff) and low (clerical and office support staff).²¹

Data analyses

We fit sex-specific Cox proportional-hazard models to study the associations between justice at work and the time to the first detection of cases of metabolic syndrome and its components at any subsequent phases, adjusting for age, ethnicity and employment grade. The proportional hazards assumption was tested by including interaction terms between each predictor and logarithm of the follow-up period (time variable) in the models. In some models there was an indication ($p < 0.05$) of an age-time interaction, but their inclusion had no effect on the estimates of interest and further examination of the Schoenfeld residual plots suggested the statistical interactions were not meaningful.²⁶ Hence, we considered the proportional hazards assumption to be justified. Additionally, we checked whether the association between the level of justice and metabolic syndrome or its components was dependent on employment grade by including interaction terms in the models and by examining separate models by grade. We did not find any meaningful grade interaction or trends across grades.

Although we had already excluded from our sample participants who were potential metabolic syndrome cases at phase 1, we conducted a further and more conservative analysis. This analysis excluded 3305 baseline participants (50.0% of the men and 42.4% of the women) who had: (1) any of metabolic syndrome components (analyses with metabolic syndrome as the outcome); (2) elevated total cholesterol (analyses with reduced HDL cholesterol as the outcome); (3) elevated total cholesterol or diabetes (analyses with triglycerides and elevated glucose as the outcomes); (4) obesity (analyses with large waist circumference as the outcome); and, (5) elevated blood pressure (analyses with elevated blood pressure as the outcome). All p -values are two-tailed, and p -values below 0.05 were considered to indicate statistical significance. All analyses were done in STATA/SE v.9.2®.

RESULTS

Table 1 shows characteristics of the participants by sex and level of perceived justice at work. Men were more likely to be slightly younger, white and working in higher employment grades at baseline than women. Baseline prevalence of metabolic syndrome type components was higher in men than women (8.1 percentage points greater for elevated blood pressure, 1.6 percentage points greater total cholesterol, and only 0.2 percentage points greater for diabetes), except for obesity for which the proportion of cases was 2.4

percentage points greater in women. In men, a higher level of perceived justice was associated with older age, higher employment grade and lower prevalence of metabolic syndrome and its components, except for elevated glucose. In women, low employment grade was associated with higher levels of justice.

Table 2 shows Cox proportional hazard ratios for the associations of justice at work with metabolic syndrome, and its components after adjustment for age, ethnicity and employment grade. Men who perceived a high level of justice at work had a 25% lower risk of having metabolic syndrome than their counterparts with low justice. With the exception of the elevated glucose component, the risk was similarly lower for all components of metabolic syndrome: 15% for reduced HDL-cholesterol, 18% for elevated triglycerides, 32% for large waist circumference and 14% for elevated blood pressure. In adjusted models that excluded all participants with any component of metabolic syndrome at baseline (Table 3), all these associations not only remained but even strengthened, such that the reduction in risk of developing metabolic syndrome was increased to 40%.

There was evidence that women reporting high justice at work had a 20% lower risk of having a large waist circumference than women reporting low justice (Table 2). However, overall there was little evidence of an association between justice at work and metabolic syndrome or its components in women. Although effect sizes were similar in the adjusted models excluding participants with any metabolic syndrome component at baseline (Table 3), the evidence with regard to large waist circumference was weaker due to lower numbers.

DISCUSSION

Our findings demonstrate for the first time that high justice at work may protect against metabolic syndrome and its components in men. We found that men who perceived a high level of justice at the workplace had a 25% lower risk of developing metabolic syndrome than men perceiving a low level of justice. This association was only partially accounted for by baseline factors such as age, ethnicity, and employment grade. These findings, which appear to be restricted to men, were based on a large well-characterized occupational cohort with repeated measurements of justice at work and clinical determination of metabolic syndrome during an 18-year follow-up.

Our results are in agreement with earlier research demonstrating an association between justice at work and health. Furthermore, we provided evidence in support of a plausible biological mechanism linking justice at work with reduced cardiovascular risk in men. Consistent with the idea that the biological mechanism associated with justice relates to reduced stress, our findings parallel those obtained for work stressors^{19,20} -although prior research did not control for metabolic syndrome or its components at Phase 1 as we did here- and are consistent with prior findings suggesting that justice at work moderates the association between work stressors and CHD.¹⁶ Our results are also in agreement with a small scale study suggesting that lack of justice at work may be related to reduced heart rate variability,⁹ a marker of potential stress-related dysfunction of the autonomic nervous system.

We found justice at work to be slightly more strongly associated with metabolic syndrome than with its components. Of the five components, large waist circumference showed the strongest association with justice at work. Justice appeared not to be associated with elevated glucose levels in contrast with a previous work²⁷ where a related construct of psychosocial adversity at work, effort-reward imbalance, was prospectively associated with incident type 2 diabetes. However, the prior study defined diabetes according to the much broader World Health Organization definition²⁸ rather than the more conservative ATPIII

criteria.¹⁸ We also found justice at work to predict elevated blood pressure more strongly than observed in a previous study from the Whitehall II cohort. That study suggested that blood pressure was weakly associated with justice at work and was not likely to mediate the relationship between justice and CHD.¹¹ However, the prior study used a continuous measure of justice rather than justice categories in an analysis combining women and men and with a shorter follow-up period. The outcome was also defined differently as that study used a higher cut-off value for elevated blood pressure. These differences between the two analyses of the same cohort indicate that the effect of justice at work may not be linear and that there could be a threshold level of justice beyond which the effects on health are more evident. It may also suggest that longer follow-up periods are needed with separate analyses for men and women. In order to obtain a more complete picture of the potential mediating role of metabolic syndrome in the justice at work-CHD association, we need more cases of metabolic syndrome occurring prior to a CHD event that we could currently track down. Future phases of the Whitehall II study may be able to provide enough cases.

There are methodological concerns related to the assessment of justice. First, two components of justice at work have been identified,⁵ procedural justice (i.e., whether decision making procedures are fair and ethical) and relational justice (i.e., whether workers are treated politely and with consideration by their supervisors). As in earlier publications of the Whitehall II Study cohort,^{11,14-16} our measure of justice at work only tapped the relational component of justice at work, since only those items were available. Future research will need to examine whether both components follow the same pattern of associations with metabolic syndrome.

Second, since the assessment of justice at work was done using self-reports, measurement imprecision may have biased our estimate of the influence of justice at work on metabolic syndrome. We tried to minimize the bias by averaging two measurements of justice creating a more accurate estimate of chronic exposure. Means, however, may not sufficiently account for the potential changes in exposure between phases. There had been earlier attempts examining changes in psychosocial working exposures,²⁹⁻³¹ but some critical issues are still unsolved. There is no agreement in the literature regarding how to measure changes in psychosocial exposures and a diversity of methods have been used to classify exposure change. Also, there is no evidence on whether and how much the timing of the transition matters. Unfortunately, we could not assess justice at follow-up since only three of the five items used in phases 1 and 2 were available at follow-up. Thus, our capability to explore changes was restricted since justice was only assessed in two close-in-time phases which may not be enough to adequately measure health effects due to change. Indeed, we observed a very high agreement in the justice scores between the two phases suggesting that only minor changes in the exposure may have occurred between phases and supporting our decision to compute a mean score. In summary, in order to appropriately examining the effect of exposure to justice changes and trajectories on health, there is a need for more theoretical as well as empirical work from well designed longitudinal studies with a greater number of repeated measures of health and organizational justice.

A question remains regarding the difference of the organizational justice construct from other models of the psychosocial work environment (e.g., demand-control and effort-reward models). Some prior work competed models in a final multivariate model demonstrating statistical independence of the association between justice and health outcomes from other psychosocial work characteristics, which only explained a modest fraction of the association.^{21,15,63,32} This approach, however, seems to be more a test of how well the exposure is measured rather than which model is more relevant. Empirical combinations of models to improve the risk estimation may provide positive findings, but the meaning of the combined effects is yet unclear. Uncertainty remains on whether the differences between the

models are conceptual or operational and before evaluating the benefit of combining or mutually adjusting the models, explicit theoretical and methodological work should be conducted to explore the feasibility of combining or contrasting any model.³³³⁴

The following issues must also be considered when interpreting our findings. First, given the composition of the cohort, mostly white male office-based civil servants, there is a need for more diverse samples to extend the validity of our findings. Nonetheless, given the increased percentage of white-collar workers in affluent societies,³⁵ this cohort may be largely representative of current workplaces. Second, although virtually no participants (n=9) were excluded from the analyses due to lack of data on justice at both phases, 14.9% of the sample (14.5% in men; 15.6% in women) provided data only at one phase, either phase 1 or 2. Exclusion of these participants did not alter our results (data not shown), partly because there was no difference between the average justice scores of participants contributing two measurements and those with only one measurement (in models adjusted for age, sex, ethnicity and employment grade the scores were 78.6 vs. 78.3; $p=0.363$), and partly because the results from models constraining the sample to those with data from both phases were in the same direction and had similar magnitude to the presented results. Third, perceptions of low justice at work could be a marker of dispositional traits, such as high neuroticism, which have been shown to be associated with a tendency to experience symptoms of CHD³⁶. This could create common method bias for studies relying on self-reported outcomes, but as our outcomes are based on clinically assessed measures, such bias remains an unlikely explanation for our findings.

Consistent with prior research on organizational justice and health outcomes,²¹⁵³⁰³² we found the associations to be of greater magnitude in men than in women which may suggest that the experience and meaning of justice at work are different for men and women. There is also some evidence that working conditions often affect men somewhat more negatively, while the impact of family demands on health is greater in women.³⁷ Last, the final analytic cohort for our study excluded 36% of the men and 44% of the women from the originally recruited cohort. Although exclusions were mostly due to participants with missing data for whom the determination of metabolic syndrome was impossible, and to the exclusion of participants with prevalent CHD disease, lost to follow-up was greater in women (24.9%) than in men (15.7%), which may have introduced selection bias contributing to underestimate the associations in women. Further research is needed to determine the generalizability of our findings to women. Overall, missingness may have biased our results towards an underestimation of the association between justice and metabolic syndrome, since cohort members lost to follow-up had lower scores of justice and a greater prevalence of any metabolic syndrome type characteristics than the participants. Retirement during the follow-up might have also attenuated the associations. However, the strong associations between justice and metabolic syndrome suggest that, at least in men, these sources of bias to be unlikely explanations of our findings.

In addition, since participants with a CHD event were censored in the analyses, we further eliminated the possibility that the diagnosis of metabolic syndrome or its components was driven by a preceding CHD event. In order to minimize the possibility of reverse causality we performed a number of exclusions related to baseline status of metabolic syndrome components. We found no evidence to support reverse causality as an explanation for our findings. Finally, in our analyses we adjusted for baseline demographic characteristics but we did not perform adjustment for other cardiovascular disease risk factors (e.g., health-related behaviours) because they are potentially in the causal pathway between justice and CHD. We were able to account for the effect of adult socioeconomic circumstances (i.e., employment grade), but these circumstances are unlikely to be true mediators since they precede behavioural and biological factors and so may be considered as markers of other

stressful conditions.³⁸ Thus, adjustment for socioeconomic factors may have controlled for the effect of some exposures we did not directly measure. In conclusion, those stringent exclusions together with the performed adjustments make us confident that our study provides good evidence for an association between high levels of justice at work and reduced risk of developing metabolic syndrome in men.

Although we acknowledge that other social environments (e.g., the family, the community) are also relevant in terms of providing people with fairness experiences,²⁴ the advantage of studying justice at work is precisely because it locates the source of the (un)fairness (i.e., workplace and the relationships with supervisors/management), and so is much more amenable to intervention. There are advantages of our study over prior research (e.g., large prospective cohort, long follow-up, repeated measurements, clinically determined outcomes), but future studies are still needed to confirm causal associations and to test whether favourable changes in justice at work results in favourable metabolic changes. Randomized controlled trials should be the ultimate goal for the research in this area (e.g., workplaces could be randomized for an intervention) although we realize that they may be extremely challenging in the real work environment.

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What this paper adds

- High levels of justice at work are associated with a reduced incidence of medically-certified coronary heart disease and cardiovascular mortality, but there is very limited research on the underlying biological mechanisms of this association.
- High justice might decrease the likelihood of hypothalamic-pituitary-adrenal axis deregulation and thus be potentially related to a lower risk of developing the metabolic syndrome.
- Men who perceived a high level of justice at the workplace had a 25% lower risk of developing the metabolic syndrome than men perceiving a low level of justice.
- These findings are based on a large well-characterized occupational cohort with repeated measurements of justice at work and clinical determination of the metabolic syndrome during an 18-year follow-up.

Figure 1.

Flow chart of sample selection. CHD = coronary heart disease.

*Years corresponding to each phase are: phase 1 = 1985-1988; phase 2=1989-1990; phase 3 = 1991-1993; phase 5 = 1997-1999; and, phase = 7 2003-2004.

†All percentages refer to the figures showed in the preceding box.

±Reasons for exclusions were: death (i.e., participant died due from any cause before participating at one of the phases), nonparticipation (i.e., participant did not respond or withdrew before participating at one of phases) and incomplete data (i.e., participant attended a phase but did not complete all tests).

TABLE 1

Baseline sample (n=6321) characteristics by sex and justice at work level. Figures are numbers (%) unless otherwise stated.

Characteristics	Men (n=4398)				Women (n=1923)			
	Justice at work level				Justice at work level			
	Total	Low	Intermediate	High	Total	Low	Intermediate	High
N	1295 (29.5)	1570 (35.7)	1533 (34.9)		614 (31.9)	613 (31.9)	696 (36.2)	
Age (mean (SD) ^b)	44.8 (5.9)	44.4 (5.8)	44.7 (5.9)	45.2 (6.0)	45.4 (5.9)	45.7 (5.8)	45.2 (5.9)	45.3 (6.0)
White ethnicity	4103 (93.3)	1192 (92.0)	1477 (94.1)	1435 (93.6)	1674 (87.1)	529 (86.2)	542 (88.4)	603 (86.6)
Employment grade								
High	1771 (40.3)	451 (34.8)	638 (40.6)	682 (44.5)	271 (14.1)	77 (12.5)	113 (18.4)	81 (11.6)
Intermediate	2318 (52.7)	727 (56.1)	833 (53.1)	758 (49.5)	828 (43.1)	299 (48.7)	254 (41.4)	275 (39.5)
Low	309 (7.0)	117 (9.0)	99 (6.3)	93 (6.1)	824 (42.9)	238 (38.8)	246 (40.1)	340 (48.9)
High total cholesterol (≥ 6.24 mmol/L) ^c	21 (0.5)	10 (0.8)	9 (0.6)	2 (0.3)	6 (0.3)	0 (0.0)	2 (0.3)	4 (0.6)
Diabetes ^d	1120 (25.5)	316 (24.4)	389 (24.8)	415 (27.1)	335 (17.4)	91 (14.9)	115 (18.7)	129 (18.5)
Obesity (BMI ≥ 30 kg/m ²) ^e	50 (1.1)	16 (1.2)	21 (1.3)	13 (0.9)	68 (3.5)	32 (5.2)	20 (3.3)	16 (2.3)
Elevated blood pressure ^f	1010 (23.0)	292 (22.6)	373 (23.8)	345 (22.6)	406 (24.4)	113 (18.7)	146 (24.1)	147 (21.4)
								0.263

^a P trend = p for linear trend across the justice at work levels

^b SD=standard deviation.

^c According to ATPIII guidelines.¹⁸

^d Self-reported diabetes or on drug treatment.

^e BMI = body mass index, based on clinically assessed weight and height.

^f According to the AHA/NHLBI definition,²³: systolic ≥ 130 or diastolic ≥ 85 mmHg or on antihypertensive drug treatment.

TABLE 2

Associations (hazard ratio and 95% CI)^a of justice at work with metabolic syndrome and its components^b in men (n=4398) and women (n=1923).

Justice at work	Components of metabolic syndrome											
	Metabolic syndrome		Reduced HDL cholesterol		Elevated triglycerides		Large waist circumference		Elevated blood pressure		Elevated glucose	
	Person-years at risk (cases)	HR (95%CI)	Person-years at risk (cases)	HR (95%CI)	Person-years at risk (cases)	HR (95%CI)	Person-years at risk (cases)	HR (95%CI)	Person-years at risk (cases)	HR (95%CI)	Person-years at risk (cases)	HR (95%CI)
MEN												
Low (n=1295)	13375 (265)	1.00	12178 (386)	1.00	10554 (569)	1.00	13839 (241)	1.00	9031 (773)	1.00	13874 (138)	1.00
Intermediate (n=1570)	16343 (277)	0.86 (0.73-1.02)	15017 (408)	0.87 (0.76-1.00)	13052 (629)	0.90 (0.80-1.01)	16672 (252)	0.86 (0.72-1.03)	11187 (889)	0.93 (0.84-1.02)	16606 (173)	1.08 (0.87-1.36)
High (n=1533)	16850 (249)	0.75 (0.63-0.89)	15241 (395)	0.85 (0.74-0.98)	13795 (589)	0.82 (0.73-0.92)	17334 (205)	0.68 (0.56-0.82)	11623 (851)	0.86 (0.78-0.95)	16473 (175)	1.09 (0.87-1.36)
p for linear trend		0.001		0.023		0.001		<0.0005		0.003		0.488
WOMEN												
Low (n=614)	6179 (97)	1.00	5656 (147)	1.00	5854 (151)	1.00	5693 (174)	1.00	4671 (302)	1.00	6054 (51)	1.00
Intermediate (n=613)	613 (80)	0.83 (0.62-1.12)	5951 (145)	0.97 (0.77-1.22)	6026 (161)	1.07 (0.86-1.34)	6011 (149)	0.83 (0.67-1.03)	4927 (298)	0.99 (0.85-1.17)	6259 (45)	0.94 (0.63-1.41)
High (n=696)	7300 (100)	0.88 (0.67-1.17)	6525 (182)	1.04 (0.84-1.30)	6760 (198)	1.14 (0.2-1.41)	6826 (169)	0.80 (0.64-0.98)	5440 (336)	1.02 (0.87-1.19)	7098 (47)	0.80 (0.54-1.19)
p for linear trend		0.404		0.681		0.227		0.036		0.846		0.268

^z Adjusted for age, ethnicity and employment grade.

^b According to the AHA/NHLBI definition. ²³

TABLE 3

Associations (Hazard Ratio and 95% CI)^a of justice at work with metabolic syndrome and its components^b in men and women after excluding potential cases participants from phase 1^c.

Justice at work	Components of metabolic syndrome									
	Metabolic syndrome (1)		Reduced HDL cholesterol (2)		Elevated triglycerides (3)		Large waist circumference (4)		Elevated blood pressure (5)	
	Person-years at risk (cases)	HR (95%CI)	N	Person-years at risk (cases)	HR (95%CI)	N	Person-years at risk (cases)	HR (95%CI)	N	Person-years at risk (cases)
MEN	2197		3373	3352		4341	3272		3352	
Low	7505 (92)	1.00	998	9445 (279)	1.00	1277	13785 (224)	1.00	978	7869 (501)
Intermediate	8638 (86)	0.81 (0.60-1.09)	1192	11562 (281)	0.84 (0.71-0.99)	1547	16597 (233)	0.85 (0.71-1.03)	1178	9734 (553)
High	8978 (66)	0.60 (0.44-0.83)	1183	11916 (278)	0.82 (0.69-0.97)	1517	17243 (193)	0.68 (0.56-0.83)	1116	9937 (500)
p for linear trend		0.002			0.002			<0.0005		<0.0005
WOMEN	1108		1495	1489		1855	1587		1489	
Low	3935 (50)	1.00	493	4575 (111)	1.00	582	5588 (146)	1.00	522	4268 (227)
Intermediate	3717 (36)	0.83 (0.54-1.27)	461	4493 (101)	0.97 (0.74-1.27)	593	5966 (132)	0.86 (0.68-1.09)	498	4450 (211)
High	4461 (38)	0.70 (0.45-1.06)	541	5316 (119)	0.92 (0.71-1.19)	680	6780 (157)	0.87 (0.70-1.10)	567	4874 (229)
p for linear trend		0.093			0.508			0.253		0.496

^a Adjusted for age, ethnicity and employment grade.

^b According to the AHA/NHLBI definition.²³

^c Excluding participants that at phase 1 had: (1) Elevated total cholesterol or diabetes or obesity or elevated blood pressure; (2) Elevated total cholesterol; (3) Elevated total cholesterol or diabetes; (4) Obesity; (5) Elevated blood pressure.