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# Work stress and hair cortisol levels among workers in a Bangladeshi ready-made garment factory — Results from a cross-sectional study

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**Summary** Evidence on the association of work stress with cortisol levels is inconsistent and mostly stems from Western countries, with limited generalizability to other regions of the

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world. These inconsistencies may partly be due to methodological limitations associated with the measurement of cortisol secretion in saliva, serum or urine. The present study set out to explore associations of work stress with long-term integrated cortisol levels in hair among 175 workers of an export oriented ready-made garment (RMG) factory in Dhaka, Bangladesh.

Work-related demands (WD), interpersonal resources (IR) and work-related values (WV) were assessed using a psychometrically evaluated interview. WD consisted of four items on physical demands, time pressure, worries about mistakes and exposure to abusive language. IR comprised five items addressing support, recognition, adequate payment, workers' trust in the management, and the management's trust in workers, as perceived by the workers. WV captured job security, promotion prospects and job latitude by three items. Hair cortisol concentrations (HCC) were analyzed by liquid chromatography—mass spectrometry. Stepwise multivariable linear regression models (backward elimination of predictors) were used to estimate associations of HCC with the three work stress components. For significant work stress component(s), further multivariable linear regression analyses were conducted to explore whether, and if so, which individual item(s) contributed most.

The mean HCC equaled 3.27 (SD 2.58) pg/mg. HCC were found to be significantly associated with WV (beta = 0.209, $p = 0.021$). Additional analyses of the three WV items revealed that this association was largely driven the item on ''promotion prospects'' (beta = 0.230, $p = 0.007$) implying that the perception of *good* promotion prospects was associated with *higher* HCC.

The finding of elevated HCC with good promotion prospects may initially seem counter-intuitive, but is supported by research documenting that job promotion may result in poorer mental well-being. Moreover, being promoted in the Bangladeshi RMG industry may represent a stressful experience: job promotions are rare in this setting and are associated with the need to meet exceptional job-related demands. Further research from ethnic and culturally diverse occupational settings is needed to test this hypothesis, to shed light on the reproducibility of our findings and to improve our understanding of the psychobiological implications of psychosocial working conditions across cultures and contexts.



## 1. Introduction

Work stress is common in Western work forces (National Institute for Occupational Safety and Health, 1999; European Foundation for the Improvement of Living and Working Conditions, 2006) and is assumed to represent an emerging concern in developing countries (Houtman et al., 2007). While a uniform definition of work stress is lacking, research predominantly conducted in Western countries has suggested theoretical models which are assumed to capture key components of stressful working experiences. The two most dominant and best researched of these models are the job demand control (JDC) model (Karasek, 1979) and the effort-reward imbalance (ERI) model (Siegrist et al., 2004). The JDC model conceptualizes work stress as resulting from situations with simultaneous exposure to high job demands (e.g., intense work) and low job control (e.g., reduced control over work, skill and variety of tasks). The ERI model, by contrast, posits that work conditions are particularly distressing when efforts (e.g., the working under time pressure and under insecure contracting conditions) are insufficiently reciprocated by rewards (e.g., adequate salary, good promotion prospects, job security and recognition from colleagues and supervisors).

Work stress (e.g. defined according to the JDC model or the ERI model) has been identified as a risk factor for adverse health outcomes (Siegrist et al., 2009). Amongst others, cortisol may represent a mediator of these associations (Staufenbiel et al., 2012). However, according to a systematic review, the evidence on associations between work stress and diurnal cortisol levels is mixed (Hansen et al., 2009). This may partly be explained by the reliance of previous studies on cortisol assessments in saliva, serum or urine, which are affected by the temporal and situational variability of cortisol secretion and issues of non-compliance (Stalder and Kirschbaum, 2012). In contrast, cortisol assessments based on *hair* are considered to be less affected by these methodological limitations. Another advantage of hair cortisol concentrations (HCC) is that they reflect patterns of long-term cortisol secretion (Stalder and Kirschbaum, 2012), thereby capturing exposure to the stress hormone cortisol cumulatively over long time periods. Considerable data has supported the validity and reliability of this method (summarized in Stalder and Kirschbaum, 2012). Though evidence is still limited, studies have found HCC to be associated with various stress-related chronic conditions, such as psychiatric diseases (Staufenbiel et al., 2012) and myocardial infarction (Pereg et al., 2011).

At least two previous studies investigating HCC have addressed potential occupational determinants: Manenschijn et al. (2011b) have observed higher HCC in employees working in shifts as compared to those not working in shifts. Furthermore, Dettenborn et al. (2010) have reported higher HCC among unemployed individuals compared to those in employment. To date however, specific associations of HCC with work stress remain unexplored. Furthermore, given that cultural factors may affect the appraisal of occupational stress (Mazzola et al., 2011), it is