



## Repeated exposure to effort–reward imbalance, increased blood pressure, and hypertension incidence among white-collar workers Effort–reward imbalance and blood pressure

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### ABSTRACT

**Objectives:** To determine whether men and women with repeated ERI exposure have increased BP means or higher hypertension incidence over a 3-year follow-up. To examine the potential modifying effect of age and overcommitment.

**Methods:** The study cohort was composed of 1,595 white-collar workers (629 men and 966 women) assessed at baseline and 3-year follow-up. Ambulatory BP measures were taken every 15 min during a working day. ERI at work was self-reported using validated scales. BP means at follow-up and cumulative incidence of hypertension were respectively modeled with analyses of covariance (ANCOVA) and log-binomial regression.

**Results:** Among men, no association was observed between repeated ERI exposure and BP. Among women, age had a modifying effect. Women <45 years old exposed to ERI at both times had significantly higher BP means at follow-up (122.2/78.9 mm Hg) than those unexposed (120.4/77.4 mm Hg). In women ≥45 years old, the cumulative incidence of hypertension was 2.78 (95% CI: 1.26–6.10) times higher among those exposed to ERI at both times. Men and women in the higher tertile of overcommitment had higher BP means (men: 128.9/82.2 mm Hg, women: 121.9/78.0 mm Hg) than those in the lower tertile (men: 127.2/81.3 mm Hg, women: 120.6/77.0 mm Hg).

**Conclusion:** This prospective study showed that, among women, repeated ERI exposure led to a significant age-specific increase in BP means and a major age-specific increase in hypertension incidence. These results suggest that primary intervention aimed at reducing ERI may contribute to lower BP and prevent hypertension in women.

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### Introduction

Cardiovascular diseases (CVD) are one of the primary causes of death and incapacity in industrialized countries [1]. High blood pressure (BP) is a major risk factor of CVD [2]. Almost one American in five [3] and one Canadian in five (19.8% and 18.6% of adult Canadian women and men respectively) [4] have high BP. Prospective studies have shown that the risk of cardiovascular mortality grows linearly with BP from 115/75 mm Hg in adults aged 40–69 years-old with no CVD. At the population level, even a 2 mm Hg lower systolic BP would lead to a reduction of middle-age mortality from coronary heart disease and stroke of about 7% and 10%, respectively [5,6]. Factors such as age [7], obesity [8,9], sedentary lifestyle [8], alcohol

consumption [8], and a diet rich in sodium [10] may contribute to increased BP. A number of epidemiological studies have shown that psychosocial factors, including workplace psychosocial factors, may also contribute to increased BP [11–16].

Two well-defined and internationally recognized theoretical models are used to assess psychosocial work factors: the Karasek demand–latitude model [17] and the Siegrist effort–reward-imbalance (ERI) model [18]. The two-dimensional demand–latitude model suggests that workers simultaneously experiencing high psychological demands and low decision latitude (job control) are more likely to develop stress related health problems [17]. The Siegrist ERI model proposes that extrinsic efforts (e.g. pressure to work overtime, increasingly demanding work, constant time pressure, repeated interruptions) should be rewarded in various ways: income, respect, esteem, and occupational status control (job security, promotion prospects, unforced job changes) [18]. Workers are in a state of detrimental imbalance when high extrinsic efforts are accompanied by low reward, and thus more susceptible to health problems. A third component, overcommitment, is a personal

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coping trait expressed through both an inability to withdraw from work obligations, and impatience and irritability [18]. It would seem that overcommitted workers may expose themselves more often to high demands at work, or may deploy efforts beyond what is needed [19]. Overcommitment is hypothesized to modify (i.e. increase) the effect on health produced by ERI [19]. No previous studies have investigated the modifying effect of overcommitment on the association between ERI and BP. However, two previous studies investigated the association between overcommitment and BP [20,21], both of them observing a positive effect.

Eight studies investigated the association between ERI exposure and BP [11,20–26]. Four observed a positive association [11,22–24] and four other studies observed no association [20,21,25,26]. The previous studies suffered from methodological limitations such as small sample size [11,20–22], office BP measurements [22–26], cross-sectional designs [11,20–23] a small number of women [11,21,22,24], and low participation rates [20,21]. Moreover, all the previous studies only assessed ERI exposure at baseline (one-point exposure). Our prospective study used repeated measures of ERI exposure (at baseline and at 3-year follow-up), ambulatory BP measures, and a large sample size, 60.6% of whom were women.

The objectives of this study were to: 1) determine whether men and women with repeated ERI exposure had increased BP means or

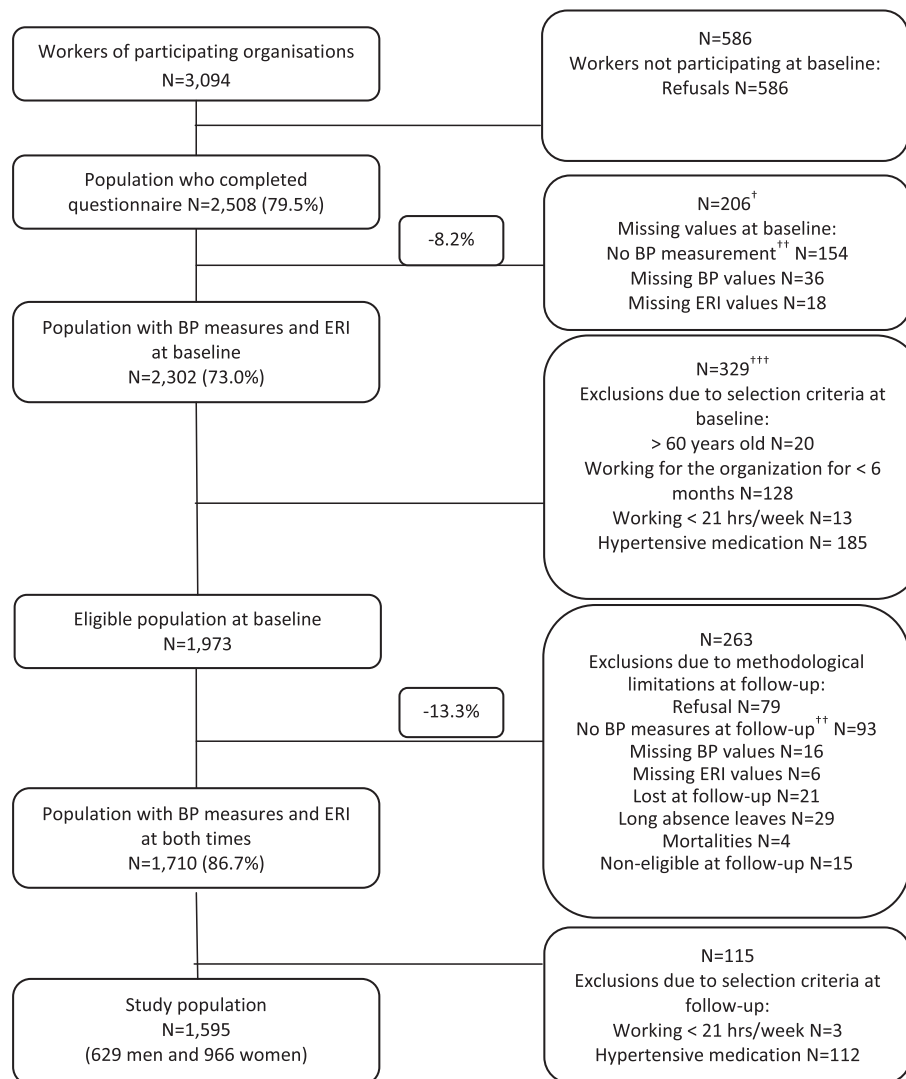
higher hypertension incidence at follow-up, and 2) examine the potential modifying effect of age and overcommitment on these associations.

## Methods

### Population and study design

This study was part of a larger prospective study aimed at investigating the effects of psychosocial factors on BP evolution over 5 years [27]. Workers from three public insurance organizations in Quebec City were invited to participate (N=3,094). The present study focused on the first 3 years of follow-up, which included a two-point measurement. The baseline data collection was performed between June 2000 and June 2003. The follow-up data collection was carried out between October 2004 and November 2006. Mean follow-up time was 3.3 years (SD = 0.9).

At baseline, the overall participation rate was 79.5% (N = 2508) (Fig. 1). Workers' jobs encompassed a wide range of white-collar occupations, including office workers (30.2%), technical (24.8%), professional (40.1%), and senior management (5.0%). Their main activities involved organizing and providing insurance services to the



**Fig. 1.** Study population. <sup>†</sup> 2 participants had simultaneously no BP measurements and missing ERI values, so adding participants from this cell resulted in 208 rather than 206. <sup>††</sup> Pregnant women were excluded at this stage because they were non-eligible for BP measurement. <sup>†††</sup> 16 participants were classified simultaneously in two or more selection criteria; the addition of participants from this cell thus resulted in 346 rather than 329.

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