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# Women's work stress and cortisol levels: A longitudinal study of the association between the psychosocial work environment and serum cortisol

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**Abstract**

**Objective:** The aim of the present study was to investigate whether there is an association between serum cortisol and work-related stress, as defined by the demand–control model in a longitudinal design. **Methods:** One hundred ten women aged 47–53 years completed a health questionnaire, including the Swedish version of the Job Content Scale, and participated in a psychological interview at baseline and in a follow-up session 2 years later. Morning blood samples were drawn for analyses of cortisol. **Results:** Multiple stepwise regression analyses and logistic regression analyses showed that work demands and lack of social support were significantly associated with cortisol. **Conclusions:** The results of this study showed that negative work characteristics in terms of high demands and low social support contributed significantly to the biological stress levels in middle-aged women. Participation in the study may have served as an intervention, increasing the women's awareness and thus improving their health profiles on follow-up.


*Keywords:* Cortisol; Demand–control model; Middle-aged women; Social support; Work stress; Longitudinal study

## Introduction

Over the last decade, there has been a substantial increase in long-term sick leave in Sweden. Work-related stress and work overload are considered to be the major underlying causes, and it is middle-aged women who are affected the most [1]. Several studies showed that women not only report more symptoms but also actually suffer physically and mentally more than men do [2–4]. Most studies in stress research have been conducted on men; thus, results cannot automatically be generalized to women [5,6]. Women may also experience different stressors, have different perceptions of stress [6,7], and display different patterns of neuroendocrine reactivity to stress compared to men [8–10]. Midlife, entailing biological and psychosocial changes, has been shown to be a vulnerable phase of life for women [11,12]. Studies of middle-aged women are scarce, and there is an urgent need to elucidate the possible association between the negative aspects of the psychosocial work environment and stress-related conditions among women of this age group.

The demand–control model has been widely used as an instrument to explain work-related stress. The model identifies job demands and job control as two crucial dimensions of the work environment and proposes that work strain is caused by the combination of high psychological demands and low decision latitude [13]. The third dimension of the model, social support, accounts for a potential moderating or buffering effect against stress. Furthermore, social support has been shown to promote health [14–16].

An elevation of cortisol levels has been considered as an indicator of stress, which, in turn, has been linked to detrimental effects on health [17,18]. The results concerning

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the association between cortisol and job strain are still contradictory. Ohlsson et al. [19] were unable to show a significant correlation between job strain and cortisol among workers in a mainly female sample employed in human service organizations; on the other hand, their study indicated an association between high emotional strain and increased levels of prolactin, a hormone affected by stress [20]. Steptoe et al. [21] found that job strain was correlated with elevated cortisol concentrations early in the working day among male and female teachers. Luecken et al. [22] showed that cortisol levels measured during the working day in a sample of women were unrelated to job strain but were greater among those reporting high strain at home due to domestic responsibilities. Perceived stress among male and female teachers was found to correlate with increased cortisol levels during the first hour after awakening [23]. Thus, results concerning the association between stress and cortisol are still contradictory, and there is paucity in research concerning work stress and cortisol levels among middle-aged women.

Stressful working conditions have been shown to influence both physical and psychological health by acting as important mediating factors in the development of, for example, cardiovascular and musculoskeletal disorders [24–26], and symptoms of depression and anxiety [27]. High demands at work were found to be related to increased symptoms of poor health among middle-aged women [15]. A recent study suggests a link between work stress and Type 2 diabetes in middle-aged women [28]. Psychosocial stressors may also affect health-related behaviors such as smoking, alcohol consumption, food intake, and exercise habits [29]. Thus, it is important to consider lifestyle variables and their influence on stress reactions in women.

The present study, using a longitudinal design, aims to investigate whether there is an association between serum cortisol and work-related stress, as defined by the demand–control model, in terms of high demands, lack of control, and social support in middle-aged women.

## Methods

### *Participants*

This study reports on the characterization of the health behaviors and working conditions of menopausal women at baseline and on follow-up. The participants were recruited in a two-step procedure. The cohort was recruited through the Swedish population register and included 2000 women aged 47–53 years (mean age, 50 years) who were residing in Stockholm and its suburbs. In order for the sample to represent the socioeconomic status of urban middle-aged women, the participants were randomized according to their yearly income level (low, medium, and high: 20%, 60%, and 20%, respectively, from each group).

The original cohort of 2000 women was invited to participate in the study, and they received a mailed questionnaire covering questions about sociodemographic background, health and lifestyle, and the psychosocial work environment. Women with chronic or acute conditions, such as cardiovascular disease, cancer, and diabetes, were excluded from the study. As a second step, a random representative sample of 200 women was drawn among 940 women who had completed and returned the questionnaire. One hundred and forty-two women accepted participation in the study, while 58 declined (29%). The final percentage in the different income groups was 6.7%, 61.3%, and 31.9%, respectively, at baseline. Only participants who provided a complete data set (questionnaires, an interview, and a blood sample) were included in the analyses. During the time between baseline and follow-up, four women suffered from ovarian cancer, breast cancer, heart disease, and Parkinson's disease. These women were excluded from the study. Furthermore, since the aim of the study was to investigate work-related stress, women who were on sick leave during the previous 2 months or more (baseline, $n$=3; follow-up, $n$=3) or who were students (baseline, $n$=3; follow-up, $n$=1) were excluded. In addition, two women who were on leave of absence and unemployed on follow-up were excluded. Due to the fact that some of the participants failed to complete all parts of the study, such as mailing the questionnaire and giving the blood sample, a total of 110 women were included in the analyses at baseline and 125 women at follow-up.

The overall aim of this population-based longitudinal study was to characterize the health profile of middle-aged Swedish women in terms of menopausal status, cardiovascular risk factors, body weight, lifestyle, food intake, and stress at work. The data reported here focus on the relationship between the psychosocial work environment and work-induced stress in terms of cortisol levels.

### *Procedure*

The study included both psychological and biological measures and covered blood sampling, anthropometric measures, a psychological interview, and completion of a questionnaire. The sample of 200 women received an invitation to participate in the study. The women who accepted were scheduled for blood sampling and a psychological interview, and they received written confirmation and instructions for participation. The baseline study was conducted during 2000–2002, and the follow-up, using the same procedure, was carried out 2 years after the baseline.

Blood samples were drawn between 0800 and 0900 h after an overnight fast at the Department of Otorhinolaryngology of the Karolinska University Hospital. The samples were analyzed with time-resolved fluoroimmunoassay kits (Perkin Elmer, Finland) in the Laboratory of Clinical Chemistry of the Karolinska University Hospital.

Measurements of weight, height, waist, and hip were performed before the interview. Body weight was measured using an electric scale (Tanita BWB-800). Using a non-