



# No association found between cardiovascular mortality, and job demands and decision latitude: Experience from the Västerbotten Intervention Programme in Sweden



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## ABSTRACT

The current prospective study with the longest follow-up period in Northern Sweden aims to investigate the association between job demands and decision latitude and cardiovascular disease (CVD) mortality. Further, we aim to assess the effect of conventional risk factors (i.e., body mass index, alcohol consumption, physical activity, marital status, education and smoking) on the association between job demands and decision latitude and CVD mortality. The data originated from the Linnaeus database, available at the Center for Population Studies, Umeå University, Sweden. A cohort of men and women aged 40, 50 and 60 years were recruited from the Västerbotten Intervention Programme. Deaths due to stroke and myocardial infarction at the end of the follow up are considered the outcome. Baseline job characteristics were defined by the Swedish version of the Karasek demand/control model. Statistical methods include proportional Cox hazard modeling and Relative Excess Risk due to Interaction (RERI) to assess interactions. The findings from this study did not support the association between job demands and decision latitude and CVD mortality. Instead, conventional risk factors were found stronger predictors, most evidently education differentials were associated with CVD mortality. We know from previous research that the greater the attenuation of the gradient after adjustment for a given risk factor, the greater the potential to reduce educational inequality via interventions that target this factor. Based on the present findings of the experience in Västerbotten, further research is needed to identify other risk factors besides job strain and its components that would reduce the socioeconomic gradient in CVD mortality.

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## 1. Introduction

Coronary heart disease is known as the most common cause of death in Sweden and other Western countries (Björck et al., 2009). The inverse social gradient in mortality from coronary heart disease is well documented and since the first Whitehall study (Marmot et al., 1984), it has been shown that about a quarter of this gradient can be explained by social differentials in smoking, blood pressure, obesity and physical activity. Several decades ago, occupational health researchers raised a concern that rates of coronary heart disease may vary markedly among people with different levels of psychosocial work characteristics (Nedic et al., 2008), and that this variation is more than what can be explained by conventional risk factors for coronary heart disease (e.g., smoking, obesity

and physical activity). This notion has been operationalized and has received empirical support, especially after the introduction of the demand-control model in 1979 (Karasek, 1979), which became the most cited model regarding psychosocial work characteristics. There is some evidence suggesting a positive association between job stress and increased risk of cardiovascular disease and myocardial infarction (Hammar et al., 1998; Johnson and Hall, 1988; Kivimaki et al., 2006). However, there are several non-confirmatory findings concerning job strain and CVD outcomes published in large scale studies where no such relationships can be found (Andre-Petersson et al., 2007; Belkic et al., 2004; De Bacquer et al., 2005; Hlatky et al., 1995; Johnson et al., 1996; Lee et al., 2002). A key issue yet to be addressed is the direction in which methodological issues would likely be acting and hence influencing the situations that would increase the likelihood of obtaining null results or overestimation of the association (Belkic et al., 2004). A comprehensive and systematic assessment of methodological issues is

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given by [Belkic et al. \(2004\)](#) in which the methodological quality criteria are grouped into four categories, namely assembly of the sample, validity of exposure variable assessment, considering confounding variables and the validity of outcome variable. Despite inconsistent evidence of an association between exposure to job strain and CVD and the role of methodological issues, there is a substantial body of data on biological plausibility that job strain is a major CVD risk factor. For example, exposure to job strain has been associated with increased blood pressure and left ventricular mass and since there is a direct relation between increased left ventricular mass and cardiac events, this pathophysiological process may account for a substantial part of the reported association between job strain and CVD-related morbidity and mortality ([Belkic et al., 2004](#); [Schnall et al., 1990](#)). The issue of job-related stressors has received considerable research attention among the Swedish population ([Jansson et al., 2009](#); [Kuper et al., 2007](#); [Norberg et al., 2007](#); [Peter et al., 2002](#); [Toivanen and Hemstrom, 2008](#)), with predominantly cross-sectional and case-control designs in the literature and little prospective data. In a review of prospective cohort studies that have examined the relation between job strain and coronary heart disease, six of the 10 studies showed moderate positive association ([Hemingway and Marmot, 1999](#)). In the review by [Belkic et al. \(2004\)](#), it was reported that 8 of the 17 longitudinal studies, including several of the largest showed significant positive results and 3 of the 17 had non-significant positive results. Altogether 15 of the 17 longitudinal studies had dominant biases towards the null. Among Swedish longitudinal studies, only one study ([Kivimaki et al., 2008](#)) revealed marginally significant effect of job strain on cardiovascular disease (CVD) mortality and morbidity among men. The results from a systematic review of 20 cohort studies show that most significant results on work stress and developing cardiovascular diseases come from analyses that include men, and the findings are controversial among women ([Backe et al., 2012](#)). Our purpose is to extend the literature on job characteristics, specifically psychological demands and decision latitude in relation to CVD mortality among men and women. We will attempt to clarify the role of social support and traditional coronary risk factors in assessing the association between work characteristics and CVD mortality. Furthermore, we will test for interaction effects, as we hypothesize that the health effects of job stress will be more pronounced in people with low levels of social support, lower education and significant conventional CVD risk factors.

## 2. Methods

### 2.1. Setting

In the County of Västerbotten in northern Sweden, a programme featuring annual health surveys has been conducted since 1985 (Västerbotten Intervention Programme, VIP) ([Norberg et al., 2010](#)). This was a pilot study that began in a small municipality in 1985, and throughout the county beginning in 1990, reaching total coverage in 1992. All county residents reaching 40, 50 and 60 years old are invited to participate in a health survey at their local primary care center. The design of the VIP ([Norberg et al., 2010](#)) and patterns of participation ([Norberg et al., 2012](#)) have previously been described in detail elsewhere.

The data originated from the Linnaeus database, available at the Center for Population Studies, Umeå University, Sweden ([Malmberg et al., 2010](#)). The Linnaeus database is constructed by linking individual records from multiple national sources with two local datasets (VIP and Betula). The national registers include Death Cause Register (death and cause of death), Inpatient Register (hospitalization and diagnosis), and Statistics Sweden. A large part

of the data from Statistics Sweden comes from the Longitudinal integration database for health insurance and labor market studies (LISA by Swedish acronym), as well as from censuses, the Multi-generational Register and the Geography Database. Civic ID numbers are replaced by codes, and the key is preserved by Statistics Sweden.

### 2.2. Study population

A prospective cohort of men and women aged 40, 50 and 60 years, who were employed at baseline were recruited from the VIP. In the case of those who participated twice, only the first observation is considered. We include all healthy VIP participants from 1990 to 2006. Participation rates in the VIP increased from 56% in 1995 to 65% in 2006. Increasing participation rates occurred regardless of socio-economic characteristics, age, sex and medical history assessed by previous CVD hospitalizations. Participants and non-participants had minimal differences in education, age and number of previous CVD hospitalizations. However, those with low income had an approximately 10% lower participation rate ([Norberg et al., 2012](#)). Based on data from patient's registry two years before the first VIP visit, individuals with a history of stroke or myocardial infarction before the start of follow up were excluded. The cohort was followed up through linkage with existing nationwide health registers (available up to 2006) using the unique national registration number of the participants. Deaths due to stroke (ICD-9: 431, 434, 436 and ICD-10: I61, I63, I64) and myocardial infarction (ICD-9: 410, 411, 412, 414, 427F and ICD-10: I21, I22, I23, I25, I46) are identified and are considered the outcome of our study.

### 2.3. Psychosocial conditions

Work stress was defined by the Swedish version of the Karasek demand/control model ([Karasek and Theorell, 1992](#)). This model is used commonly in occupational research and has been tested for reliability in the Swedish population ([Theorell et al., 1988](#)). Psychological job demands and decision latitude were calculated based on four job demand items and six job decision latitude items on a four-point Likert scale. Psychological demands and decision latitude were both dichotomized by the median score consistent with previous Swedish studies ([Alfredsson et al., 2002](#); [Peter et al., 1998](#)). The cross-classification of job demands and job control according to their gender-specific medians produces four mutually exclusive categories: “low strain” (low demands + high control), “active” (high demands + high control), “passive” (low demands + low control), and “high strain” (high demands + low control). Social support at work is also part of the Karasek questionnaire and is based on five questions regarding contacts with co-workers during work and leisure time. “Iso-strain” refers to high strain in combination with low support defined as the score of social support at work less than the gender-specific median.

Social support outside of work, including social network and emotional support, was measured by an abbreviated version of the Interview Schedule for Social Interaction ([Henderson et al., 1980](#)), which was previously tested for validity and reliability ([Unden and Orth-Gomer, 1989](#)). Availability of social integration (AVSI) describes the magnitude of a person's social network and contacts that manage every day stress. AVSI is based on seven questions, e.g., “How many friends do you have, who could come to your home any time and feel unembarrassed? How many can you openly talk to, without thinking twice?”. Adding up the scores for the seven items resulted in a value on scale from 0 to 14.

Availability of attachment (AVAT) describes the extent of close emotional support and appreciation and attachment within and outside of family. AVAT consisted of six items, such as, “Is there any

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