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**Running head:** Justice and cognition

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**Organizational justice and cognitive function in middle-aged employees: The Whitehall II study**

Marko Elovainio, Archana Singh-Manoux, Jane E. Ferrie, Martin Shipley, David Gimeno, Roberto De Vogli, Jussi Vahtera, Marianna Virtanen, Markus Jokela, Michael G. Marmot, Mika Kivimäki

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## ABSTRACT

**Background:** Little is known about the role work-related factors play in the decline cognitive function. We examined the association between perceived organizational justice and cognitive function among middle-aged men and women.

**Methods:** Perceived organizational justice was measured at Phases 1 (1985-1988) and 2 (1989-1990) of the Whitehall II study when the participants were 35-55 years old. Assessment of cognitive function at the screening clinic at Phases 5 (1997-1999) and 7 (2003-2004) included the following tests in screening clinic: memory, inductive reasoning (Alice Heim 4), vocabulary (Mill Hill), and verbal fluency (phonemic and semantic). Mean exposure to lower organizational justice at Phases 1 and 2 in relation to cognitive function at Phases 5 and 7 were analysed using linear regression analyses. The final sample included 4531 men and women.

**Results:** Lower mean levels of justice at Phases 1 and 2 were associated with worse cognitive function in terms of memory, inductive reasoning, vocabulary and verbal fluency at both Phases 5 and 7. These associations were independent of covariates, such as age, occupational grade, behavioural risks, depression, hypertension and job strain.

**Conclusions:** This study suggests an association between perceived organizational justice and cognitive function. Further studies are needed to examine whether interventions designed to improve organizational justice would affect employees' cognition function favourably.

**Key words:** Justice, cognitive function, memory, CHD, psychosocial factors

**What is already known on this subject:**

Low organizational justice has been shown to be associated with increased risk of health problems.

A potential mechanism through which perceived organizational injustice may affect health related issues is prolonged stress.

Prolonged stress affects cognitive functions especially in old age.

**What does this study add:**

Our results suggest that unfair treatment by supervisors is associated with increased risk of poor cognitive functions.

The association between repeated exposure organizational justice and cognitive functions may be apparent already in middle-age.

In occupational health research, increasing attention should be focused on organizational decision-making and managerial procedures.

Many studies on cognitive decline target populations at age 60 or older even though it is increasingly recognised that age-related changes in cognition are already evident in midlife [1]. The fact that midlife cognitive changes predict old-age dementia risk sets the rationale for examining determinants of early cognitive decline [2]. A recent study of a working-aged cohort found that work-related factors, such as working extremely long hours, was associated with a decline in aspects of cognitive function [3]. Similar associations were not observed between job strain and cognition [4]. However, very little data, to date, are available for other psychosocial factors at work.

Organizational justice, i.e., the decision making rules and managerial behaviours within the organization that affect employees' fairness experience, may influence a range of attitudes and behaviors [5], including organizational commitment [6], job satisfaction [7], citizenship behavior [8], and turnover [9]. Epidemiological studies suggest that low organizational justice may also contribute to serious health problems, such as depression [10, 11] and cardiovascular disease [12-15]. Given that injustice has also been shown to be an important source of psychological distress [16, 17], which, in turn, may have adverse effects on cognitive function [18-20], the association between organizational justice and cognitive function seems plausible.

According to a recent study, psychological distress affects multiple memory systems and learning strategies [21]. Studies of brain regions suggest that the hippocampus, a limbic area involved in learning and memory, is particularly sensitive to the effects of distress [22]. Chronic distress has also been shown to be associated with other cognitive functions, such as encoding or retrieval of words [23]. Thus, it may be reasonable to hypothesize that long term exposure to low organizational justice, a potential source of chronic distress, may adversely affect certain aspects of cognitive function.

In this study, we examined the relationship between organizational justice and cognitive function in a cohort of British civil servants. Because an accelerated decline in cognitive function may indicate disease processes, such as depression [24] and hypertension [25], we also took into account the effects of these conditions in the analyses.

## METHODS

### **Subjects and design**

The target population for the Whitehall II Study was all the office staff aged 35 to 55 years based in 20 civil service departments in London, England. With a 73% participation rate, the cohort included 6895 men and 3413 women at study entry in 1985-1988. Data on organizational justice and cognitive function were available for 4879 participants at Phase 5 (1997-1999) and 4531 participants at both Phase 5 and Phase 7 (2003-2004). The sample selection is presented in Figure 1. Those excluded were older (45.1 years compared to 43.4 years,  $p < .001$ ), more likely to be women (60% vs 49%,  $p < 0.001$ ), belonged to the lowest employment grade (58% vs 42%,  $p < 0.001$ ), and had both lower job demands (mean 59.1 vs. 56.7,  $p = 0.043$ ) and lower job control (mean 67.0 vs 63.1,  $p < 0.001$ ) at baseline. Informed consent was gained from all participants. The University College London Medical School Committee on the Ethics of Human Research approved the protocol.

### **Organizational justice**

Self-reported justice scale, assessed at Phases 1 and 2 (1989-1990), tapped the relational component of organizational justice (5 items; Cronbach  $\alpha = .72$ ) and are further described in earlier studies from the Whitehall II cohort [14, 17]. This scale includes the following items: (1) Do you ever get criticized unfairly? (reversed) (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. The mean scores were scaled from 0 to 100, reversed so that higher scores indicate greater perceived injustice and treated as a continuous variable in the analysis.

### **Covariates**

Covariates included age, socioeconomic position, smoking, alcohol consumption, body mass index (BMI), depression, hypertension and job strain and were all measured at baseline (Phase 1). Socioeconomic position was measured as civil service employment grade (administrative, professional, clerical/ support). Health behaviors were smoking (self-reported cigarette smoking classified as never smoker, former smoker and current smoker), alcohol consumption (units/week, classified as: none, 1–14 units, 15–22 units, 22 + units with the highest two categories being combined in women), BMI ( $\text{kg}/\text{m}^2$ , classified as under 18.5, 18.5 - 25, 25 -30 over 30). Depressive symptoms were assessed using the 4-item depression subscale of the General Health Questionnaire, a 30-item screening questionnaire for common mental disorders such as depression and anxiety and suitable for use in general population samples [26]. Those scoring more than 3 out of 4 on the depression subscale were classified as having depressive symptoms. Subjects with  $\text{SBP} \geq 140$  mm Hg and  $\text{DBP} \geq 90$  mmHg or on antihypertensive treatment were considered to be hypertensive. Self-reported job strain was measured using the Job Strain Questionnaire [27] and composed of the subscales job demands, assessed using 4 questions ( $\alpha = 0.67$ ), and decision latitude/skill discretion (job control), assessed using 15 items ( $\alpha = 0.84$ ). Responses on a four point scale from “often” to “never/almost never” were combined into summary scales and then divided as high and low defined as above or below the median of the summary score on the respective scale. Job strain was classified in four categories: Active work (high control and high demands), Low strain (high control and low

demands), Passive work (low control and low demands) and High strain (low control and high demands) [28].

### **Cognitive function**

Cognitive testing was introduced to the Whitehall study midway through Phase 3. Consequently cognitive data are available only for 40 percent of the participants at Phase 3 but for the entire sample at Phases 5 and 7. Thus, we used cognitive data only from Phases 5 and 7.

Cognitive function was measured using the following five standard tests. Short-term memory was assessed by a 20-word free recall test. Participants were presented a list of 20 one or two syllable words at 2-second intervals and were then asked to recall in writing as many of the words in any order within 2 minutes. The AH4-I [29] is composed of a series of 65 items (32 verbal and 33 mathematical reasoning items) of increasing difficulty. This is a test of inductive reasoning that measures the ability to identify patterns and infer principles and rules. Participants had 10 minutes to complete this section. The Mill Hill vocabulary test [30] assesses vocabulary and encompasses the ability to recognize and comprehend words. We used the test in its multiple format, which consists of a list of 33 stimulus words ordered by increasing difficulty, and six response choices per word. Two measures of verbal fluency: phonemic and semantic, were used [31]. Phonemic fluency was assessed via “S” words and semantic fluency via “animal” words. Subjects were asked to recall in writing as many words beginning with “S” and as many animal names as they could. One minute was allowed for each test.

### **Statistical analysis**

The multivariate relationships between organizational justice at Phases 1 and 2 and cognitive function at Phases 5 and 7 were analyzed using linear regression analyses with continuous measures of the cognitive tests as outcomes. The measures of organizational justice (skewness -0.6, kurtosis 0.4) and cognitive functions (skewness range -1.3 to 0.1, and kurtosis range 0.2 to 2.6) were relatively normally distributed. Statistical models were sequentially

adjusted for age, employment grade, alcohol consumption, smoking status, body mass index, depressive symptoms, hypertension, and job strain. The regression analyses were performed with Statistical Analysis System version 9.01. Statistical significance was inferred at a 2-tailed p-value <0.05.

Sensitivity analyses included three set of analyses. First, to take into account the potential effects of a subjective perception of unfair treatment, that may be related to the individual's characteristics, we additionally adjusted the final model for negative affectivity (NA) measured at Phase 1 using the Negative Affect subscale of the Affect Balance Scale (Cronbach's  $\alpha = .67$ ; [32]. The psychometric properties of NA measure in this sample have been reported elsewhere [33]. Second, we replicated our analyses with multilevel modeling (random intercept model), to take into account the fact that each participant is working in a particular department. The participants worked at 23 departments, and the range of the number of participants working in each department was from 60 to 607. Third, we rerun our final analyses using multiple multivariate imputation to evaluate the effect of sample attrition from the baseline study phase (using STATA 10, `ice/micombine`-procedures).

## RESULTS

Characteristics of the study participants are shown in Table 1. The mean age of the participants at baseline was 43.9 (range 34-56) years. The majority of the participants worked in the professional grades, more than half of them were never smokers, about 20% experienced depressive symptoms and 7% were hypertensive. The changes in mean cognitive scores between Phases 5 and 7 were relatively small.

The association between organizational justice and cognitive function at Phases 5 and 7 are shown in Table 2. Lower justice across Phases 1 and 2 was associated with worse cognitive functions measured at Phase 5; associations with all cognitive tests were robust to adjustments for covariates. Similarly, lower perceived justice at Phases 1 and 2 was associated

with worse cognitive functions at Phase 7 and very small changes in associations were detected after adjustments for covariates.

Additionally adjusting the final steps in the regression models for negative affectivity, did not produce changes in any of the associations (the standardized estimate range from -0.04 to -0.05 and non-standardized from -0.13 to -0.45 and p-values were from 0.028 to <0.001 (supplementary Table S1). Replicating the final step of regression models with multilevel modelling produced significant associations between organizational justice and all cognitive functions (p-values ranged from <0.001 to 0.034 (supplementary Table S1). The association between organizational justice and cognitive functions were stronger (regression coefficient range from 0.12 to 0.56) when using data (n=10308) from multiple multivariate imputation (all p-values <0.001) and adjusted for age, sex and occupational grade (data not shown).

## DISCUSSION

In this prospective study of a large working-age population, we found lower organizational justice to be associated with worse scores in memory, inductive reasoning, vocabulary and phonemic and semantic fluency tests. The associations were not explained by the covariates included in the present analyses; age, health related behaviours, depressive symptoms, hypertension or job strain. We did not find significant weakening of the effects with longer follow up.

Age, low employment grade, vascular problems, hypertension, and teetotalism have all been associated with poor cognitive function in previous investigations [34-38]. Furthermore, a large body of research has shown that depression is associated with cognitive decline [20]. None of these factors explained the increased risk of poor cognitive function associated with long-term organizational injustice. However, as we had no measure of cognitive function at baseline, the possibility of reverse causation (i.e. cognitive function affecting organizational justice perceptions) cannot be ruled out in this set of analyses. It is also possible

that the perception of organizational justice may be related to the individual's characteristics, such as personality traits, such as negative affectivity. Negative affectivity is the disposition to respond negatively to environmental stimuli and to questionnaires and may inflate correlations between self reported work characteristics and cognitive performance tests [39, 40]. However, taking in to account the effect of negative affectivity did not account for the associations between justice evaluations and cognitive performance.

One potential pathway linking organizational justice and cognitive function is physical health status, including high long-term levels of inflammatory markers [41] and coronary heart disease [36]. These conditions have previously been found to be associated with both cognitive function and organizational justice perception [14, 36, 41, 42]. It is also possible that poor physical health status intensifies negative perceptions of environmental stressors or that mild cognitive decline adversely affects justice evaluation via deteriorated work performance. An employee may fail the duties that were earlier easy and get into conflict with co-workers and supervisors because of being late with tasks, forgetting or misunderstanding things. These experiences might make him/her feel unjustly treated. A further potential pathway linking organizational justice and cognitive decline is psychological stress or distress. An alternative psychosocial factors at work that may increase stress is measured in the present cohort is high job strain. Adjusting the models for job strain had minimal effect on the associations between justice and cognition. This result is in line with a previous study of the Whitehall II cohort, which suggested that job strain did not have an independent effect on cognitive functions [4].

The strength of this study is repeat measures on both organizational justice and cognitive function. Clinic measures covered the major components of cognitive function, such as memory, reasoning, vocabulary, and fluency and the availability of data on known risk factors enabled adjustment for a range of potential confounding and mediating factors. However, in interpreting the present results, it is important to note some limitations. First, although our

measure of justice is predictive of various health outcomes and comparable to the standard measures of justice [16, 17], it does not capture more extreme sources of injustice (including coercion, intimidation, discrimination and denigration) which might have particularly strong effects on stress-related outcomes. Second, all the analyses were conducted using participants with complete data on organizational justice and cognitive outcome variables at the last study phase, Phase 7. This meant that more than half the original population was excluded raising concerns about potential selection effects leading to over- or underestimation of associations. However, differences in baseline characteristics between the included and excluded civil servants were relatively small and we adjusted for these baseline characteristics in the analyses. We also replicated the analyses using multiple imputation method and using the imputed data produced stronger associations between organizational justice and cognitive functions. Third, as most of the organizational studies, our analyses were based on individual-level data although multilevel analyses, with work unit as the second level, would take into effects associated with the fact that all employees work in some work unit or department. Although the rotation of higher-grade civil servants, changes of departments, and turnover of staff during the follow-up makes multilevel approach problematic in our cohort, we replicated our findings using multilevel regression modelling (random intercept) which produced similar results than the regression analyses using only the individual level data.

### **Conclusions**

These findings suggest that low levels of perceived organizational justice are associated with impaired cognitive function in midlife. Further longitudinal studies are needed to examine whether interventions designed to improve organizational justice would alter cognitive function among employees.

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Conflict of interests: None declared.

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**Table 1. Sample characteristics.**

	<b>N</b>	<b>%</b>	<b>Mean (SD)</b>
<b>Phase 1 (1985-1988)</b>			
Age (years)	4531		43.9 (5.9)
Sex			
Men	3273	72	
Women	1258	28	
Grade level			
Administrative (High)	1592	35	
Professional	2295	51	
Clerical/support (Low)	644	14	
Smoking			
Never smokers	2418	54	
Former smokers	1517	34	
Current smokers	512	12	
Alcohol consumption (units of alcohol/week)			
None	667	16	
1-14 units/week	2710	58	
15 –22 units/week	550	12	
over 22 units/week	574	13	
Body mass index (kg/m <sup>2</sup> )	4526		24.4 (3.3)
Depressive symptoms			
No	3728	83	
Yes	803	17	
Hypertension			
No	4207	93	
Yes	314	7	
Job strain			
Active work	1810	39	
Low strain	764	17	
Passive work	1021	23	

High strain	932	21
<b>At Phase 5 (1997-1999)</b>		
Memory	4146	6.9 (2.4)
Inductive reasoning (AH4-I)	4146	47.4 (10.7)
Vocabulary (Mill Hill)	4146	25.2 (4.3)
Phonemic fluency	4146	17.0 (4.4)
Semantic fluency	4146	15.8 (4.2)
<b>At Phase 7 (2003-2004)</b>		
Memory	4146	6.9 (2.4)
Inductive reasoning (AH4-I)	4144	44.6 (10.9)
Vocabulary (Mill Hill)	4136	25.2 (4.3)
Phonemic fluency	4126	16.9 (4.2)
Semantic fluency	4138	15.9 (3.9)

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**Table 2. Associations between low organizational justice (z-score from mean level at Phases 1 and 2) and cognitive functions at Phase 5 and 7. Standardised regression coefficients ( $\beta$ ) and p-values, N=4146.**

	Memory		AH4-I (reasoning)		Mill Hill (vocabulary)		Phonemic fluency		Semantic fluency	
	$\beta$	p-values	$\beta$	p-values	$\beta$	p-values	$\beta$	p-values	$\beta$	p-values
<b>Organisational justice</b>	<b>Phase 5</b>									
Unadjusted	-0.05	0.002	-0.05	<0.001	-0.06	<0.001	-0.04	0.018	-0.05	<0.001
Adjusted for age, sex and employment grade	-0.04	0.002	-0.04	0.002	-0.04	0.001	-0.03	0.033	-0.04	0.002
Adjusted for age, sex, employment grade, behavioral risks, depressive symptoms, hypertension and high job strain	-0.04	0.003	-0.04	0.038	-0.05	<0.001	-0.04	0.030	-0.04	0.047
<b>Organisational justice</b>	<b>Phase 7</b>									
Unadjusted	-0.04	0.006	-0.05	<0.001	-0.06	<0.001	-0.04	0.004	-0.04	0.011
Adjusted for age, sex and employment grade	-0.04	0.006	-0.04	0.002	-0.04	<0.001	-0.04	0.009	-0.03	0.025
Adjusted for age, sex, employment grade, behavioral risks, depressive symptoms, hypertension and high job strain	-0.04	0.008	-0.04	0.002	-0.05	<0.001	-0.04	0.011	-0.03	0.031

Figure legends:

Figure 1. Sample selection

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