$See \ discussions, stats, and \ author \ profiles \ for \ this \ publication \ at: \ https://www.researchgate.net/publication/51731255$

A cross-sectional study of psychosocial work environment and stress in the Danish symphony orchestras

Article in International Archives of Occupational and Environmental Health · October 2011

DOI: 10.1007	7/s00420-011-0710-z · Source: PubMed				
CITATIONS	;	READS 401			
3 author	rs, including:				
0	Helene M Paarup University of Southern Denmark 21 PUBLICATIONS 282 CITATIONS SEE PROFILE		Jesper Baelum Odense University Hospital 96 PUBLICATIONS 1,911 CITATIONS SEE PROFILE		
Some of	the authors of this publication are also working on these related projects:				

Musicians' Health - Denmark View project

Reports on Occupational Lung Disease View project

ORIGINAL ARTICLE

A cross-sectional study of psychosocial work environment and stress in the Danish symphony orchestras

Gitte Juel Holst · Helene M. Paarup · Jesper Baelum

Received: 20 February 2011 / Accepted: 4 October 2011 © Springer-Verlag 2011

Abstract

Purpose To investigate psychosocial work environment and stress in Danish symphony orchestra musicians.

Methods This was a cross-sectional questionnaire survey of psychosocial work factors and stress symptoms among 441 musicians in six Danish symphony orchestras. The response rate was 78% (n = 342). The questions were from COPSOQ (Copenhagen Psychosocial Questionnaire). Mean values of 19 COPSOQ-scales were compared by gender and instrument group. The results for the musicians were compared with results for the general Danish work force (COPSOQ database).

Results Female musicians reported higher work demands and higher stress symptoms than their male colleagues. Between instrument groups, 2nd violinists seemed to be of particular risk compared with the other instrumental groups in aspects of work pace, work organization, and content, whereas 1st violinists perceived higher emotional stress compared with 2nd violinists. The musicians' experience of increased work demands as well as deteriorated, work organization and job content, interpersonal relations and leadership, and work-individual interface was significantly

G. J. Holst · H. M. Paarup · J. Baelum Department of Occupational and Environmental Medicine, Odense University Hospital, Odense, Denmark

G. J. Holst (🖂)

H. M. Paarup · J. Baelum Research Unit of Occupational and Environmental Medicine, Clinical Institute, University of Southern Denmark, Odense, Denmark associated with increasing stress symptoms. Compared to the general workforce independently of gender, Danish symphony orchestra musicians reported higher emotional demands, lower influence, lower social support, lower sense of community, and lower job satisfaction. However, the musicians reported a higher commitment to the workplace.

Conclusions The findings indicate a more demanding psychosocial work environment exposure among symphony orchestra musicians than among Danish workers in general. Critical results are the relatively high work demands, low influence, and low social support, females being of higher risk than males.

Keywords Psychosocial work environment exposure · Stress symptoms · Symphony orchestra musicians

Introduction

The hierarchical structure of the symphony orchestra leaves limited influence for the individual musician, and the psychosocial work environment of symphony orchestra musicians has been characterized by rigorous demands for high levels of technical skills, strict discipline, and an orchestral performance depending on high collaborative skills (Ostwald et al. 1994; Fetter 1993; Sternbach 1993; Piperek 1981). Thus, symphony orchestra musicians are a highly selected group. Despite these remarkable working conditions, only few epidemiological studies have emphasized on the psychosocial work environment and stress of symphony orchestra musicians, and the results of the studies have been conflicting. A Danish study showed that only 1% of 145 symphony orchestra musicians reported they often experienced stress (Laitinen and Poulsen 2008). In contrast,

Department of Environmental and Occupational Health, Aarhus University, Ole Worms Allé 6, 8000 Aarhus C, Denmark e-mail: gjho@mil.au.dk

an American study of 2,212 musicians from 47 symphony orchestras showed that 23% of the musicians reported more perceived stress than colleague musicians (Middlestadt and Fishbein 1988). Similarly, among 154 musicians, 21% experienced moderate stress, 6% severe, and 4% extreme stress (Salmon et al. 1995).

Previous studies have identified string and woodwind players to report more stress symptoms than other instrument groups (Middlestadt and Fishbein 1988; Parasuraman and Purohit 2000; Liljeholm Johansson and Theorell 2003). However, most studies have not distinguished between string players, which should be of particular interest since 1st violinists seem to be more exposed due to a high work load, high technical demands, being responsible for solos, and being more visible during the entire performance, while the 2nd violins usually are a subordinate to the 1st violins. Thus, the 2nd violinists seem more withdrawn as support for the remaining orchestra which may result in perceiving the psychosocial work environment less strenuous. Moreover, the influence of gender on stress symptoms seems to be conflicting. Liljeholm and Theorell found a significant difference between genders regarding female musicians reported a more adverse work environment compared with male musicians (Liljeholm Johansson and Theorell 2003). In contrast to this, Hamilton et al. found that male orchestra musicians reported higher mental, physical, and interpersonal strain than female musicians (Hamilton et al. 1995). A third study found that the perception of stress was unrelated to instrumental group and gender in 93 musicians (Kivimäki and Jokinen 1994).

Occupational stress is considered a significant workrelated health problem (European Commission 2002). Therefore, it is of great preventive interest to get an understanding of how musicians experience their psychosocial work environment and to what extent stress effects the musicians and moreover, what factors in their work environment that might contribute to the experience of stress. Several studies among symphony orchestra musicians have found that social relations in particular can be an important stressor (Parasuraman and Purohit 2000; Liljeholm Johansson and Theorell 2003). Among 12 Swedish classical orchestras, work content and social support were among the most important work-quality factors related to health aspects, and the higher social support, the fewer symptoms, and more well-being were reported (Liljeholm Johansson and Theorell 2003). Another Swedish study found that symphony orchestra musicians, compared with five other occupations, reported high psychological demands and low decision authority (Theorell and Ahlberg-Hulten 1990) which according to the demand-control model is a known combination of factors to increase the risk of ill health (Karasek 1979).

Having the resources to fulfill the specific work conditions, the symphony orchestra musicians represent a selected group, but a paradox seems to exist; on one hand, studies have reported that symphony orchestra musicians experience strenuous work conditions and stress; on the other hand, symphony orchestra musicians also report high levels of work satisfaction (Kivimäki and Jokinen 1994; Liljeholm Johansson 1996). Many studies on psychosocial work environment and stress among different occupational groups have been performed over the last decades, in Denmark as well as in many other countries. However, symphony orchestra musicians have often been neglected in these studies leaving an uncertainty about their psychosocial work environment exposure and thereby how this profession is characterized compared with other professions.

The overall objective of the present study was to investigate psychosocial work environment and stress in Danish symphony orchestra musicians emphasizing on three questions: (1) Does the mean level of work stress differ between different groups within the orchestras?; (2) Is adverse psychosocial work environment positively associated with stress symptoms?; (3) Do mean levels of works stress and psychosocial work environment of symphony orchestra musicians differ from those of the general work force? This knowledge may be helpful for health professionals to get a better understanding of the musicians work conditions and allow health professionals to advise and treat symphony orchestra musicians appropriately.

Methods

Participants

Study population

The study was designed to comprise all symphony orchestra musicians from the seven professional Danish symphony orchestras; as one orchestra did not participate for administrative reasons, the study population was 441 musicians from six orchestras. The response rate was 78%, 342 respondents, of which 39.2% were women and 60.8% were men. The distribution of gender did not differ significantly between the respondents and the non-respondents. The overall demographic data are presented in Table 1. The women were significantly younger than men (p < 0.001)and constituted a large proportion of the high string player group and a low proportion of the low string players and brass players. The distribution of gender and age did not differ significantly between the orchestras. A higher proportion of men had a secondary job. Similarly, more men lived with a partner, and more females had received a candidate/ master level from the conservatorium.

Table 1Differences in sociode-
mographic and occupational
data in Danish symphony
orchestra musiciansstratified by gender

Sociodemographics	Male (<i>n</i> = 208)	Female $(n = 134)$	р
Individual			
Age (year), mean (SD)	46.8 (11.3)	41.8 (10.6)	< 0.001
Age, range	35.5-58.1	31.2-52.4	
Orchestra			
Orchestra 1, n (%)	28 (13.5)	21 (15.7)	NS
Orchestra 2, n (%)	45 (21.6)	24 (17.9)	
Orchestra 3, n (%)	17 (8.2)	18 (13.4)	
Orchestra 4, n (%)	32 (15.4)	26 (19.4)	
Orchestra 5, n (%)	32 (15.4)	18 (13.4)	
Orchestra 6, n (%)	54 (26.0)	27 (20.1)	
In total, <i>n</i> (%)	208 (100.0)	134 (100.0)	
Instrument group			
High string players	63 (23.2)	86 (39.1)	< 0.001
1. violinist, n (%)	32 (11.8)	33 (15.0)	< 0.05
2. violinist, <i>n</i> (%)	12 (4.4)	30 (13.6)	< 0.001
Viola players, n (%)	19 (7.0)	23 (10.5)	< 0.05
Low string players, <i>n</i> (%)	43 (15.9)	16 (7.3)	< 0.05
Woodwind players, <i>n</i> (%)	41 (15.1)	21 (9.5)	NS
Brass players, n (%)	46 (17.0)	7 (3.2)	< 0.001
Players of other instruments, n (%)	15 (5.5)	4 (1.8)	NS
In total, <i>n</i> (%)	208 (100.0)	134 (100.0)	
Work			
Number of weekly playing hours, mean (SD)	29.9 (11.0)	32.7 (9.7)	NS
Had secondary jobs (yes), n %	141 (67.8)	70 (52.2)	< 0.01
Family			
Living with a partner (yes), n (%)	170 (81.7)	91 (67.9)	< 0.001
Children at home (yes), n (%)	97 (46.6)	70 (52.2)	NS
Educational level			
Conservatory of Music, n (%)	194 (93.3)	127 (94.8)	NS
Candidate level or equal, n (%)	144 (69.2)	107 (79.9)	< 0.05
Bachelor level or equal, n (%)	17 (8.2)	7 (5.2)	NS
Educational level unspecified, n (%)	33 (15.9)	13 (9.7)	NS
Other education than conservatory of music, n (%)	14 (6.7)	7 (5.2)	NS

Prevalence in number (*n*) and percent (%) or mean, standard deviation (SD), and range are presented. Chi-square test for categorical variables (n > 5), Fischers exact-test (n < 5) and student's *t* test for continuous variables

Reference population

A random sample of the Danish work force of 3,517 active workers aged 20–60 years reported in 2004–2005 on their psychosocial work environment and health by a postal questionnaire (National Research Centre for the Work Environment 2005). The questions were to a large extent similar to the questions that were later used for the symphony orchestra musicians in 2007–2008 for the present study. The overall mean value across all professions for each gender served as the reference for the mean value of the symphony orchestra musicians.

Questionnaire

The study was designed as a part of a cross-sectional survey of the work environment and health in Danish symphony musicians conducted during 2007–2008 (Paarup et al. 2011). The dimensions of psychosocial work environment and stress symptoms were investigated using the Copenhagen Psychosocial questionnaire (COPSOQII) developed by the National Institute of Occupational Health in Denmark (Pejtersen et al. 2010). The questionnaire has been validated based on factor analysis and the Cronbach's alpha for internal consistency of categorizing items and computing scales (Bjorner and Pejtersen 2010). Four dimensions covered psychosocial work environment: work demands, work organization and job content, interpersonal relation and leadership, and work-individual interface, while stress symptoms covered emotional-, cognitive- and somatic stress. A detailed description of the items and scales and a guideline for calculating these is available (Pejtersen et al. 2010).

Sociodemographics and occupational variables

Factors included in the study with a probable influence on the perceived psychosocial work environment and stress involved demographics described in terms of gender (Stansfeld et al. 1998), age (Jorm et al. 2005), living with a partner (Mausner-Dorsch and Eaton 2000; Hope et al. 1999), one or more children living at home (Pugliesi 1999), and educational level (Landsbergis et al. 2003). Occupational information included terms of orchestra membership, weekly playing hours, and having secondary jobs. Instrument played was categorized in the instrument groups: 1st violinists, 2nd violinists, other string players (viola, cello, double bass), and other instruments (oboe, clarinet, bassoon, flute, trombone, trumpet, tuba, horn, piano, timpani, percussion, and harp).

Psychosocial work environment

Sixteen of 30 scales and one separate item from the original COPSOQ questionnaire were used to describe the psychosocial work environment. These scales constituted four overall dimensions. (1) Demands at work: quantitative demands, work pace, emotional demands, demands for hiding emotions, cognitive demands, insecurity at work and role conflicts. (2) Work organization and job content: influence at work, possibilities for development, meaning of work, and commitment to the workplace. (3) Interpersonal relation and leadership: role clarity, role conflicts, predictability, social support, sense of community and reward. (4) Work-individual interface: insecurity at work and job satisfaction. Each scale was based on 2-5 items except cognitive demands only including 1 item and job satisfaction including 6 items. Each item had five response categories: (1) Very often, (2) Rather often, (3) Sometimes, (4) Rather seldom, and (5) Very seldom, the categories were given the scores (1) 100, (2) 75, (3) 50, (4) 25, and (5) 0, respectively. The scale value was calculated as an average score of the items included. High work demand thus implies unfavored condition while high values in the other scales are favorable. An individual scale score was only calculated if at least half of the items were filled in, otherwise they were omitted. Missing values only aroused for the majority of scales for less than 2% of the respondents although for less than 5% for social support.

Stress symptoms

Three scales were used: emotional-, cognitive-, and somatic stress symptoms. Each scale included four items each with four response categories: (1) Whole time, (2) Large part of time, (3) Small part of time, and (4) No time. The response categories were given the scores (1) 100, (2) 66.6, (3) 33.3, and (4) 0, respectively, and the scale score was the average of the included items. Individual scale scores were only calculated if at least two of the items in a scale were filled in and were otherwise omitted. Missing values constituted less than 2% of the respondents on the stress scales.

Statistical analyses

Comparison of continuous variables was done using t test or ANOVA (analysis of variance) and for categorical variables Chi-square test. For comparison of male with female musicians, and comparison of musicians with Danish workers, additional criteria of an absolute difference of at least five points in the mean values were set to pinpoint only differences of clinical relevance (Pejtersen et al. 2010; Nübling 2006). Additionally was tested whether the difference was larger among females than among males (gender*workgroup interaction). Unpaired t tests were used supplied with additional criteria of an absolute difference of at least five points in the mean values, again in order to pinpoint only differences of clinical relevance. Multiple linear regression analysis was employed to measure the impact of instrument group on the scores of psychosocial work environment and stress symptoms. Independent variables included: instrument group (1st violinist, 2nd violinists, other string players, and other instruments), gender, orchestra (1 through 6), age, children living at home (yes/no), having a partner (yes/no), and having a secondary job (yes/no). Dependent variables included: COPSOQ-scales of work demands, work organization and job content, interpersonal relations and leadership, work-individual interface variables of overall scales and scales of stress symptoms emotional-, cognitive-, and somatic stress. In addition, multiple regression analysis was employed to measure the effect of the psychosocial variables on the three stress scales. Independent variables included psychosocial scales (work demands, work organization and job content, interpersonal relations and leadership, work-individual interface), gender, age, orchestra, and instrument groups. Dependent variables included stress scales: emotional-, cognitive-, and somatic stress. Coefficients (β) and their 95% confidence intervals were calculated. The probability value for evaluating statistical significance was $p \leq 0.05$. All calculations were done using STATA version 10.1 (Stata Corp., College Station, TX, USA).

Table 2	Psychosocial	l work environmei	it and stress in	n Danish symphony	orchestra musicians	stratified by gender
	2			~ ~ ~ ~		20

	Danish symphony orch	nestra musicians	<i>df</i> = 340		
	Male $(n = 208)$	Female (<i>n</i> = 134)	p	Difference	
	Mean \pm (SD)	Mean \pm (SD)			
Psychosocial work environment factors					
Work demands	54.9 (9.7)	59.7 (8.9)	< 0.001	-4.8	
Quantitative demands	41.6 (10.4)	44.6 (10.6)	< 0.01	-3.1	
Work pace	57.7 (18.1)	66.0 (15.9)	< 0.001	-8.3	
Emotional demands	54.1 (17.0)	59.5 (15.2)	< 0.01	-5.4	
Demands for hiding emotions	48.7 (18.0)	54.3 (19.3)	< 0.01	-5.6	
Cognitive demands	72.5 (22.2)	75.2 (21.2)	NS	-2.7	
Work organization and job content	55.9 (13.0)	57.0 (12.0)	NS	-1.1	
Influence at work	27.8 (19.7)	25.4 (19.7)	NS	2.4	
Possibilities for development	60.9 (17.2)	63.1 (15.5)	NS	-2.2	
Meaning of work	70.0 (67.7)	70.9 (68.2)	NS	-0.8	
Commitment to the workplace	65.2 (15.8)	69.1 (14.2)	< 0.05	-3.9	
Interpersonal relation and leadership	59.6 (11.0)	61.5 (9.9)	NS	-1.9	
Role clarity	72.9 (15.7)	74.1 (13.8)	NS	-1.3	
Role conflicts	46.6 (16.7)	46.2 (16.2)	NS	0.4	
Predictability	53.8 (16.1)	56.0 (16.7)	NS	-2.2	
Social support	48.5 (20.9)	52.2 (19.5)	NS	-3.7	
Sense of community	69.7 (20.1)	71.8 (15.6)	NS	-2.1	
Reward	61.9 (14.7)	62.8 (15.3)	NS	-0.8	
Work-individual interface:	66.3 (10.1)	67.4 (10.0)	NS	-1.1	
Insecurity at work	24.2 (15.5)	25.6 (16.9)	NS	-1.4	
Job satisfaction	56.6 (10.5)	59.7 (10.0)	< 0.01	-3.1	
Stress					
Emotional stress	26.5 (15.3)	35.1 (16.9)	< 0.001	-8.6	
Cognitive stress	17.0 (14.2)	22.0 (17.1)	< 0.01	-5.0	
Somatic stress	18.1 (13.9)	27.4 (14.6)	< 0.001	-9.3	

The table shows the mean values and standard deviation (SD) for each variable. Differences are calculated and t test is performed, and p values represent significant differences in mean scores between genders. n indicates number; level of significance p < 0.05; NS denotes non-significant

Ethics

The study was approved by The Danish Data Protection Agency before the data collection in 2007 and 2008. The musicians were informed about the study by written and oral information. Consent was obtained by participation.

Results

Symphony orchestra musicians

Table 2 shows gender differences within the Danish symphony orchestras showing that female musicians reported on significantly higher work demands. Females also

reported higher commitment to the workplace and higher job satisfaction than their male colleagues. These findings were, however, underneath the threshold of relevant difference. In addition, female musicians reported on higher levels of stress symptoms on all the three scales.

The differences between instrument groups are shown in Table 3. 1st violinists reported higher work demands than 2nd violinists. However, none of these associations were significant. Moreover, 1st violinists reported significantly more emotional stress than the 2nd violinists. Compared to other string players, 2nd violinists reported lower meaning of work. Other instrument groups reported a significant lower work pace compared with 2nd violinists. According to the resource dimensions work organization and job content, interpersonal relation and leadership, and work–individual

Table 3	Mutiple regression	analysis of p	psychosocial	work environment and	d stress symptoms stratifie	d by instrumer	it group
---------	--------------------	---------------	--------------	----------------------	-----------------------------	----------------	----------

	Instrument groups					
	2. violin	1. violin	Other string players	Other instruments		
		Coeff. (95% CI)	Coeff. (95% CI)	Coeff. (95% CI)		
Psychosocial work environment factors						
Work demands	Reference	3.67 (-0.23 to 7.58)	-2.09 (-5.72 to 1.53)	-1.40 (-4.95 to 2.15)		
Quantitative demands	Reference	2.02 (-2.30 to 3.39)	-0.61 (-4.60 to 3.39)	-0.71 (-4.63 to 3.20)		
Work pace	Reference	6.10 (-0.82 to 13.02)	-4.40 (-10.79 to 1.99)	-9.58 (-15.84 to -3.31)		
Emotional demands	Reference	3.87 (-2.72 to 10.46)	-3.50 (-9.57 to 2.58)	2.27 (-3.68 to 8.22)		
Demands for hiding emotions	Reference	1.53 (-6.18 to 9.25)	-5.39 (-12.52 to 1.73)	-2.75 (-9.72 to 4.22)		
Cognitive demands	Reference	1.37 (-7.68 to 10.42)	-0.49 (-8.86 to 7.89)	-0.42 (-7.68 to 10.42)		
Work organization and job content	Reference	1.72 (-3.38 to 6.81)	3.16 (-1.57 to 7.89)	6.07 (1.44–10.70)		
Influence at work	Reference	-0.78 (-8.27 to 6.71)	3.76 (-3.16 to 10.68)	$11.86\ (5.0818.64)$		
Possibilities for development	Reference	3.76 (-2.95 to 10.47)	5.28 (-0.94 to 11.49)	8.13 (2.05–14.21)		
Meaning of work	Reference	0.04 (-0.01 to 0.09)	0.06 (0.01-0.10)	0.06 (0.01-0.10)		
Commitment to the workplace	Reference	-0.03 (-6.30 to 6.24)	-1.37 (-7.16 to 4.42)	-0.47 (-6.14 to 5.20)		
Interpersonal relation and leadership	Reference	-0.34 (-4.69 to 4.00)	3.43 (-0.53 to 7.38)	1.26 (-2.58 to 5.09)		
Role clarity	Reference	4.00 (-2.05 to 10.05)	4.02 (-1.56 to 9.61)	1.59 (-3.88 to 7.05)		
Role conflicts	Reference	3.83 (-2.80 to 10.47)	-0.87 (-6.98 to 5.25)	1.54 (-4.45 to 7.53)		
Predictability	Reference	-0.42 (-6.43 to 5.59)	-0.32 (-5.87 to 5.23)	-3.80 (-9.24 to 1.63)		
Social support	Reference	-3.08 (-11.44 to 5.27)	5.71 (-1.90 to 13.32)	8.95 (1.56–16.34)		
Sense of community	Reference	1.47 (-6.09 to 9.02)	4.80 (-2.18 to 11.78)	-1.24 (-8.08 to 5.60)		
Reward	Reference	2.21 (-3.64 to 8.06)	3.14 (-2.26 to 8.55)	4.25 (-1.03 to 9.54)		
Work-individual interface	Reference	-2.31 (-6.34 to 1.71)	-0.49 (-4.18 to 3.20)	-3.70 (-7.32 to -0.07)		
Insecurity at work	Reference	0.48 (-5.90 to 6.87)	-2.34 (-8.23 to 3.55)	2.48 (-3.29 to 8.25)		
Job satisfaction	Reference	-3.04 (-7.27 to 1.19)	-2.13 (-6.00 to 1.74)	-3.77 (-7.58 to 0.04)		
Stress						
Emotional stress	Reference	6.83 (0.10-13.57)	1.53 (-4.71 to 7.76)	-4.30 (-1.81 to 10.41)		
Cognitive stress	Reference	2.09 (-4.45 to 8.63)	1.86 (-4.18 to 7.90)	1.92 (-4.00 to 7.84)		
Somatic stress	Reference	4.62 (-1.40 to 10.65)	-2.07 (-7.65 to 3.50)	-0.28 (-5.75 to 5.18)		

Adjusted for gender, age, orchestra, children living at home, having a partner and having a secondary job. Bold denotes statitical significance at p < 0.05

interface, a tendency toward 2nd violinist reported lower scores than other instrument groups was found. However, the associations for these findings were insignificant.

Associations between psychosocial work environment and stress

Table 4 shows the relation between psychosocial work environment and stress symptoms adjusted for individual determinants. Both the overall scale of work demands and the sub-scales were positively correlated to three scales of stress symptoms. The remaining overall scales and subscales were negatively correlated to stress symptoms and associations were strong. The strongest associations were found in the category of work demands and interpersonal relations and leadership. Symphony orchestra musicians versus Danish workers

Table 5 shows that compared with Danish male and female workers, the symphony orchestra musicians reported more than 5% higher mean scores on work demand variables on two and three out of five work demands factors, respectively, and lower scores on variables of work organization and job content, interpersonal relations and leadership, and work–individual interface. The most prominent differences were the higher scores in musicians on emotional demands and cognitive demands, and the lower scores on influence at work, social support, sense of community, and job satisfaction; still musicians reported higher scores on commitment to the workplace compared with the Danish workers. Male musicians were different from the male Danish workers in relation to reporting lower possibilities for development.

Table 4	Mutiple	linear regres	ssion analy	sis of p	osychosocial	work envi	ironment and	l stress syr	nptoms
		0			2				

	Emotional stress	Cognitive stress	Somatic stress
	Coeff. (95% CI)	Coeff. (95% CI)	Coeff. (95% CI)
Psychosocial work environment factors			
Work demands	0.49 (0.31-0.68)	0.25 (0.06-0.45)	0.45 (0.29-0.62)
Quantitative demands	0.14 (-0.03 to 0.30)	0.19 (0.02-0.36)	0.12 (-0.03 to 0.27)
Work pace	0.06 (-0.04 to 0.17)	-0.01 (-0.12 to 0.09)	0.13 (0.03-0.22)
Emotional demands	0.34 (0.23-0.45)	0.19 (0.08-0.30)	0.27 (0.18-0.37)
Demands for hiding emotions	0.19 (0.09-0.28)	0.17 (0.08-0.26)	0.17 (0.09-0.25)
Cognitive demands	0.07 (-0.01 to 0.15)	-0.04 (-0.12 to 0.04)	0.05 (-0.03 to 0.12)
Work organization and job content	-0.19 (-0.33 to -0.04)	-0.22 (-0.36 to -0.08)	-0.14 (-0.27 to -0.02)
Influence at work	-0.06 (-0.15 to 0.04)	-0.07 (-0.16 to 0.03)	-0.08 (-0.17 to 0.00)
Possibilities for development	-0.14 (-0.25 to -0.03)	-0.13 (-0.23 to -0.02)	-0.09 (-0.19 to 0.00)
Meaning of work	-0.12 (-0.22 to -0.01)	-0.16 (-0.27 to -0.05)	-0.07 (-0.17 to 0.02)
Commitment to the workplace	-0.10 (-0.22 to 0.01)	-0.13 (-0.25 to -0.02)	-0.05 (-0.16 to 0.05)
Interpersonal relation and leadership	-0.42 (-0.60 to -0.25)	-0.34 (-0.53 to -0.16)	-0.25 (-0.41 to -0.09)
Role clarity	-0.12 (-0.24 to -0.01)	-0.19 (-0.31 to -0.07)	-0.10 (-0.21 to 0.00)
Role conflicts	-0.28 (-0.38 to -0.17)	-0.24 (-0.34 to -0.13)	-0.19 (-0.29 to -0.09)
Predictability	-0.09 (-0.21 to 0.03)	-0.02 (-0.14 to 0.10)	-0.04 (-0.15 to 0.06)
Social support	-0.07 (-0.16 to 0.02)	-0.05 (-0.15 to 0.04)	-0.05 (-0.13 to 0.03)
Sense of community	-0.16 (-0.25 to -0.06)	-0.12 (-0.21 to -0.02)	-0.09 (-0.18 to -0.01)
Reward	-0.24 (-0.36 to -0.12)	-0.25 (-0.37 to -0.13)	-0.13 (-0.24 to -0.02)
Work-individual interface	-0.39 (-0.57 to -0.21)	-0.42 (-0.60 to -0.24)	-0.38 (-0.54 to -0.27)
Insecurity at work	-0.20 (-0.31 to -0.09)	-0.23 (-0.34 to -0.12)	-0.22 (-0.32 to -0.12)
Job satisfaction	-0.27 (-0.44 to -0.09)	$-0.01 \ (-0.02 \ \text{to} \ -0.01)$	$-0.01 \ (-0.01 \ \text{to} \ -0.01)$

Adjusted for gender, age, orchestra, instrument groups, children living at home, having a partner and having a secondary job. Bold denotes statitical significance at p < 0.05

The female musicians differed from female workers in relation to work pace. According to stress symptoms, the Danish symphony orchestra musicians scored higher on stress symptoms than the Danish workers most evident in emotional- and somatic stress for the female musicians. The interaction term gives an indication whether difference between musicians and the Danish workforce is more pronounced in females than in males. This showed a significantly larger difference in cognitive demands and work pace, and emotional stress in females than in males, while the difference in emotional demands was lower in females due to a higher level in the female Danish workforce.

Discussion

Key findings

The findings of this national study of psychosocial work environment and stress showed that Danish symphony orchestra musicians reported their psychosocial work environment and prevalence of stress symptoms more negatively than the Danish work force in both genders. Within the group of musicians, females reported their psychosocial work environment and stress symptoms more negatively than the male musicians. Our findings indicate that 2nd violinists experienced higher work pace and lower resources than other instrument groups, whereas 1st violinists perceived higher emotional stress compared with 2nd violinists. In general, adverse psychosocial work environment was strongly and positively associated with stress symptoms.

Regarding the findings of gender differences, female musicians reported higher work demands and in particular higher stress symptoms compared with their male colleagues. Similar differences have been reported by others (Liljeholm Johansson and Theorell 2003). On the other hand, female musicians reported higher commitment to the work place and higher job satisfaction which are known strong motivational factors for choice of job and important factors of wellbeing. A part of this difference was inherited by a general higher rate of symptoms in the female work force, but the test of interaction indicated that work as a musician is more strenuous to women than men resulting in

	Danish symphony orchestra musicians		Danish workers		Differences between musicians and Danish workers		
	Male (<i>n</i> = 208)	Female (<i>n</i> = 134)	Male (<i>n</i> = 1,668)	Female (<i>n</i> = 1,849)	Male difference	Female difference	Female difference
	Mean \pm (SD)	$Mean \pm (SD)$	$\text{Mean} \pm (\text{SD})$	$\text{Mean} \pm (\text{SD})$			difference
Psychosocial work environment for	actors						
Work demands							
Quantitative demands	41.6 (10.4)	44.6 (10.7)	40.1 (20.0)	40.2 (20.8)	1.5	4.4	2.9
Work pace	57.7 (18.1)	66.0 (16.0)	58.6 (18.5)	60.1 (19.6)	-0.9	5.9	6.8
Emotional demands	54.1 (17.0)	59.5 (15.2)	34.2 (22.7)	46.5 (24.2)	19.9	13.0	-6.9
Demands for hiding emotions	48.7 (18.0)	54.3 (19.3)	47.2 (21.1)	53.7 (19.8)	1.5	0.6	-0.9
Cognitive demands	72.5 (22.3)	75.2 (21.2)	64.3 (18.7)	46.5 (24.2)	8.2	28.7	20.5
Work organization and job conten	ıt						
Influence at work	27.8 (19.8)	25.4 (19.7)	51.8 (21.7)	47.8 (20.4)	-24.0	-22.4	1.6
Possibilities for development	60.9 (17.2)	63.1 (15.6)	66.0 (17.6)	65.7 (17.5)	-5.1	-2.6	2.5
Meaning of work	70.0 (67.7)	70.9 (68.3)	73.2 (15.7)	74.3 (15.7)	-3.2	-3.4	-0.2
Commitment to the workplace	65.7 (15.9)	69.1 (14.2)	60.9 (19.8)	60.9 (20.8)	4.8	8.2	3.4
Interpersonal relation and leadersh	hip						
Role clarity	72.9 (15.7)	74.1 (13.8)	73.9 (16.3)	73.2 (16.3)	-1.0	0.9	1.9
Role conflicts	46.6 (16.8)	46.2 (16.3)	42.5 (16.1)	41.4 (16.8)	4.1	4.8	0.7
Predictability	53.8 (16.1)	56.0 (16.7)	57.5 (21.3)	57.8 (20.4)	-3.7	-1.8	1.9
Social support	48.5 (20.9)	52.2 (19.6)	55.0 (19.9)	59.3 (19.3)	-6.5	-7.1	-0.6
Sense of community	69.7 (20.1)	71.8 (15.6)	79.3 (18.6)	78.1 (19.1)	-9.6	-6.3	3.3
Reward	61.9 (14.8)	62.8 (15.3)	66.7 (19.1)	65.7 (20.5)	-4.8	-2.9	1.9
Work-individual interface							
Insecurity at work	24.2 (15.6)	25.6 (17.0)	22.6 (19.5)	24.7 (21.8)	1.6	0.9	-0.7
Job satisfaction	56.6 (10.6)	59.7 (10.0)	65.3 (17.9)	65.1 (18.4)	-8.7	-5.4	3.3
Stress							
Emotional stress	26.5 (15.3)	35.1 (17.0)	25.4 (17.0)	27.7 (18.1)	1.1	7.4	6.3
Cognitive stress	17.0 (14.3)	22.0 (17.1)	16.8 (15.1)	18.7 (16.0)	0.2	3.3	3.1
Somatic stress	18.1 (13.9)	27.4 (14.7)	14.6 (14.5)	20.6 (16.6)	3.5	6.8	3.3

Table 5 Psychosocial work environment and stress in Danish symphony orchestra musicians and Danish workers stratified by gender

Differences and interaction between gender and work are calculated and tested using unpaired *t* test. Values in bold represent differences of more than 5%, which all are significant with p < 0.01. *n* indicates number; mean and SD indicates standard deviation

higher perceived cognitive demands and emotional stress symptoms.

In relation to instrument groups, the 2nd violinists reported lower resources compared with other instrument groups in accordance with the previously stated expectations. Liljeholm stated that social pressure to perform perfectly is omnipresent during the carrier as professional symphony orchestra musician. Great emphasis is put on the individual to contribute to a high artistic quality both on an individual level but also in the orchestra as a whole (Johansson 2010). This may be part of the reason why the 2nd violinists reported lower social support and reward compared with the other instrument groups. The findings in the present study also indicate that string players in general experience lower influence and possibilities for development compared with other instrument groups. The findings in this study distinguish between string players but do not, however, distinguish between the group of "other instruments". There may be important differences between string players and wood wind players, brass players, percussion, and other but the groups were too small to make any distinctions.

Associations between psychosocial work environment and stress showed that the musicians' reporting of adverse work demands, work organization and job content, interpersonal relations and leadership, and work-individual interface were significantly associated with increasing stress symptoms. Other studies have found specific working conditions of musicians to be related to adverse psychological outcomes such as interactions with the conductor, rehearsals, artistic integrity, solo performances, and performance anxiety (Parasuraman and Purohit 2000; Liljeholm Johansson and Theorell 2003; Salmon et al. 1995; Middlestadt and Fishbein 1988). Social support has been identified as an important stressor in symphony orchestras in several previous studies (Liljeholm Johansson and Theorell 2003; Johansson 2010; Theorell et al. 2007). However, in the present study, the findings on associations of social support and stress did not emphasize this factor in particular.

Finally, the findings indicate that both male and female musicians experience more strenuous work conditions and stress compared with Danish workers (National Research Centre for the Work Environment 2005). A Norwegian study also found that musicians reported higher levels of gastrointestinal complaints and pseudoneurology complaints such as tiredness and mood changes compared with a representative sample of the Norwegian population (Halleland et al. 2010). The findings in this study were also consistent with previous studies showing high work demands, adverse job content, and high perception of stress being of concern (Theorell and Ahlberg-Hulten 1990; Liljeholm Johansson and Theorell 2003; Parasuraman and Purohit 2000; Middlestadt and Fishbein 1988). In addition, low influence was reported in the Danish musicians, which in combination with high demands according to the demandcontrol-model, is known to cause adverse health effects such as cardiovascular diseases and therefore may be considered a serious risk (Karasek 1979). Moreover, social support is known to decrease the risk of high demands and low control (Karasek and Theorell 1990; Johnson and Hall 1988). However, our findings showed that both social support and the related variables sense of community and role conflicts were reported negatively in the musicians compared with the Danish workers. In addition, our multivariate analysis showed that these variables individually were associated with the musicians' experience of stress; however, no combination of variables was analyzed. A positive finding related to the musicians reporting of higher commitment to the work place than the Danish workers. A possible explanation of these findings might be that the musicians often commit themselves to work in the same symphony orchestra throughout their musical careers and thus develop a strong attachment.

In relation to prevention, a comparison with specific work groups is interesting. Pejtersen et al. have data for many Danish professions from a national study that used the same COPSOQ instrument. Compared to these findings, the group of Danish symphony orchestra musicians had similar scores as academics in social- and human sciences in relation to work demands (Pejtersen et al. 2010). On the other hand, according to the dimensions work organization, interpersonal relations, and work–individual interface, the symphony orchestra musicians had similar scores to slaughterhouse workers (Pejtersen et al. 2010). Therefore, the symphony orchestra musicians have a unique psychosocial work environment that cannot necessarily be compared with other occupational groups with similar educational levels.

Limitations

Including six out of seven symphony orchestras in Denmark, with a response rate of 78%, the study population was representative of the population of Danish symphony orchestra musicians according to sex, age, type of orchestra, and geography, suggesting that the response bias is limited. However, respondents and non-respondents may differ thus non-respondents may have higher prevalence of stress symptoms. If this is the case, our study may have underestimated the prevalence of stress symptoms.

The majority of the musicians in this study have been playing music full time for decades and a major selection can be expected to have taken place several years ago. Based on this assumption, the risk of a healthy worker effect is existent; however, this may potentially only weaken the associations found. Likewise, a healthy worker effect may be present in the population of the general work force which potentially may have increased the difference between musicians and Danish workers in our findings.

One main limitation of the study is inherent to the crosssectional design because both exposure and outcome are measured at the same time representing the problem of common method bias (Kristensen 1996). Therefore, the associations between perceived psychological work environment and stress symptoms found in this study may represent problems for Danish orchestra musicians but may not be interpreted as causal relations. Moreover, assessment by questionnaire includes only selected variables representing a limited area of psychosocial work environment and stress. Stress reactions occur as an interaction between the individual's work situation (psychosocial and physical work environment), private life situation, and personal factors (genetics, gender, age, personality; Gadalla 2009). Several individual determinants were included in the analysis to avoid confounding but due to the complexity of stress potential, confounders may have been omitted.

A golden standard for measuring stress is not available; triangulation is suggested by comparing the self-reported measures of perceived stress with behavioral and physiological measures of stress (Kristensen 1996; European Commission 2002). This was desirable, but not possible in the given research context. The generic COPSOQ instrument was used in the study, and this theory-based instrument has been tested nationally as a reliable and valid method to assess psychosocial work environment and stress reactions in a wide range of occupations (Pejtersen et al. 2010; Arvidsson et al. 2008; Borritz et al. 2006). Information bias can, however, occur in case of different interpretations of the items within different groups, e.g., gender and instrument groups. However, our findings are very similar to Liljeholm and Theorell's findings based on an adapted questionnaire for musicians (Liljeholm Johansson and Theorell 2003).

Conclusion

This study characterized the psychosocial work environment in the Danish symphony orchestras. Within the orchestras, female musicians and 2nd violinists seemed to be of particular risk compared with the other instrumental groups in aspects of work pace, work organization, and content. Associations between the demanding psychosocial work environment and increasing stress symptoms could indicate a need for promotion and improvement of the musicians' working conditions in order to prevent possible adverse health effects. Finally, both male and female symphony orchestra musicians reported a more demanding psychosocial work environment exposure and a higher level of stress symptoms compared with what was earlier found among the general Danish workforce. Our findings emphasize the importance for future studies to focus more comprehensively on the work-related, private, and personal factors associated with stress reactions, and coping strategies to deal with stressors in a symphony orchestra context in order to get a deeper understanding of these relations.

Acknowledgments We would like to thank the participating symphony orchestras for taking part in the study. Thanks to the Danish National Research Centre for the Working Environment for providing data on the general work force. The study was funded by the Health Foundation, Denmark; The Carl Nielsen Academy of Music, Odense, Denmark; The Faculty of Health Sciences and The Clinical Institute, University of Southern Denmark, Odense, Denmark.

Conflict of interest The authors declare that they have no competing interests. The funding organization had no role in the design or the conduct of the study.

References

- Arvidsson I, Axmon A, Skerfving S (2008) Follow-up study of musculoskeletal disorders 20 months after the introduction of a mousebased computer system. Scand J Work Env Hea 34:374–380
- Bjorner J, Pejtersen JH (2010) Evaluating construct validity of the second version of the copenhagen psychosocial questionnaire

through analysis of differential item functioning and differential item effect. Scand J Public Health 38:90–105

- Borritz M, Rugulies R, Bjorner JB, Villadsen E, Mikkelsen OA, Kristensen TS (2006) Burnout among employees in human service work: design and baseline findings of the PUMA study. Scand J Public Health 34:49–58
- European Commission (2002) Guidance on work-related stress: spice of life kiss of death. Report, Luxembourg: Office for Official Publications of the European Communities
- Fetter D (1993) Life in the orchestra. Md Med J 42:289-292
- Gadalla TM (2009) Determinants, correlates and mediators of psychological distress: a longitudinal study. Soc Sci Med 68:2199–2205
- Halleland HB, Harris A, Sørnes S, Murison R, Ursin H (2010) Subjective health complaints, stress, and coping in orchestra muscians. Med Probl Perform Ar 24:58
- Hamilton LH, Kellea JJ, Hamilton WG (1995) Personality and occupational stress in elite performers. Med Probl Perform Ar 10:86–89
- Hope S, Rodgers B, Power C (1999) Marital status transitions and psychological distress: longitudinal evidence from a national population Sample. Psychol Med 29:381–389
- Johansson YL (2010) Psyksocial arbeitsmiljö I en yrkesgrupp med krav på hög kvalitet—orkestrar inom konstmusik. Thesis, Karolinska Instituttet—Department of Public Health Science, Sweden
- Johnson JV, Hall EM (1988) Job strain, work place social support, and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population. Am J Public Health 78:1336–1342
- Jorm AF, Windsor TD, Dear KJ, Christensen H, Rodgers B (2005) Age group differences in psychological distress: the role of psychosocial risk factors that vary with age. Psychol Med 35:1253–1263
- Karasek RA (1979) Job demands, job decision latitude and mental strain: implications for job redesign. Adm Sci Q 24:285–307
- Karasek R, Theorell T (1990) Healthy work. Basic Books, New York
- Kivimäki M, Jokinen M (1994) Job perceptions among symphony orchestra musicians: a comparison with other occupational groups. Med Probl Perform Ar 9:73–76
- Kristensen TS (1996) Job stress and cardiovascular disease: a theoretic critical review. J Occup Health Psychol 1:246–260
- Laitinen H, Poulsen T (2008) Questionnaire investigation of musicians' use of hearing protectors, self reported hearing disorders, and their experience of their working environment. Int J Audiol 47:160–168
- Landsbergis PA, Schnall PL, Pickering TG, Warren K, Schwartz JE (2003) Lower socioeconomic status among men in relation to the association between job strain and blood pressure. Scand J Work Env Hea 29:206–215
- Liljeholm Johansson Y (1996) Konstmusikers arbeitssituation-en explorativ studie med fokus på arbetstillfredsställelse och prestationsstress. SAMU, Sweden
- Liljeholm Johansson Y, Theorell T (2003) Satisfaction with work task quality correlates with employee health. Med Probl Perform Art 18:141–149
- Mausner-Dorsch H, Eaton WW (2000) Psychosocial work environment and depression: epidemiologic assessment of the demandcontrol model. Am J Public Health 90:1765–1770
- Middlestadt SE, Fishbein M (1988) Health and occupational correlates of perceived occupational stress in symphony orchestra musicians. J Occup Med 30:687–692
- National Research Centre for the Work Environment (2005) Psykisk arbejdsmiljø [psychosocial work environment, COPSOQ]. Available at: http://www.arbejdsmiljoforskning.dk/Nationale%20Data/ 3DII.aspx. Accessed 10 Dec 2010
- Nübling M (2006) Measuring psychological stress and strain at work—evaluation of the COPSOQ questionnaire in Germany. Psycho Soc Med 3:1860–5214

- Ostwald PF, Baron BC, Byl NM, Wilson FR (1994) Performing arts medicine. West J Med 160:48–52
- Paarup HM, Baelum J, Holm JCW, Maniche C, Wedderkopp N (2011) Prevalence and consequences of musculoskeletal symptoms in symphony orchestra musicians vary by gender: a cross-sectional study. BMC Musculoskel Dis 12:223
- Parasuraman S, Purohit YS (2000) Distress and boredom among orchestra musicians: the two faces of stress. J Occup Health Psychol 5:74–83
- Pejtersen JH, Kristensen TS, Borg V and Bjorner JB (2010) The second version of the Copenhagen psychosocial questionnaire. Scand J Public Health 38:8
- Piperek M (1981) Stress and music: medical, psychological, sociological and legal strain factors in a symphony orkestra musician's profession. Universitäts-Verlagsbuchhandlung Ges., Wien
- Pugliesi K (1999) The consequences of emotional labor: effects on work stress, job satisfaction, and well-being. Motiv Emot 23:125–154

- Salmon P, Shook CP, Lombart K, Berenson G (1995) Performance impairments, injuries, and stress hardiness in a sample of keyboard and other instrumentalists. Med Probl Perform Ar 10:140– 146
- Stansfeld SA, Fuhrer R, Shipley MJ (1998) Types of social support as predictors of psychiatric morbidity in a cohort of British civil servants (Whitehall II study). Psychol Med 28:881–892
- Sternbach D (1993) Addressing stress-related illness in professional musicians. Md Med J 42:283–288
- Theorell T, Ahlberg-Hulten G (1990) A psychosocial and biomedical comparison between men in six contrasting service occupations. Work Stress 4:51–63
- Theorell T, Liljeholm-Johansson Y, Björk H, Ericson M (2007) Saliva testosterone and heart rate variability in the professional symphony orchestra after "public faintings" of an orchestra member. Psychoneuroendocrino 32:660–668