Effort–Reward Imbalance, Overcommitment, and Measures of Cortisol and Blood Pressure Over the Working Day

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Objective: To assess the biological correlates of effort–reward imbalance and overcommitment to work using measurements over the working day. Methods: Participants were 197 working men and women aged 45 to 59 years, recruited from the Whitehall II epidemiological cohort. Salivary cortisol was sampled on waking, 30 minutes later, and then at 2-hour intervals from 8:00 hours to 22:00 hours. Blood pressure was measured every 20 minutes using ambulatory methods. Effort–reward imbalance and overcommitment to work were assessed with standard questionnaires. Results: Cortisol responses to waking were positively associated with overcommitment in men, with mean increases between waking and 30 minutes of 14.5 and 4.2 nmol/l in high and low overcommitment groups, after adjustment for age, socioeconomic position, smoking, time of waking up, and job demands. Cortisol averaged from 8 samples over the working day was also related to overcommitment in men, with an average difference of 22% between high and lower overcommitment groups. Overcommitment predicted systolic blood pressure over the day in men after adjustment for age, smoking, body mass index, physical activity, and job control, with adjusted means of 132.2 and 125.8 mm Hg in high and low overcommitment groups. There was a significant interaction between overcommitment, socioeconomic position, and time of day in men (p = .016), because systolic pressure was higher in lower status overcommitted men, and rose over the day. Neither effort–reward imbalance nor overcommitment predicted biological responses in women. Conclusions: Chronic neuroendocrine and cardiovascular activation may mediate in part the impact of overcommitment to work on cardiovascular disease risk in men. Key words: work stress, overcommitment, effort–reward imbalance, cortisol, ambulatory blood pressure, socioeconomic position, cardiovascular disease risk

CHD = coronary heart disease.

INTRODUCTION

Research linking workplace factors with cardiovascular disease outcomes has been dominated over recent years by 2 theoretical models: the demand-control model (1) and the effort–reward imbalance model (2). The focus of the demand-control model is on an adverse job task profile in terms of high demands and low control, whereas the effort–reward imbalance model is based on the norm of reciprocity of work contracts. Accordingly, effort at work is reciprocated by socially defined rewards that include money, esteem, and status control in terms of promotion prospects and job security. However, an imbalance between (high) efforts spent and (low) rewards received in turn is likely to be experienced under the following conditions: 1) if employees have little choice of alternative workplaces (this dependency is more frequent in people with less education and lower socioeconomic position); 2) if employees accept this imbalance for strategic reasons (this strategy is mainly chosen to improve future work prospects by anticipatory investments); 3) if employees exhibit a specific cognitive and motivational pattern of coping with demands characterized by excessive work-related commitment (“overcommitment”). Overcommitted people may suffer from inappropriate perceptions of demands and of their own coping resources more often than their less involved colleagues, because perceptual distortion prevents them from accurately assessing cost–gain relations (eg, underestimation of demands, overestimation of own coping resources) (2).

Evidence supporting the impact of effort–reward imbalance and/or overcommitment on coronary heart disease (CHD) risk has emerged from a number of prospective epidemiological studies (3–6). Interestingly, in one of these studies, CHD risks were more pronounced in overcommitted people and in people holding low socioeconomic positions (5). Moreover, overcommitment was related to the risk of restenosis in male cardiac patients after percutaneous transluminal coronary angioplasty (7). Effort–reward imbalance has also been shown to predict psychiatric disorder, alcohol dependence, poor subjective well-being, and reports of chronic illness (8–11).

The biological pathways through which effort–reward imbalance and overcommitment might increase cardiovascular disease risk are beginning to be understood. Both components of the model—the extrinsic (effort/reward ratio; see Methods) and the intrinsic component (overcommitment)—have been related to major cardiovascular risk factors, although not in a consistent way. For instance, in a Swedish investigation, the effort/reward ratio, but not overcommitment, was associated with hypertension in men, whereas overcommitment was related to a higher ratio of total cholesterol to high-density lipoprotein (12). In a sample of middle-aged male employees in the Netherlands, overcommitment, but not the effort/reward ratio, was associated with hemostatic risk factors (13). However, the effort/reward ratio in this study was strongly related to ambulatory systolic blood pressure, heart rate, and heart rate variability over the workday (14). On conceptual and empirical grounds, separate analysis of the two components of the model with respect to health indicators is well justified. Moreover, as most previous investigations have been restricted to men, it is important to explore possible gender-specific effects.

This contribution provides a further test of the effort–reward imbalance model by analyzing the psychobiological correlates of stressful experience at work in employed men.

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Received for publication October 27, 2003; revision received January 23, 2004.

This research was supported by the Medical Research Council, UK, and by the European Science Foundation Scientific Program on “Social Variations in Health Expectancy in Europe.”
and women under naturalistic conditions, using ambulatory monitoring. Ambulatory monitoring provides an opportunity to study the influence of job stress factors on levels and variations of biological markers of enhanced activation of neuroendocrine and sympathetic nervous system pathways in everyday life. It has previously been used with respect to the demand-control model of job stress, where effects on cortisol (15,16) and on blood pressure elevation (17,18) have been described. Few naturalistic studies of the effort–reward imbalance model have yet been published (13,14,19,20).

The data described in this article were taken from a study of psychobiological aspects of socioeconomic position, results from which have been published previously in this journal (21). This analysis was focused on the following research hypotheses: First, cortisol responses to waking would be more pronounced in a group of working people defined by a high effort/reward imbalance or by a high level of overcommitment compared with others. The cortisol waking response (the change in cortisol over the first 30–60 minutes of the day) has been shown in a number of studies to be positively associated with chronic stress and low psychological well-being (22–24). We have previously found that cortisol waking responses are larger on working than nonworking days, and are positively associated with job demands in lower socioeconomic groups (15,25). Second, we hypothesized that mean cortisol output over the working day would be greater in this high-stress group compared with other participants. We assessed cortisol output over the working day by obtaining saliva samples every 2 hours from 08.00 to 08.30 to 22.00 to 22.30. Research using urinary sampling has shown inconsistent relations with work stress (26), but this method may provide less sensitive estimates of output than repeated saliva sampling (27). Third, we predicted that ambulatory blood pressure over the day would be higher in people experiencing high effort/reward imbalance and/or overcommitment at work. Most studies of ambulatory blood pressure in the workplace have shown more consistent effects for systolic than diastolic pressure, so this was the focus of the present investigation (18). Additionally, in line with the theoretical arguments described earlier, we tested whether the impact of effort–reward imbalance or overcommitment varies with socioeconomic position.

**METHODS**

**Participants**

Participants in this study were 197 volunteers (105 men and 92 women) drawn from the Whitehall II cohort, a sample of 10,308 London-based civil servants recruited in 1985 to 1988 to study demographic, psychosocial, and biological risk factors for CHD (28). They were recruited from the larger cohort on the following criteria: white, aged 45 to 59 years, day workers based in the London area, not planning to retire for at least 3 years, no history of CHD, no previous diagnosis or treatment for hypertension, and willingness to take part in laboratory testing (not described here) as well as ambulatory monitoring. Premenopausal women were excluded, because ambulatory blood pressure increases after the menopause (29), so including pre- and postmenopausal women would have introduced additional sources of variation. Occupational grade was used as the marker of socioeconomic position, because this relates to cardiovascular disease risk (30), and is strongly associated with income and educational attainment. Participants were sampled systematically from higher (administrative and professional), intermediate (senior and higher executive officer), and lower (clerical, office support) employment grades. Three hundred fifty-eight members of the Whitehall cohort were initially invited, but 161 either refused to take part or considered themselves ineligible, so the response rate was 55%. Data from this study relating ambulatory blood pressure and cortisol with socioeconomic position have been published elsewhere (21).

**Work Stress Measures**

All work stress measures were assessed with multi-item scales previously used in the complete Whitehall II cohort (5,31,32), with each item rated on a 4-point scale. Effort was assessed with 5 items (eg, “Do you have enough time to do everything?”), “Does your work demand a high level of skill and expertise?”), and reward with 7 items (eg, “How satisfied are you with your usual take-home pay?”). Mean scores on each component were computed (range 0–3), with higher scores reflecting greater effort and greater rewards, and effort–reward imbalance was calculated as effort divided by reward. A score of 1 represents a perfect balance of effort and rewards, with higher scores reflecting disproportionate effort. The Cronbach α for the scales in this study was 0.68 and 0.77.

Overcommitment was assessed with 5 items reflecting preoccupation with work and an inability to switch off (eg, “As soon as I get up in the morning, I start thinking about work problems,” and “People close to me say I sacrifice myself too much for my job”). Ratings were totaled so that higher scores indicate greater overcommitment (range 0–15). The internal reliability of the scale was 0.83.

The job demand scale consisted of 4 items (eg, “Do you have to work very intensively?”), and the control scale of 9 items (eg, “I can decide when to take a break”). Scores were converted to a scale from 0 to 100, where 100 indicates maximum demands or maximum control. The Cronbach α for the scales in this study were 0.70 and 0.73 for demands and control, respectively.

**Ambulatory Blood Pressure Monitoring Procedures**

Ambulatory blood pressure monitoring was carried out using the SpaceLabs 90217 monitor (Redmond, WA). The monitor was fitted between 7.30 hours and 9.30 hours on a working day at the participant’s place of work or in the laboratory at University College London, and was worn for the remainder of the day and evening. Blood pressure was measured at 20 minutes intervals throughout. Each reading was accompanied by an entry in a diary in which the participant recorded location, activity over the past 5 minutes (lying, sitting, standing, or walking), a measure of current specific activities (eg, desk work, preparing food), verbal interactions, and any eating, drinking, smoking, or medication taken since the last reading.

The blood pressure readings were reviewed and outliers were excluded using the criteria described by Berardi et al. (33). The number of eligible readings averaged 34.3 ± 5.7, but ranged widely between individuals, so it was not possible to compare all time points or hourly averages without substantial missing data. Data were therefore averaged into 4 periods: morning (7.50–10.50), midday (11.00–14.00), afternoon (14.00–17.00), and evening (17.00–22.30). The mean number of readings in these 4 periods was 4.61 ± 0.98, 7.27 ± 1.1, 8.17 ± 1.4, and 14.1 ± 4.2, respectively. We only included individuals in the analyses who had at least 2 readings from each time period, so as to ensure that robust findings were obtained. There were no differences across occupational grades in the number of readings contributing to each time period (F(3,579) = 0.61, p = .59), or in the time of starting monitoring in the morning.

**Salivary Cortisol Sampling Procedure**

Saliva samples were collected using cotton dental rolls held in the mouth until saturated, and then stored in Salvette tubes (Sarstedt, Leicester, UK). Participants were instructed to take 10 samples over a single working day, with measures on waking up, 30 minutes later, and then within 8 30-minute time windows space at 2-hourly intervals through the day and evening (08.00–08.30 hours, 10.00–10.30 hours . . . 22.00–22.30 hours). The time of waking up was recorded, as was the time of the first sample. Participants were asked to take the first sample while lying in bed, and not to brush their teeth,

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Eat, drink, or smoke before the second sample. Tubes were returned to the investigators personally or by post, and cortisol was analyzed using a biotin-streptavidin fluorescence immunoassay (34). Cortisol values higher than 75 nmol/l were excluded, since these may be due to altered pH-values or blood contamination of the sample.

Separate analyses were carried out of cortisol responses to waking and cortisol over the remainder of the working day. Cortisol responses to waking can be erroneously measured if people fail to take the first sample immediately after waking. Because the increase is rapid, a delay in the first sample means that the ”waking” sample is taken on this upward curve, and that the overall increase may be correspondingly reduced. Kudielka et al. (35) have recently used electronically tagged sampling tubes to show that a proportion of individuals do delay their sampling. Compliance with the waking sampling protocol in this study was judged by calculating the difference between the time participants stated they woke up, and the time they stated that the first saliva sample had been taken. Individuals with time differences of more than 10 minutes were excluded. Exclusions did not vary by sex or grade of employment. Elsewhere, we have shown that cortisol increases between ”waking” and 30 minutes later are severely attenuated in people who report a delay of greater than 10 minutes (25). Cortisol waking data were available for 94 men and 84 women in this study. Cortisol over the remainder of the day was analyzed by averaging the 8 timed samples and by repeated-measures analysis. Individuals with any missing values were excluded, so the sample analyzed totaled 86 men and 79 women.

Other Measures

Height, body weight, and waist and hip circumference were measured using standard procedures. Information concerning smoking was obtained by questionnaire. Sleep problems were assessed with the scale described by Jenkins et al. (36). This consists of 4 items, asking respondents how often in the past month they had woken up several times in the night, had trouble staying asleep, etc. There were 6 response options, ranging from 0 (not at all) to 5 (22–31 days). The total was computed, so scores could range from 0 to 20. The Cronbach α in this sample was 0.73. In addition, participants were also asked how well they had slept the night before cortisol and ambulatory blood pressure monitoring.

Statistical Analysis

No associations between effort–reward imbalance, cortisol, and ambulatory blood pressure were found in this study. The results therefore focus on overcommitment. Study data were analyzed using general linear model repeated-measures analysis of variance, treating overcommitment as a between-subject factor, and time (8 values from 08:00 hours to 22:00 hours) as the within-subject factor. Subsequently, averages were compared, covarying for age, smoking, and time of waking.

Blood pressure was analyzed using repeated-measures analysis of variance with gender, occupational grade, and overcommitment as between-subject factors, and time of day (morning, midday, afternoon, evening) as the within-subject factor. Age, body mass index, and smoking status were included as covariates in the blood pressure analyses. Blood pressure is influenced by concurrent physical activity, with higher levels when people are more active (39). We have previously shown that physical activity ratings obtained at the same time as blood pressure recordings in this study correlate with objective measures of energy expenditure assessed using accelerometers (21). We therefore indexed physical activity in terms of the proportion of blood pressure readings in each time period taken when the individual was standing or walking, and used this value as a covariate.

RESULTS

The characteristics of participants with high and low overcommitment scores are summarized in Table 1. Women tended to have higher overcommitment scores on average than men (F(1,196) = 2.87, p = .09), with the result that more women than men were in the high overcommitment category (χ2 = 6.77, p = .01). High and low overcommitment groups did not differ in age, distribution by occupational grade, or body mass index. The time of waking on the morning of cortisol sampling averaged 06:17 hours, but did not vary with overcommitment or gender (F(1,173) = 0.78 and 0.18, respectively). By definition, high and low overcommitment groups differed in overcommitment scores. Ratings of effort–reward imbalance (F(1,174) = 19.2, p < .001) and job demands (F(1,192) = 33.4, p < .001) were also associated with overcommitment. By contrast, job control ratings did not differ in overcommitted and nonovercommitted groups. There was a significant association between overcommitment and sleep problems (F(1,193) = 23.7, p < .001), with overcommitted men and women reporting more sleep problems. Information concerning quality of sleep on the night before monitoring was provided by 77 men and 78 women. Overcommitted men were more likely to report poor sleep than were nonovercommitted men (χ2 = 6.01, p = .019). The difference in women was similar but not statistically significant (χ2 = 3.52, p = .080).

Cortisol Responses to Waking

Salivary cortisol averaged 19.3 nmol/l on waking, increasing to 28.6 nmol/l after 30 minutes. The analysis of cortisol waking responses in relation to overcommitment is summarized in Figure 1. Repeated-measures analysis of variance showed a significant gender by overcommitment by sample interaction (F(1,170) = 5.71, p = .018). Subsequent analysis indicated that the overcommitment effect was significant in men (F(1,90) = 4.36, p = .04), but not in women (F(1,79) = 1.21). High and low male overcommitment groups did not differ in cortisol on waking. However, the increase in cortisol over the first 30 minutes was significantly greater in overcommitted men (F(1,81) = 4.32, p = .041), with an increase of 14.5 nmol/l compared with 4.2 nmol/l in nonovercommitted men after adjustment for age, smoking, time of waking, and job demands. This effect did not vary with occupational grade. The association between overcommitment and cortisol waking
responses also remained significant when scores on the sleep problems scale were included as covariates. The cortisol waking response in women did not relate to overcommitment. When participants were categorized on the basis of showing a cortisol response to waking \(2.49 \text{ nmol/l}, 65.3\% \text{ of men and } 77.4\% \text{ of women were cortisol waking responders. Logistic regression on the likelihood of being a cortisol waking responder showed a significant gender } \times \text{ overcommitment interaction (Wald } = 8.10, p = .005\). Separate analyses by gender demonstrated that overcommitment was associated with an increased likelihood of being a cortisol waking responder in men but not in women. In logistic regression, the odds of being a responder were 3.76 (95\% CI 1.19–11.9, \(p = .024\)) in overcommitted men, adjusted for age, smoking, time of waking, and job demands.

**Cortisol Over the Working Day**

Cortisol sampled on 8 occasions between 08:00 hours and 22:30 hours over the working day averaged 8.07 nmol/l in men and 7.26 nmol/l in women. The gender \(\times\) occupational grade \(\times\) overcommitment \(\times\) time interaction was significant \((F(14,1106) = 1.92, p = .05)\), so separate analysis of men and women was carried out. In women, no effects involving overcommitment were significant, but in men, there was a main effect of overcommitment \((F(1,184) = 4.00, p = .05)\), together with an occupational grade by time interaction described in our previous study of socioeconomic position (21). In men, cortisol averaged over the day was also positively associated with overcommitment \((F(1,79) = 4.06, p = .047)\), with levels being 22\% higher in overcommitted than in non-overcommitted men after adjustment for age, smoking, and time of waking. There was no interaction of overcommitment with occupational grade. This effect is illustrated in Figure 2, where it is apparent that differences were most prominent early and in the middle of the day.

### Table 1. Characteristics of High and Low Overcommitment Groups

<table>
<thead>
<tr>
<th></th>
<th>High Overcommitment</th>
<th>Low Overcommitment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>N</td>
<td>41 (39.0%)</td>
<td>53 (57.6%)</td>
</tr>
<tr>
<td>Age</td>
<td>52.1 (2.9)</td>
<td>51.9 (2.6)</td>
</tr>
<tr>
<td>Occupational grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>20 (48.8%)</td>
<td>21 (39.6%)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>14 (34.1%)</td>
<td>22 (41.5%)</td>
</tr>
<tr>
<td>Lower</td>
<td>7 (17.1%)</td>
<td>10 (18.9%)</td>
</tr>
<tr>
<td>Body mass index</td>
<td>25.6 (3.6)</td>
<td>25.7 (4.7)</td>
</tr>
<tr>
<td>Smoking</td>
<td>3 (7.3%)</td>
<td>5 (9.4%)</td>
</tr>
<tr>
<td>Morning waking time</td>
<td>06:13 (45)</td>
<td>06:15 (37)</td>
</tr>
<tr>
<td>Overcommitment score</td>
<td>8.76 (2.5)</td>
<td>8.53 (2.2)</td>
</tr>
<tr>
<td>Effort–reward imbalance</td>
<td>1.13 (.21)</td>
<td>1.19 (.50)</td>
</tr>
<tr>
<td>Job demands</td>
<td>75.0 (15.9)</td>
<td>70.9 (16.1)</td>
</tr>
<tr>
<td>Job control</td>
<td>66.5 (16.0)</td>
<td>65.8 (16.0)</td>
</tr>
<tr>
<td>Sleep problems questionnaire</td>
<td>6.49 (4.4)</td>
<td>6.68 (3.8)</td>
</tr>
<tr>
<td>Poor sleep on night before assessment</td>
<td>10 (33.3%)</td>
<td>17 (37.8%)</td>
</tr>
</tbody>
</table>

Means (standard deviation) and number (percentage).

a Significant difference between high- and lower-overcommitment groups.
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Blood Pressure Over the Day

Systolic blood pressure recorded under resting conditions in the laboratory did not vary with overcommitment scores. Physical activity levels (proportion of blood pressure readings taken standing or walking) averaged 26.7% and 23.5% in low and high overcommitment men, and 26.4% and 26.0% in low and high overcommitment women. These differences were not significant. The repeated measures analysis of variance showed a significant gender × occupational grade × overcommitment × time interaction ($F(6,567) = 3.04, p = .009$), and was followed by separate gender analyses. In the analysis of men, there was a main effect of overcommitment ($F(1,101) = 4.05, p = .047$), together with significant interactions between overcommitment and time of day ($F(3,303) = 3.56, p = .019$), and a 3-way interaction between occupational grade, overcommitment, and time of day ($F(3,303) = 3.79, p = .015$). These findings are illustrated in Figure 3. Overall, systolic blood pressure over the day was higher in overcommitted than in nonovercommitted men, averaging 132.2 and 125.8 mm Hg in the two groups after controlling for age, smoking, and body mass index ($F(1,98) = 5.03, p = .027$). The difference remained significant after further statistical adjustment for physical activity and job control ratings ($F(1,96) = 6.05, p = .016$). The interaction effects were due to the impact of overcommitment on lower occupational grade men. Post hoc analyses indicated that in the higher-grade men, there were no significant differences related to time of day. However, in the lower-grade men, the overcommitment × time interaction was significant ($F(3,78) = 4.31, p = .015$). Systolic blood pressure increased over the day in the lower occupational grade overcommitted men, but not in the other groups. There were significant differences between overcommitted and nonovercommitted lower-grade men in the evening ($p = .04$) and afternoon ($p = .031$), but not in the morning or midday periods after adjustment for age, smoking, body mass index, physical activity, and job control.

A different pattern of results was observed for women. In the repeated-measures analysis, the interaction between overcommitment and time of day was significant ($F(3,264) = 2.89, p = .046$), but there was no interaction with occupational grade. The result was due to marginally higher systolic blood pressure in the overcommitted women in the morning, with convergence between groups later in the day. However, the differences were no longer significant after adjustment for covariates.

There were no differences in ambulatory diastolic blood pressure or heart rate over the day related to overcommitment ($F(3,573) = 0.20$ and 0.79, respectively).

DISCUSSION

This study found more pronounced cortisol awakening responses and higher cortisol output over the working day in employed men who were overcommitted to their job. Similarly, overcommitment predicted systolic blood pressure over the day, particularly so in lower socioeconomic status men. Associations persisted after adjustment for relevant confounders, but were absent among women. These findings have interesting implications and raise further questions.

First, the association of overcommitment with enhanced cortisol output may provide a “missing link” in previously reported relations in men between overcommitment, hematostatic risk factors, and elevated fasting insulin and glucose (13). In experimental studies, enhanced activation of the hypothalamic–pituitary–adrenocortical stress axis has been shown to influence these cardiovascular and metabolic processes (40,41). Similarly, increased cortisol output may have an impact on blood pressure regulation and, thus, can contribute to an explanation of the observed relation of overcommitment with elevated systolic blood pressure (42). Overcommitment is strongly associated with sleep problems, indicating a reduced state of mental, emotional, and physiological recovery overnight. This association has found in several studies, and points to a compromised potential for recovery in overcommitted people (6,43,44).

A further implication of these findings concerns differences between, and similarities with, alternative constructs of chronic psychosocial stress at work. As indicated, the effort–reward imbalance model contains 2 components—a situational and a personal component—thus assessing both the coping characteristics of the working person and the characteristics of the perceived work environment. Other formulations of chronic psychosocial stress at work are restricted to the situational component, ie, to the assessment of an adverse work environment, as is the case with the demand-control model. Several prospective studies have shown that effort–reward imbalance and high demand and/or low control at work predict CHD independently and with similar strengths (3–5,45). Interestingly, workers suffering from psychosocial stress at work in terms of high demand and/or low control showed elevated salivary cortisol early in the working day (16) and increased cortisol output over the working day (15). These findings parallel the ones reported here; because the effect of overcommitment on physiological measures in the study remains significant after adjusting for job control, we...
can exclude the possibility that the 2 constructs measure closely related phenomena.

The results are consistent with recent evidence that the cortisol response to waking is sensitive to chronic psychosocial stress. It has previously been found that the magnitude of the cortisol response to waking is greater in students reporting chronic work stress, in more depressed people, and in those reporting high levels of general stress in their lives (22–24). Associations with time of waking have been observed in some studies, with greater cortisol responses in people waking up earlier (37,46), but this has not been confirmed in other investigations (21,38). One possibility is that overcommitted people are preoccupied with work, have trouble sleeping, so wake up earlier in the morning, and consequently have larger cortisol waking responses. However, no relationship between time of waking and overcommitment was found (Table 1), and the greater cortisol response to waking remained significant after adjustment for time of waking up and sleep difficulties. It may therefore represent a profile of disturbed neuroendocrine function due directly to inappropriate coping responses to work.

The association between overcommitment and physiological measures was observed in men but not women. Several studies have found more consistent associations of psychosocial stress at work, including coping with work demands, with CHD risk in men (47, for review see 18). As noted in the Introduction, most of the previous research on psychobiological correlates of overcommitment and effort/reward imbalance has been conducted on men. The absence of associations between overcommitment and the 3 aspects of physiological activity among women adds to this evidence. Although gender-related inconsistencies of current results are far from being resolved, they suggest that differences in gender roles need to be considered more carefully as potential determinants. It may well be that a substantial part of stressful experience at work is contingent on the perceived threats associated with one’s occupational position, and that men, as a result of socialized gender roles, are generally more vulnerable to these threats than women. In men, these threats elicit exaggerated ways of coping with challenge at work (overcommitment) more often than in women. One hypothesis states that men often stick to their occupational role more exclusively because it provides a major source of their self-concept. Women, in contrast, are better suited to combine different roles or to change roles with more flexibility and thus to profit from multiple sources of self-efficacy and self-esteem (48).

One of the aims of this analysis was to explore interactions between socioeconomic position defined by occupational grade and overcommitment. In previous analyses of this data set, we have demonstrated higher ambulatory systolic blood pressure in the morning and elevated cortisol responses to waking in lower-grade groups (21,25). Cortisol over the day was greater in lower than higher occupational grade men, with the reverse pattern in women. We postulated that overcommitment might exacerbate the adverse physiological consequences of lower socioeconomic position. However, such a pattern was only observed for systolic blood pressure, with lower-grade overcommitted men having the highest values and increases over the day (Figure 3). Because promotion prospects and additional occupational rewards are clearly limited in lower-status groups, recurrent high effort resulting from overcommitment is unlikely to be met by appropriate rewards. This state of social reward deficiency may trigger sustained autonomic arousal and, in the long run, could increase blood pressure (see also Vrijkotte et al. (14)). Increased and prolonged stress reactivity has been discussed as 1 of several mechanisms explaining higher levels of cardiovascular risk among lower occupational status groups (49).

This study was restricted to middle-aged white men and women working in an urban environment, so results may not generalize to other populations. Data were obtained over a single working day, and patterns may vary with more sustained measurement. Objective indices of physical activity were not available for all participants, so self-ratings of activity were used to control for the covariation of blood pressure with energy expenditure. Finally, the sample size means that some of the cells in the analyses were small, particularly when divisions were made by gender, overcommitment, and occupational grade. This was the reason why it was not possible to analyze the theoretically interesting interaction between effort/reward imbalance and overcommitment. Despite these limitations, the results suggest that overcommitment is associated with chronic cardiovascular and neuroendocrine activation that may mediate in part the impact of work experience on cardiovascular disease risk in men.

We thank Sabine Kunz-Ebrecht, Pamela J. Feldman, Natalie Owen, Bev Murray, and Gonneke Willemsen for their involvement in data collection.

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