Covariation between physical and psychosocial stressors in the workplace: implications for musculoskeletal epidemiology

MacDonald LA [1,2], Karasek RA [2], Punnett L [2], Scharf T [1]

[1.] *National Institute for Occupational Safety and Health (NIOSH), Cincinnati, OH, USA, e-mail: LMacDonald@cdc.gov.*
[2.] *University of Massachusetts Lowell, Department of Work Environment, Lowell, Massachusetts, USA.*

Introduction

There is increasing interest in distinguishing the effects of physical and psychosocial workplace stressors on the etiology of work-related musculoskeletal disorders (MSDs). Modest associations have been found between psychosocial stressors and MSDs, but interpretation of these results are limited by likely covariation between physical and psychosocial stressors. The aim of is investigation was to examine exposure covariation among blue- and white-collar workers and to perform an exploratory factor analysis to investigate the structure of possible underlying factors linking these conceptually distinct stressors.

Methods

Four hundred and ten (84% participation) workers were enrolled in a epidemiologic study at an appliance manufacturing plant. Over half (54%) of the participants were blue-collar workers assigned to direct production (assembly) and support functions. White-collar workers were employed in management and professional positions, and a small proportion (9%) were clerks and secretaries. All participants completed a detailed questionnaire about exposure to physical and psychosocial workplace stressors. Physical stressor questions were adapted from ergonomic checklists, and composite physical job demand scores were computed for the upper extremity (UE) and for the back/lower extremities (BL) by weighting stressors by intensity and duration criteria according to a proposed regulation (5). As described by Estill et al. (1), quantitative assessments of upper limb motion were obtained from wrist-worn accelerometers (ACC) among 146 (36%) participants: 91 blue-collar and 55 white-collar. Measures of psychological job demands and decision latitude were selected from the Job Content Questionnaire (JCQ) (4). Other psychosocial stressors were selected from the NIOSH Generic Job Stress Questionnaire (3). Correlation coefficients were computed, and orthogonal and oblique rotations were used in an exploratory factor analysis.

Results

Moderately high correlations between selected physical and psychosocial stressors showed evidence of covariation (table 1). Strong inverse relationships were found between the occupational group aggregate measure of decision latitude and aggregate measures of physical stressors: UE (r= -0.91, p=0.001), BL (r= -0.82, p=0.0002) and ACC (r= -0.75, p=0.005). Factor analysis results yielded one factor with bi-polar loadings and substantial clustering of repetition and job control measures, while another showed a strong interrelationship between time (pacing) pressure and social pressure (table 2).

Table 1. Spearman correlations between composite physical job demand scores and accelerometry with workplace psychosocial stressors, by work group.

Psychosocial Stressors	Blue-Collar (N=220)			White-Collar (N=190)		
	UE	BL	ACC[1]	UE	BL	ACC[1]
Job Strain (ratio)	**0.58** [a]	**0.34** [a]	**0.37** [b]	**0.34** [a]	0.14	0.26
Psychological Demands	**0.24** [c]	**0.25** [c]	0.23 [d]	**0.26** [b]	0.09	0.12
Decision Latitude	**-0.61** [a]	**-0.34** [a]	**-0.32** [c]	**-0.24** [c]	-0.09	-0.10
Mental Demands	-0.11	0.02	-0.12	0.19 [d]	0.06	0.20
Poor Work Schedule Control	0.16 [d]	0.17 [d]	0.01	0.06	-0.07	0.14
Lack of Group Cohesion	0.09	0.07	-0.05	-0.15 [d]	0.12	-0.02
Group Pressure	0.21 [d]	0.17 [d]	0.18	0.19 [d]	0.03	0.22
Lack of Supervisor Support	**0.25**[c]	0.11	-0.03	-0.19 [d]	-0.01	0.15
Lack of Co-Worker Support	0.01	-0.03	-0.16	0.03	0.05	-0.12
Opinions not Accepted	0.13	0.05	0.01	0.03	0.05	-0.12

Significance: a ≤0.0001, b≤0.001, c≤0.01, d≤0.05 (bold if significance ≤0.01).

1. Sample size: 91 blue-collar and 55 white-collar.

Table 2. Factor loading pattern from principal factor analysis with orthogonal rotation showing the structure of possible underlying factors linking physical and psychosocial stressors in the workplace (N=410).

Stressor Measures (bold if a physical load measure)	Organizational Constraint	Work Pace Pressure
Work Pace Regulation	0.776	0.035
Short Cycle Work	0.774	0.080
Repetition Rating Scale	0.628	0.254
Physical Monotony	0.486	-0.000
Poor Work Schedule Control	0.455	-0.068
Skill Discretion[1]	-0.654	-0.043
Decision Authority[1]	-0.827	0.154
Group Pressure	-0.187	0.602
Mental Demands	-0.527	0.581
Hard*Fast [2]	0.256	0.530
Time Demands [3]	-0.360	0.501
Difficulty Maintaining Pace	0.252	0.493

Loading values >0.30, explaining more than 9% factor variance, underlined.

1. Sub-scale component of decision latitude, 2. Two-items from the psychological job demands scale, 3. Three-items from the psychological job demands scale.

Discussion

Moderately high correlations between selected physical and psychosocial stressors showed evidence of covariation. The strength of these correlations was especially notable considering that imperfect scale reliability can attenuate empirical relationships (2). Correlations were strongest among blue-collar production and low status (clerks and secretaries) office workers. Factor analysis results showed considerable common variance among selected stressors, suggesting that concomitant exposure to physical and psychosocial stressors arises from

organization-level antecedents. While recognizing the conceptual differences between these stressors, the findings call attention to the strong empirical relationships that can exist in the workplace. These associations may explain why the epidemiologic evidence concerning the role of psychosocial stressors in the development of work-related musculoskeletal disorders has been inconsistent. Ecologic understandings of workplace exposure situations are critical to formulating correct inferences about the components of risk as well as effective prevention strategies. Further research is warranted to gain further insight into work organization factors linking physical and psychosocial stressors.

Conclusion

Exposure covariation was found between selected physical and psychosocial stressors and was strongest in blue-collar production and low-status office workers. Factor analysis results suggest that these disparate stressors manifest from common work organization factors that govern the structure of work

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Mats Hagberg, Bengt Knave, Linnéa Lillienberg and Håkan Westberg (Eds)

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Preface

This book contains the extended abstracts to the X2001 Conference on Exposure Assessment in Epidemiology and Practice in Göteborg, Sweden, June 10-13, 2001. The excellent work performed by the contributing scientists has made this book a first-class, up-to-date, state of the art review on what is known about exposure assessment today.

The outstanding scientific quality of the extended abstracts was secured through the work of five international programme committees. The chairmen for the committees were: Chemical, Patricia Stewart; Ergonomic, Alex Burdorf; Physical, Ulf Bergqvist; Psychosocial, Annika Härenstam and Biological, Jean-Francois Caillard.

Financial support to the conference and thereby to the publishing of this book was made possible by contributions from The National Institute for Working Life, Stockholm, Sweden; The Swedish Council for Working Life and Social Research, Stockholm and Volvo. Without the excellent skills of the organizing committee - Ulrika Agby (administration and layout), Ann-Sofie Liljenskog Hill (administration) and Christina Lindström Svensson (administration) - the production of this book would not have been possible.

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Mats Hagberg
Department of Occupational Medicin
Göteborg University, Göteborg

Bengt Knave
The National Institute for Working Life
Stockholm

Linnéa Lillienberg
Occupational and Environmental Medicine
Sahlgrenska University Hospital, Göteborg

Håkan Westberg
Occupational and Environmental Medicine
Örebro Regional Hospital, Örebro