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Changes in Allostatic Load during workplace reorganization

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ABSTRACT

Objective: Allostatic Load (AL) represents the strain on the body produced by repeated physiologic or allostatic responses activated during stressful situations. Several cross-sectional studies have found empirical substantiation for the relationship between impaired psychosocial work environment and high AL. The aim of this longitudinal study is to investigate changes in AL during workplace reorganization that has been shown to cause impaired psychosocial work environment. Moreover, we aim to investigate the association between changes in AL and changes in psychosocial work environment (job strain, effort-reward imbalance) and psychological distress (stress symptoms and perceived stress).

Methods: A major reorganization of non-state public offices was effectuated in Denmark on 1 January 2007. In 2006 and 2008, we collected clinical and questionnaire data from 359 participants, 265 women and 94 men, employed in seven municipality or county administrations. Four municipalities and one county merged with others, while one municipality and one county remained unmerged.

We calculated the AL score based on 13 physiological markers reflecting stress responses of the cardiovascular, metabolic, neuroendocrine and immune systems. We analysed changes in AL from 2006 to 2008.

Results: AL increased significantly during workplace reorganization in the whole study group but we observed only a tendency of significant increase in AL in the merger group compared with the control group. Moreover, we observed no association between the changes in AL and changes in psychosocial work environment and psychological distress.

Conclusions: This result leaves the conclusion unclear but contributes to the limited research in this area with a longitudinal design and focus on low-risk levels and small changes in AL in healthy people as predictor of future disease.

1. Introduction

Employees confront with increasing numbers of organizational change at work at different levels ranging from minor daily stressors related to changes in technology and workplace practices to major upheavals of mergers, downsizing, and restructuring [42].

Research in this area has shown workplace reorganization to cause impaired psychosocial work environment and have negative health consequences [22,33]. More specifically, the health effects of different types of intervention during workplace reorganization have been investigated in two different reviews. Egan et al. investigated the health and psychosocial effects of increasing employee participation and control through workplace reorganization including 18 studies and identified evidence suggesting that some organizational-level participation interventions may benefit employee health [8].

Closely related to this review, Bambra et al. investigated the health and psychosocial effects of changes in work environment through task structure work reorganization. They found that task- restructuring intervention that increased demand or decreased control had a negative effect on health [2]. A recent Danish review including 17 studies, both cross-sectional and longitudinal, observed an association between organizational change and elevated risk of mental problems in 11 of 17 studies. However, the authors concluded the review to provide insufficient evidence of this association and that more studies of long-term effects are required [1].

Physiological systems activated by stress can protect and restore the body, and the ability to physiologically adapt to the environment is of importance for the person's health. Sterling and Eyer defined the term

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allostasis as the regulatory process of maintaining physiological stability [43]. In contrast to the term homeostasis meaning "steady state" and coined by Walter Cannon for the phenomenon that physiological variables critical to cell survival, such as blood pH and body temperature, maintain within narrow ranges of normal values despite environmental fluctuations [5], allostasis has much broader boundaries also expanding outside normal values. In other words, allostasis differs from homeostasis by operating with dynamic rather than static biological set-points [36]. Although the way allostasis operates across a broad physiological range is protective and normal, the body needs recovery and return to an optimal physiologic equilibrium or a more basal state. The term Allostatic Load (AL) describes the lack of recovery or a result from chronic overactivity or underactivity of allostatic systems [29]. McEwen and Stellar defined AL as "wear and tear" or strain on the body produced by repeated ups and downs of physiologic response under challenge predisposing the organism to disease [30]. Acute and chronic stress responses promote adaptation via responses of neural, cardiovascular, autonomic, immune, and metabolic systems, all of them examples of allostatic systems [28]. AL represents the cumulative physiological dysregulation and incorporates multiple stress-sensitive allostatic systems. Typically, it is measured as an index or sum-score of a number of relevant physiological markers. Several studies showed this comprehensive measure to better predict future health risks than any other single factor on its own [39,21].

A recent review by Beckie describes how several studies have focused on AL and psychosocial work environment and found empirical substantiation for this relationship [3]. A German study of industrial workers found an association between increased job demands and high AL [35]. Another study among Chinese industrial workers observed an association between low job control and increased glucolipid AL [26] and, in a sub-study of the same cohort, an association between high job demands, low decision latitude and high AL [44]. In another German study including female schoolteachers, researchers found that AL scores were significantly higher in women with high effort-reward imbalance but also with high levels of exhaustion in terms of vital exhaustion and exhaustion measured with emotional exhaustion scale of the Maslach Burnout Inventory [4]. A Swedish study showed that lack of recovery from work stress was associated with increased AL [46] and in a study there was found a high AL among middle-aged women working in the health care sector [14]. In studies investigating burnout or exhaustion as a consequence of stressful working conditions, a study among Dutch telecom managers found no relation between AL and burnout or exhaustion [25], contrary to another study among healthy, Canadian workers found a relation between increased AL and a high frequency of burnout symptoms [16,18]. All these studies used cross-sectional designs, which limit the interpretation of the causal direction of the association.

Another review by Juster also describes this empirical substantiation between impaired psychosocial work environment and high AL and relates to a high extent to the same studies. Moreover, this review details the existing measures of AL and the statistical techniques used in earlier studies [17]. The authors describe "the group AL index", defined by Seeman et al. as the traditional and most often used measure. In the studies by Seeman et al. the physiological markers falling within the clinically high-risk 75th percentile with respect to the samples marker distribution were dichotomized as "1", and those within normal ranges (low-risk levels) as "0", and subsequently all markers are summed into an AL index [39]. This division of the range may be limited for some purposes. With respect to the definition of AL as "wear and tear", or strain on the body produced by repeated ups and downs of physiologic response under challenge predisposing the organism to disease [30], it might be relevant also to focus on the distribution of values in the low-risk levels and especially when observing small changes in AL within individuals as a predictor of disease later in life [40].

A major reorganization of non-state public offices took place in Denmark on 1 January 2007. Before reorganization, the non-state public sector in Denmark had two levels of administration: the counties and the municipalities. After reorganization, most of the counties and municipalities merged into larger units; the 14 counties merged into five regions, and the 275 municipalities merged into 98.

To contribute to the limited research on this field based on primarily cross-sectional studies, this longitudinal study aims to investigate changes in AL during workplace reorganization. Moreover, we investigated the association between changes in AL and changes in perceived psychosocial work environment (job strain and effort reward imbalance (ERI)) and psychological distress (stress symptoms and perceived stress). We hypothesized an increase in AL as a consequence of workplace reorganization and expected a positive association between changes in AL and changes in perceived psychosocial work environment and psychological distress. In another study based on the same data, we investigated changes in different physiological markers, perceived psychosocial work environment and psychological distress during workplace reorganization and the association between changes in physiological markers and changes in perceived psychosocial work environment and psychological distress [6].

2. Methods

We used data from the study Organizational change, Stress and Health (OSH) for this sub-study.

The study originates from The Clinic of Occupational Medicine at Hilleroed Hospital in collaboration with Statistics Denmark, The Danish Institute of Governmental Research, and The National Research Centre for the Working Environment.

The regional ethics committee approved the study. All participants gave written, informed consent before entering the study, and all participants received the results of their clinical examinations.

2.1. Participants

In November 2004, Statistics Denmark identified 2030 potential participants from data regarding place of employment and salary code.

This selection included white-collar employees in the administration of five municipalities and two counties and was based on our knowledge of the impending mergers. Four municipalities and one county merged with others, while one municipality and one county remained unmerged with only minor changes in tasks.

In April 2006, the potential participants received a questionnaire followed by two reminders. The response rate was 68%. In autumn 2006, we offered the 1118 participants a clinical examination, and 502 agreed. We found no statistically significant difference between the 616 that did not accept the clinical examination and the 502 participants that agreed regarding demographic characteristics, although a tendency for more perceived stress among non-participants was observed ($p = 0.10$).

In autumn 2008, 391 participants completed the follow-up clinical examination. The 111 participants who did not complete the follow-up were compared with the 391 participants using data from autumn 2006. We found significant differences in the form of a higher age in the group of participants ($p < 0.01$), and more sick days among the 111 non-participants ($p < 0.05$). Interleukin-6 ($p < 0.01$) and awakening cortisol response ($p < 0.01$) were also significantly higher among the non-participants compared with the participants.

To characterise the exposure, we used data from the questionnaires in the spring and autumn 2006 and 2008. An inclusion criterion was employment in the period 2006–2008. The study group comprised 359 participants, 265 women and 94 men.

The original design of the OSH study was based on cases and controls in the form of merging or not. From the information given in the questionnaire about workplace in spring 2006 and in autumn 2008, we divided the participants into three reorganization groups: 1. Merger, 2. New job, and 3. Control.