

EFFORT-REWARD IMBALANCE AT WORK AND CARDIOVASCULAR DISEASES

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Abstract

Working conditions and employment arrangements make a significant contribution to the burden of cardiovascular disease, in particular in modern societies where mental and emotional demands and threats are becoming widespread. Occupational research has identified health-adverse features of modern work with the help of theoretical models. One such model, effort-reward imbalance, has been developed by this author and his group and has been widely tested in epidemiological and experimental studies. The model claims that stressful experience at work is elicited by a lack of reciprocity between efforts spent at work and rewards received in return, where rewards include money, promotion prospects, job security, and esteem. Results demonstrate elevated risks of coronary heart disease among employees exposed to effort-reward imbalance. Moreover, in ambulatory and experimental investigations, elevated heart rate and blood pressure and altered secretion of stress hormones were observed under these conditions.

Although additional scientific evidence is needed, available findings call for practical measures towards improving quality of work, most importantly at the level of single companies and organisations. This conclusion is supported by first results from intervention studies that are guided by this theoretical approach. In view of the burden of cardiovascular disease attributable to unfavourable working conditions, such efforts are well justified and need to be extended in order to promote healthy work.

Key words:

Work stress, Effort-reward imbalance, Cardiovascular diseases, Epidemiology, Intervention

INTRODUCTION

The nature of work has undergone rather fundamental changes in economically advanced societies. Industrial mass production no longer dominates the labour market. This is due, in part, to technological progress, and in part to a growing number of jobs available in the service sector. Many jobs are confined to information processing, controlling, and coordination. Sedentary rather than physically strenuous work is becoming more and more dominant. Moreover, the traditional separation of the spheres of work and home is vanishing. Homework, participation in virtual networks, and an unprecedented degree of flexibility in local and temporal work arrangements contribute to this process. Traditional continuous occupational careers are increasingly being replaced by job change, fix-

term contract, temporary work, or self-employment. With the advent of economic globalisation, pressure towards an increase in return on investment has been growing over the past two decades. As a consequence, work pressure increased considerably in private, and increasingly in public sectors, due to financial cuts [1]. Another consequence of economic globalisation concerns the segmentation of the labour market, a related increase in income inequality and a substantial loss of jobs. A large part of the workforce in advanced societies suffers from job insecurity, low wages and salaries, and a low level of safety at work. With the globalisation of labour markets, competition among employees has been increasing, and a growing proportion has been exposed to mergers, downsizing, outsourcing, or redundancy [2].

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How do these changes relate to the occurrence of cardiovascular diseases?

Occupational health research has clearly demonstrated that working conditions and employment arrangements make a significant contribution to the burden of cardiovascular disease [3,4]. While specific physical and chemical occupational hazards with direct impact on cardiovascular pathology that are identified by occupational medicine are still relevant in distinct occupational groups, large proportions of the work force in modern economies are exposed to mental and emotional demands and threats at work, rather than material demands and hazards. As a result, psychological and social stressors (often termed psychosocial stressors) are becoming more frequent, and their contribution to cardiovascular disease at work is likely to parallel or even outweigh the contribution of more traditional occupational stressors.

Although psychosocial adversity at work has become an important concern of research and policy, conceptual clarification and valid measurement are major challenges to science. In a stress-theoretical perspective, occupational demands, threats and conflicts act as psychosocial stressors if active coping efforts are required that cannot be easily resolved.

These conditions cannot be identified by direct physical or biological measurement. Rather, theoretical concepts are needed to delineate particular stressful job characteristics so that they can be identified at a level of generalization that allows for their use in a wide range of different occupations. These concepts can be translated into measures with the help of social science research methods (standardized questionnaires, observation techniques, etc.) that meet the criteria of adequate reliability and validity of data collection. A variety of concepts that encapsulate adverse psychosocial work environments have been developed in occupational health psychology and sociology, social epidemiology and organisational sciences [for reviews, see 5,6]. However, only a few have been tested with convincing study designs (e.g. longitudinal observational investigations of initially healthy employed populations) and have addressed the social gradient in work and health. Among these, two models have received special attention,

the demand-control model and the effort-reward imbalance model.

The demand-control model [7] posits that stressful experience at work results from a distinct job task profile defined by two dimensions, the psychological demands put on the working person and the degree of control or decision latitude available to the person to perform the required tasks. Jobs defined by high demands in combination with low control are stressful because they limit the individual's autonomy and sense of control while generating continued pressure ('high job strain'). A third dimension, social support at work, was added to the original formulation. In this formulation, the highest level of strain would be expected in jobs that are characterized by high demand, low control and low social support at work or social isolation ('iso-strain jobs') [8].

While this model is focused on specific workplace characteristics, the effort-reward imbalance model is concerned with stressful features of the work contract [9]. This model builds on the notion of social reciprocity, a fundamental principle of all types of transactions that are characterized by some form of utility. Social reciprocity lies at the core of the work contract which defines distinct obligations or tasks to be performed in exchange for adequate rewards. These rewards include money, esteem and career opportunities (promotion, job security). Contractual reciprocity operates through norms of return expectancy, where effort spent by employees is reciprocated by equitable rewards from employers. The effort-reward imbalance model claims that lack of reciprocity occurs frequently under specific conditions. Failed reciprocity, in terms of high cost and low gain, elicits strong negative emotions and associated stress reactions with adverse long-term health consequences. 'High cost-low gain' conditions at work occur frequently if employed people have no alternative choice in the labour market (e.g. due to low qualification) or if they make strategic choices to spend additional efforts in order to improve their career prospects in highly competitive professions. Moreover, there are psychological reasons for a recurrent mismatch between efforts and reward at work. People characterized by a motivational pattern of excessive work-related overcommitment may

strive towards continuously high achievement because of their underlying need for approval and esteem at work. Although these excessive efforts often are not met by adequate rewards, overcommitted people tend to maintain their level of involvement.

In summary, the model of effort-reward imbalance at work maintains that people experiencing dependency, strategic choice, and overcommitment, either separately or in combination, are often exposed to failed contractual reciprocity at work and its health-adverse consequences. The model combines organisational features with personal coping characteristics.

The demand-control and the effort-reward imbalance models complement each other by focusing on 'toxic' components of job task profiles and employment contracts, respectively. Low control and low reward are assumed to be equally stressful experiences in the context of work that requires high levels of effort. They both elicit negative emotions and enhanced stress responses with adverse long-term health consequences including cardiovascular diseases. In the following parts of this contribution, the current state of empirical evidence linking psychosocial stress at work (specifically in terms of the effort-reward imbalance model) with cardiovascular risk and disease is briefly summarized and discussed.

METHODS

Effort-reward imbalance (ERI) at work is measured by a standardised, psychometrically validated self-report questionnaire containing the three scales: 'effort' (6 items), 'reward' (11 items that represent the three dimensions of financial and career-related rewards, of esteem and of job security in respective subscales), and 'overcommitment' (6 items representing the intrinsic model component) [10]. The Likert-scaled items are rated by respondents, and a total score of each scale is calculated. Psychometric properties of these scales were extensively assessed, including internal consistency, discriminant and criterion validity, sensitivity to change, and factorial invariance [10,11]. Moreover, confirmatory factor analysis revealed three moderately correlated second-order factors

('effort', 'reward', 'overcommitment', where 'reward' is further specified into three theoretically relevant subcomponents) loading on a general third factor that represents the latent (theoretical) construct. Based on these premises, a short version containing 16 instead of 23 items was developed more recently [12]. Both versions are available in a number of languages.

In epidemiological studies it is often convenient to represent the independent variable in terms of a single binary or continuous measure. Therefore, a ratio of the two variables 'effort' and 'reward' was constructed to represent the core theoretical notion in a quantitative way, with a possible cut-point of 1.0 representing a balance between efforts and rewards, and higher values representing the risk condition [10].

Quantitative self-report data have received methodological criticisms given their limited validity. Yet, despite obvious limitations, satisfying correlations with more objective measures and with computerized ambulatory diaries were reported [13,14]. It should also be noted that in a stress-theoretical perspective, subjective appraisals are an important source of information when estimating their potential emotional and psychobiological impact.

Given the advantage of a short, standardized quantitative measure with comparable scores the ERI questionnaire has been applied in a large number of prospective epidemiological studies, cross-sectional studies, case-control studies and experimental investigations. Study populations include industrial and service sectors, both gender and all age groups, and participants from Western industrialised societies as well as from rapidly developing Asian societies [for reviews 15,16].

RESULTS

The relatively strongest evidence on associations of psychosocial stress at work with cardiovascular risk and disease is obtained from prospective epidemiological observational studies. This is due to the temporal sequence (exposure assessment precedes disease onset), the usual sample size (based on statistical power calculation and allowing for adjustment for confounding variables in multivariate

analysis), and the quantification of subsequent disease risk following exposure (odds ratio of disease in exposed vs. non exposed individuals). Additional evidence comes from case-control studies, cross-sectional studies, ambulatory monitoring studies, and experimental or quasi-experimental investigations including intervention trials. All these types of study designs were applied to analyse associations of ERI with cardiovascular risk and disease.

Up to now, six reports from prospective epidemiological studies tested whether and to what extent components of the ERI model are associated with incident coronary heart or cardiovascular disease. In five of these reports the odds ratios or hazard ratios varied between 1.3 and 4.5, with an overall doubling of the risk of exposed people [17–21; for review 22]. Even if the reported odds ratios are not large, their effects in absolute terms are considerable, given the fact that between 10 and 25 percent of the samples were exposed to work stress in terms of this model. One report was negative [for review 23]. Five additional reports from cohort studies concern significant associations of ERI with depression as disease outcome which is now considered an established cardiovascular risk factor. In these studies elevated depression risks of exposed people varied between 1.4 and 3.6 [24,25]. In the British Whitehall II study, an elevated risk of type 2 diabetes, a further established cardiovascular risk factor, was observed in men, but not in women [26]. Several case-control studies with cardiac patients and healthy controls were conducted, most recently an interesting study in China where working men and women reporting high effort, low reward and high overcommitment were about five times more likely to belong to the group of myocardial infarction cases than those with low or no work stress [27].

Despite their methodological strengths, epidemiological studies provide little insight into the mechanisms underlying the observed statistical associations. Two such mechanisms are generally considered: the mediation by health-adverse behaviours, such as smoking, poor diet, or lack of physical exercise [28], and the mediation by chronic stress reactions that contribute to the development of disease via psychobiological mechanisms. Psychobiological processes are the pathways through which a health-adverse psychosocial work environment activates autonomic,

neuroendocrine, immune and inflammatory responses via the organism's stress axes. There is extensive evidence from animal and human research that prolonged stimulation of these psychobiological processes contributes to the development of cardiovascular disease [29–31].

Several studies were conducted so far testing effort–reward imbalance at work and its impact on cardiovascular, stress hormone and immune parameters. Two such studies concern ambulatory blood pressure monitoring where overcommitted, low status men were shown to exhibit elevated systolic blood pressure throughout the workday [32] and where stressed healthy computer employees were shown to manifest elevated heart rate, systolic blood pressure and a tendency towards reduced heart rate variability [33]. Additional studies explored associations of ERI with secretion of stress hormones, e.g. cortisol, adrenalin and noradrenalin. A dysregulated secretion pattern was observed in a majority of these studies [32,34–36]. In view of the importance of inflammation for the development of cardiovascular disease [37] a recent experimental study is of particular interest documenting higher concentrations of C-reactive protein (a marker of inflammation) following exposure to a standardized mental stress test in participants scoring high on ERI measures, compared to participants with less or no work stress [38]. Finally, a summary index of stress-related biological markers of ‘allostatic load’ has been proposed by McEwen [31], indicating increased susceptibility to cardiovascular risk and disease. In a study on female teachers it was demonstrated that the group scoring high on ERI measures exhibited a significantly higher mean score than the less stressed group [39].

Taken together, naturalistic and experimental studies supplement epidemiological evidence by demonstrating psychobiological processes that possibly mediate the observed associations of psychosocial adversity at work with cardiovascular disease.

DISCUSSION

This contribution documents available evidence on the contribution of an adverse (in terms of effort–reward imbalance) psychosocial work environment to the

development of cardiovascular risk and disease. Evidence may be even stronger if supplemented by available research on complementary work stress models, in particular the demand-control model [40,3,4] or the organisational justice model [22]. Moreover, psychosocial adversity at work often manifests itself in combination with noxious physical conditions (e.g. noise) and work time-related stressors (shift work, overtime work), thus precipitating respective health risks [41–44]. Clearly, there are further challenges concerning the robustness of scientific evidence, the generalisation of findings to other occupational groups and socio-cultural contexts, and the need of conducting intervention trials with documented health benefits.

Despite these limitations, several policy implications of the current state of evidence are obvious. First, there is a need of documenting, assessing and comparing the prevalence of critical aspects of an adverse psychosocial work environment within and between companies and organisations. By this approach, special employment groups at elevated risk can be identified, and preventive efforts can be developed on this basis. A second practical implication concerns the development, implementation and evaluation of theory-guided interventions within single companies and organisations. In this respect, the ERI model offers options to develop activities at three levels, the individual level (e.g. reduction of overcommitment), the interpersonal level (e.g. improvement of leadership, of providing esteem reward), and the structural level (e.g. compensatory wage systems, models of gain sharing, and strengthening of non-monetary gratifications).

Several intervention studies were conducted along these lines. For instance, in a trial involving urban bus drivers, skills of coping with stressful work were improved, overcommitment was reduced, superiors were trained to appreciate the bus drivers' work more closely and group sizes of subordinates were reduced to enhance communication and collaboration across hierarchies [45]. Another intervention was implemented in two Canadian hospitals to reduce burn-out and to improve occupational rewards among nurses and physicians [46]. Resistance against such interventions from the part of management may be overcome by expected increases in return on investment due to medium-term cost

savings within companies. This has been highlighted by a US study that documented a set of common organizational features among those companies that were most successful in terms of shareholder value over a couple of years [47]. These features included employment security, selective hiring of new personnel, comparatively high compensation contingent on organizational performance and reduced status distinctions, among other things. It is evident that several of these features are similar to those which result as recommendations from the scientific findings summarized above. Yet, a third level of policy implications is needed: national and international regulations that ensure and enhance healthy work and fair employment contracts and that support welfare measures to protect workers against the risks of unemployment, sickness absence, disability pensions, and occupational injuries and diseases. Therefore, joint efforts are required from stakeholders, professionals and national/international organizations to improve healthy work and, by doing so, to reduce a relevant part of the burden of cardiovascular disease.

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