Psychosocial work conditions, perceived stress, perceived muscular tension and neck/shoulder symptoms among medical secretaries.

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Abstract

Purpose: Unfavorable psychosocial working conditions are hypothesized to lead to perceived stress, which, in turn, can be related to an increased risk for development of neck/shoulder symptoms through increased and sustained muscle activation. The aim of the present study was to test this hypothesized process model among medical secretaries, a female-dominated profession characterized by a high amount of VDU (visual display unit) use and a high prevalence of neck/shoulder symptoms.

Methods: In this cross-sectional study a questionnaire survey was conducted among medical secretaries (n = 200). The proposed process model was tested using a path model framework.

Results: The results indicate that high work demands were related to high perceived stress which in turn was related to a high perceived muscle tension and neck/shoulder symptoms. Low influence at work was not related to perceived stress, but was directly related to a high perceived muscle tension.

Conclusions: In general this cross-sectional result lend tentative support for the hypothesis that adverse psychosocial work conditions (high work demands) may contribute to the development of neck/shoulder symptoms through the mechanism of stress-induced sustained muscular activation. This process model needs to be further tested in longitudinal studies.

Key words: Neck/shoulder symptoms, medical secretaries, psychosocial work environment, perceived stress, perceived muscular tension.

Introduction

Musculoskeletal symptoms and upper extremity disorders are common among VDU (visual display unit) users, and research has found an increased risk of upper extremity symptoms with increasing time spent at the VDU (Aarås et al. 2000; Christensen and Lundberg 2002). These symptoms have been reported to be more common among female than male VDU users (Jensen et al. 2002; Polanyi et al. 1997). Several reviews have concluded that there is evidence for significant associations between unfavorable psychosocial working conditions, such as high job demands and workload, low job control and lack of social support, and musculoskeletal symptoms (Ariens et al. 2001; Bongers et al. 2006; Hoogendoorn et al. 2000; NIOSH 1997). Recent studies in Scandinavia suggest unfavorable psychosocial working conditions among medical secretaries characterized by high work demands, low control, and high efforts in combination with low rewards (Hertting et al. 2003; Rugulies et al. 2009). Medical secretaries in general perform repetitive work with a high amount of VDU use (Swedish Work Environment Authority & Statistics Sweden 2003). It is therefore not surprising that medical secretaries, a female-dominated profession with a high amount of VDU use, is also characterized by work-related complaints in shoulders and arms (Swedish Work Environment Authority & Statistics Sweden 2003). However, few studies investigating psychosocial and occupational health among this occupational group are reported in the literature.

An unfavorable psychosocial work environment may contribute to the development of musculoskeletal symptoms through an increase in perceived stress (Bongers et al. 1993; Sauter and Swanson 1996). This hypothesized pathway is supported by empirical studies showing associations between self-reported stress and neck/shoulder symptoms (Larsman et al. 2006; Miranda et al. 2001; Nahit et al. 2003; Viikari-Juntura et al. 2001). A number of non-specific bio-behavioral mechanisms have been hypothesized to explain how perceived stress may affect the physiological processes involved in common musculoskeletal disorders (Bongers et al. 1993; Melin and Lundberg 1997). One of the hypothesized pathways for perceived stress to influence musculoskeletal symptoms is through increased and sustained muscle activation, and through a lack of muscular rest (Hägg 1991; Hägg and Åström 1997; Larsman et al. 2009; McLean and Urquhart 2002; Sjøgaard et al. 2000; Veiersted et al. 1993; Westgaard 1999). The Cinderella hypothesis (Hägg 1991) is an influential hypothesis in this field. According to this hypothesis, the motor units first recruited would stay active as long as the muscle is activated. In the presence of stress-related muscle activation, these motor units would be engaged as long as the stressful condition is in progress. In this way, stress-induced

muscle activity (Lundberg et al. 1994; Lundberg 2002) could lead to musculoskeletal symptoms as the first recruited motor units – the Cinderella units – get overused and damaged.

Stress-induced muscular activation may lead to sensations of (muscular) tension and discomfort, which can be considered an early sign of the development of musculoskeletal disorders (Sandsjö et al. 2006; Wahlström et al. 2004). This hypothesized relation between perceived muscular tension and the development of neck/shoulder symptoms are supported by cross-sectional studies (Holte and Westgaard 2002; Theorell et al. 1991; Vasseljen et al. 2001) as well as by longitudinal studies (Wahlström et al. 2004). In a prospective cohort study peak and cumulative musculoskeletal discomfort was found to predict future neck/shoulder pain (Hamberg-van Reenen et al. 2008).

Several psychosocial pathways to musculoskeletal disorders have been presented (see e.g., Faucett 2005). There is however a lack of empirical studies testing these process models, and specific pathways linking work stress to upper extremity symptoms need to be further investigated. The aim of the present study was to test a hypothesized process (path) model of the relations between psychosocial work environment and neck/shoulder symptoms with perceived stress and muscle tension as proposed mediators in a sample of medical secretaries. This hypothesized process model is presented in figure 1.

[Please insert figure 1 about here]

A fundament for this proposed process model is the generic psychosocial stress model (Sauter and Swanson 1996) where factors in the work environment (stressors, e.g. job demands) cause stress effects which, if persistent or frequent, can lead to negative health outcomes. This model was further developed by Wahlström (2003) who incorporated perceived muscular tension into the original model. This proposed process model is further based on a biopsychosocial model (Melin and Lundberg 1997) where unsatisfying psychosocial factors in and outside the workplace lead to increased psychological stress, which increases the risk for musculoskeletal disorders through an increase in muscle activation and secretion of cortisol and catecholamines.

The following hypotheses were tested in the present study:

a) An adverse psychosocial work environment (high work demands, low influence at work, or lack of social support) is related to neck/shoulder symptoms.
b) The relationship between an adverse psychosocial work environment and neck/shoulder symptoms is mediated by perceived work-related stress.

c) The relationship between work-related stress and neck/shoulder symptoms is mediated by perceived muscle tension.

Methods

Design

This cross-sectional study was based on a questionnaire survey among medical secretaries in Sweden. Ethical approval was obtained from the regional ethics committee in Gothenburg and the study performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent was provided by all respondents prior to inclusion in the study.

Participants

Study sample

A screening questionnaire was sent out to all medical secretaries at hospital units connected to a specific health care provider (Hälsan & Arbetslivet). In total 364 questionnaires were sent out, out of which 268 were returned (74%). Twelve respondents returned the questionnaire without responding to a single question, resulting in a study sample of $n = 253$. All of the respondents were female. About 10% were between 20 and 34 years old, 46% were between 35 and 49 years old, and 44% were between 50 and 65 years old. A little more than half of the respondents were employed full-time. The seniority of the respondents were fairly high, with 49% having more than 10 years of employment, 30% having 5-10 years of employment, 20% having between 1 and 5 years of employment, and only 1% having less than 1 year of employment.

Measures

Psychosocial work environment

Employee perceptions of their *Work demands* (6 items; “work very fast”, “unevenly distributed workload”, “not having time to complete all work tasks”, “work puts me in emotionally disturbing situations”, “emotional involvement in work”, and “work requires me to hide my emotions”, $\alpha = .69$), *Influence at work* (3 items; “influence over decisions”, “influence over amount of work”, and “influence over work tasks”, $\alpha = .71$), and *Social support* (6 items; “help and support form supervisor”, “help and support from coworkers”,

"feedback from supervisor, "feedback from coworkers", "coworker cooperation", and "fellowship", α = .68) were assessed using the short version of the Copenhagen Psychosocial Questionnaire (COPSOQ) (Kristensen et al. 2002). For each of these items there were 5 fixed response alternatives (1 to 5) ranging from "always/almost always" to "never/hardly ever" for demands and social support, and from "to a very great extent" to "to a very small extent" for influence at work. The variables work demands, influence at work and coworker support were constructed by deriving the mean values for the items in the respective factor, with high mean values indicating high work demands, high influence and high support.

Perceived stress

Perceived stress was assessed using the two-dimensional mood adjective checklist (Kjellberg and Iwanowski 1989; Kjellberg et al. 2000). This checklist, which was constructed to be used to describe mood during work, contains two mood dimensions – stress and energy. In the present study only the stress (α = .92) dimension was considered. It was measured using the six items "rested" (reversed), "relaxed" (reversed), "calm" (reversed), "tense", "stressed", and "pressured". The respondents were instructed to think about how they usually feel at the end of a normal workday. There were six fixed response alternatives (1 to 6) ranging from "not at all" to "to a very great degree". The variable perceived stress was constructed by deriving the mean value for the stress items, with high mean values indicating a high level of stress.

Perceived muscular tension

Perceived muscular tension (PMT) (Wahlström et al. 2003; Wahlström et al. 2004) was assessed using the question "Have you, during the past month, experienced muscular tension (for example: wrinkled your forehead, ground your teeth, raised your shoulders)?" There were four fixed response alternatives; never, a few times, a few times per week, one or several times per day.

Neck/shoulder symptoms

Respondents were instructed to indicate if they had experienced musculoskeletal pain during the past month and, if "yes", the number of days with ache or pain during the past month (1-31). In the present study the neck and shoulder regions were included. The variable *neck/shoulder symptoms* was constructed by deriving the mean value for the items number of days with neck pain, number of days with pain in the left shoulder, and number of days with pain in the right shoulder.

Statistical analysis

The proposed process model was tested in a path analysis framework using AMOS 18, employing the maximum likelihood (ML) estimator. Input data consisted of the raw data that were stored in PASW 18. Direct, indirect and total effects were estimated. Standard errors for these effects were estimated using bootstrap. Only respondents with complete data were included in the path analysis (n = 200).

Missing value analysis

Missing data for any of the variables included in the process model (work demands, influence, social support, stress, PMT and neck/shoulder symptoms) was present in 56 respondents (22% of the total sample). For 15 of these respondents data was missing by design, since they did not receive the questionnaire items regarding the psychosocial work environment. For 37 respondents (14% of the total sample) data regarding neck/shoulder symptoms were missing. These respondents did not differ from those with complete data for neck/shoulder symptoms regarding age, working hours, seniority, demands, influence, support, or perceived muscle tension. They did however report a slightly lower perceived stress ($t = 2.41$, df=250, $p < .05$).

Results

About 70% of the participants reported neck/shoulder symptoms (pain for at least 1 day during the past month). Parameter estimates for the path model are presented in table 1, and the resulting model is depicted in figure 2.

[Please insert table 1 about here]

Work demands were correlated with influence at work such that high demands in general were associated with lower influence. Influence at work was correlated with social support, with higher influence in general being associated with higher social support. Work demands and social support were not correlated.

Work demands had an effect on perceived stress (direct effects) such that higher demands were related to higher levels of stress. Influence at work and social support were not related to perceived stress when the effects of work demands were controlled for. Influence at work (but not work demands or social support) however showed a direct effect on perceived muscular tension. More influence at work was related to less muscular tension. None of the psychosocial factors were directly related to neck/shoulder symptoms. Perceived stress was

positively related to perceived muscular tension (direct effects), i.e. higher stress levels were related to a higher muscular tension. Perceived muscular tension was positively related to neck/shoulder symptoms, i.e., a higher muscular tension was related to more neck/shoulder symptoms. Work demands were related to perceived muscular tension through their effects on perceived stress (indirect effects), with higher demands being related to more stress and higher muscular tension. Furthermore, work demands were related to neck/shoulder symptoms (indirect effects) through their effects on stress and muscular tension. Perceived stress was not directly related to neck/shoulder symptoms, but had an effect on symptoms through its effect on perceived muscular tension (indirect effects). The model accounted for 31% of the variation in perceived stress, 30% of the variation in perceived muscular tension, and 24% of the variation in neck/shoulder symptoms.

[Please insert figure 2 about here]

Discussion

The prevalence of neck/shoulder symptoms was fairly high among the medical secretaries included in the present study, with about 70% of respondents reporting pain in the neck/shoulder area for at least 1 day during the past month.

As hypothesized, high work demands were related to a high perceived stress, however influence and social support at work were not related to perceived stress (when controlling for the effects of work demands). These findings are in general consistent with previous research among female VDU users, e.g., Larsman et al. (2006) who found work demands to be related to perceived stress among female computer users. These results are also partly consistent with studies investigating predictors for perceived stress among other occupational groups, e.g., Kjellberg and Wadman (2002) who, in a study among blue- and white collar workers, found psychological demands and social support but not decision latitude to be related to perceived stress, Kjellberg et al. (2000), who found psychological demands but not social support or decision latitude to be related to perceived stress among employees in a car body factory, and Larsman et al. (2010), who found work demands but not control to be prospectively related to perceived stress among public health care workers and social insurance officers.

Several reviews have concluded that there is in general evidence for significant associations between unfavorable psychosocial working conditions, such as high job demands and workload, low job control and lack of social support, and musculoskeletal symptoms (Ariens et al. 2001; Bongers et al. 2006; Hoogendoorn et al. 2000; NIOSH 1997). Few studies investigating occupational health among medical secretaries are reported in the literature;

however Hägg and Åström (1997) found that medical secretaries with shoulder/neck complaints had lower work task satisfaction than their coworkers without neck/shoulder complaints, and Linton and Kamwendo (1989) found that a poor psychosocial work environment (poor work content, low social support at work, and high work demands) was associated with neck and shoulder pain among medical secretaries and other hospital office personnel. The results of the present study agree with the hypothesized relation between perceived work demands and neck/shoulder symptoms. There was an indirect effect of work demands on symptoms such that higher perceived demands were related to more symptoms. Such an effect was however not found for the other aspects of the psychosocial work environment.

The hypothesis that perceived stress influence neck/shoulder symptoms was supported in the present study. This finding is consistent with previous studies showing associations between self-reported stress and neck/shoulder symptoms within different occupational groups (Kjellberg and Wadman 2002; Kjellberg et al. 2000; Miranda et al. 2001; Nahit et al. 2003; Viikari-Juntura et al. 2001). The results of the present study further indicate that the relationship between perceived stress and neck/shoulder symptoms was mediated by perceived muscle tension (PMT), that is, a high perceived stress was related to high perceived muscle tension, which, in turn, was related to more neck/shoulder symptoms. These results are in accordance with a study by Wahlström et al. (2004) who, in a longitudinal study among VDU users, found participants with high PMT to have a higher risk of developing pain. Furthermore, Byström et al. (2004) found physical discomfort (aching, hurting, stiff joints, numbness, and tense muscles), to partially mediate the relationship between psychological workload and musculoskeletal (neck, shoulder, upper back, low back) symptoms among blue collar workers.

In summary, work demands were related to neck/shoulder symptoms, and this relationship was completely mediated by perceived stress and perceived muscle tension. These results are in accordance with Larsman et al. (2006), who found that work demands were related to musculoskeletal symptoms among female VDU uses, and that this relation was completely mediated by perceived stress. These findings indicate that work demands are related to neck/shoulder symptoms only to the degree that they are related to feeling of stress. The relationship between perceived stress and symptoms was in turn completely mediated by perceived muscle tension, a finding that further supports the hypothesis that perceived stress is related to upper extremity symptoms through the mechanism of stress induced muscle activity/lack of muscle rest. These results are in accordance with Wahlström et al. (2003) who

found that VDU users who perceived high muscle tension also worked with higher muscle activation and with Hägg and Åström (1997) who found that medical secretaries with shoulder/neck complaints had fewer episodes of muscle rest than their coworkers without neck/shoulder complaints. They also concur with Larsman et al. (2009) who found associations between work-related perceived stress and trapezius muscle activity and rest during standardized simulated computer work among female VDU users.

An interesting finding was that the relationship between influence at work and perceived muscle tension was not mediated by perceived stress, i.e., a high influence did not reduce stress perceptions per se, but it was related to a lower PMT. A high influence at work may therefore act as "a buffer", reducing the harmful effects of stress on musculoskeletal health. In general this finding is consistent with theories within the field of work-related health e.g., the Demand-Control model where the adverse health effects of high work demands are assumed to be buffered by influence at work (Karasek 1979), such that insufficient levels of influence at work will enhance the adverse health effects of high work demands. In the context of medical secretary work this association may be interpreted such that a high influence over work tasks and amount of work means that the employee has opportunities to plan and perform work tasks in a way that allows for sufficient variation and micro breaks during the work day leading to a higher amount of muscle rest and thus less perceived muscle tension.

Study limitations

The proposed path model tested in the present study should be considered an "as if" model of causality (Kline 1998). The construction of this model and the interpretation of the results involve assumptions considering temporality. The model is specified such that aspects of the psychosocial work environment influence perceived stress, which, in turn, cause perceived muscle tension, which, in turn, influence the prevalence of neck/shoulder symptoms. These assumptions are based on results from previous research and on theoretical models, and, as such, considered plausible. However, other patterns of causality such as reversed or reciprocal causality might also be plausible. It is e.g. possible that suffering from neck/shoulder symptoms may cause a person to perceived higher work demands and higher stress. The relationship between muscle activation and neck/shoulder symptoms is probably reciprocal, e.g., previous research indicates an increased motor response to psychological stress among female VDU users with neck/shoulder complaints (Thorn et al. 2007). Because of the cross-

sectional nature of the data, and also because of a relatively large amount of missing data for the outcome variables, the present study should be regarded as an exploratory study that generates hypotheses to be addressed in future research. Focus of the present study is on medical secretaries, and any generalizations to other occupations should be made with caution.

Conclusions

The results of the present study indicate that high work demands are related to neck/shoulder symptoms, and that perceived stress and muscle tension are important mechanisms in this relationship. These results further support the hypothesis that influence at work may act as a buffer, helping employees deal with high work demands. The present study is however based on cross-sectional data, and therefore interpretations need to be made with caution.

Relevance for industry

In order to prevent or reduce the prevalence of neck/shoulder symptoms among medical secretaries it is important to keep work demands at optimal levels, and to provide employees with sufficient influence over work so that they can plan and perform work tasks in a way that allows them to reduce repetitive work movements and introduce micro breaks to the extent needed in order to introduce muscle rest and reduce muscle tension. Perceived stress and muscle tension may be viewed as early indicators, or warning signals, that should be carefully monitored in order to detect potentially harmful situations so that musculoskeletal symptoms can be avoided or minimized.

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Conflict of interest

The authors declare that they have no conflict of interest.

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Table 1 Selected parameters for the hypothesized process model

	Parameter estimate[a] and standard error (within brackets) *n = 200*
Correlations	
demands ↔ influence	-0.08 / -.21 (0.03)**
demands ↔ support	-0.02 / -.06 (0.02)
influence ↔ support	0.09 / .24 (0.03)**
Direct effects	
demands → stress	0.88 /.52 (0.10)**
influence → stress	-0.07 / -.05 (0.09)
support → stress	-0.22 / -.12 (0.12)
stress → PMT	0.53 / .48 (0.08)**
PMT → neck/shoulder symptoms	3.84 / .37 (0.87)**
demands → PMT	0.05 / .03 (0.14)
influence → PMT	-0.25 / -.16 (0.10)*
support →PMT	0.02 / .01 (0.13)
stress → neck/shoulder symptoms	1.99 / .17 (1.06)
demands → neck/shoulder symptoms	-1.69 / -.09 (1.56)
influence → neck/shoulder symptoms	-1.29 / -.08 (1.03)
support → neck/shoulder symptoms	-0.87 / -.04 (1.63)
Indirect effects	
demands on PMT through stress	0.46 / .25 (0.09)**
influence on PMT through stress	-0.04 / -0.02 (0.05)
support on PMT through stress	-0.12 / -0.06 (0.07)
demands on symptoms through stress and PMT	3.70 /0.19 (0.99)**
influence on symptoms through stress and PMT	-1.23 /-0.08 (0.56)*
support on symptoms through stress and PMT	-0.82 / -0.04 (0.70)
stress on symptoms through PMT	2.02 / 0.18 (0.54)**

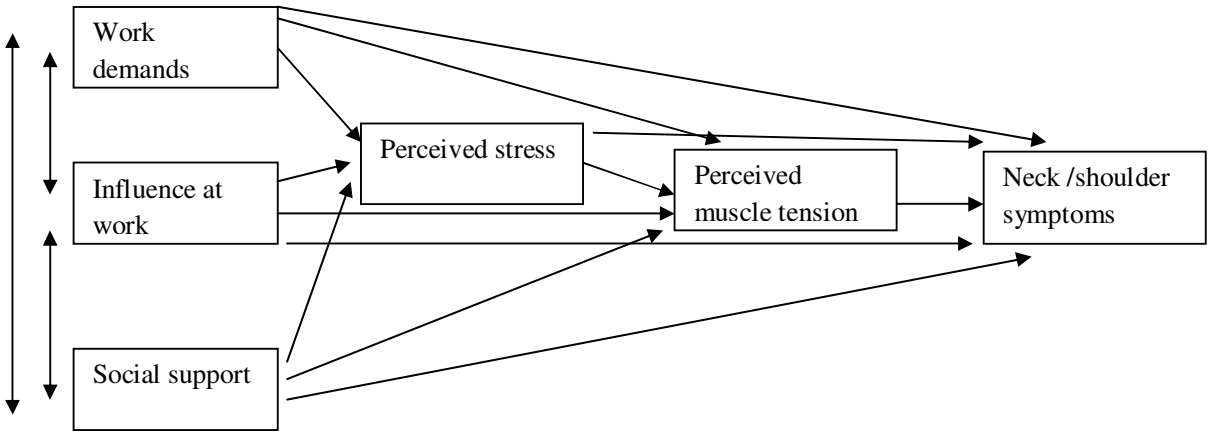
[a] Unstandardized / standardized parameter

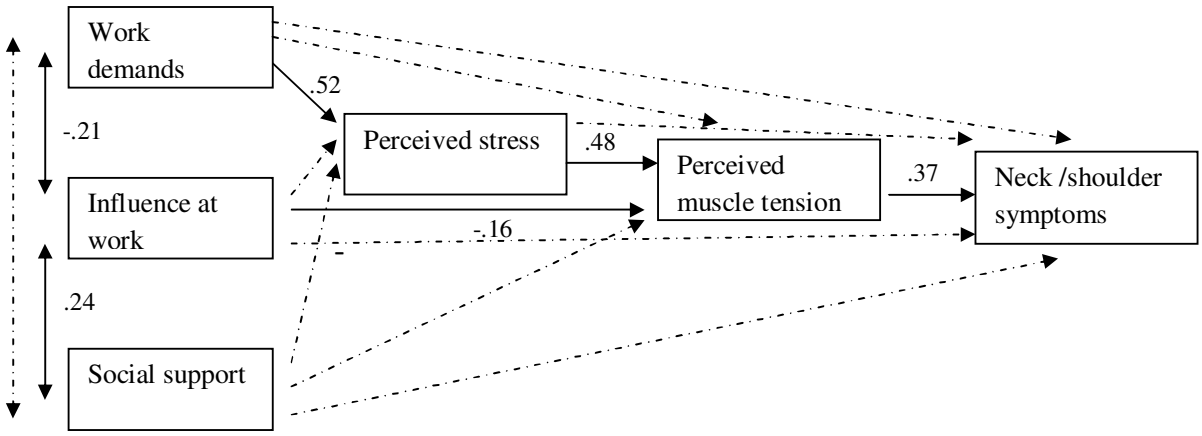
* $p < .05$

** $p < .01$

Fig.1 Hypothesized process model tested in the present study. Disturbance terms have been omitted from the figure.

Fig.2 The resulting model. Significant direct paths are depicted with their respective standardized parameter estimate. Non-significant paths are depicted as dotted lines (without parameter estimates).


Work demands
Influence at work
Social support
Perceived stress
Perceived muscle tension
Neck /shoulder symptoms


Work demands
.52
-.21
Perceived stress
.48
Perceived muscle tension
.37
Neck /shoulder symptoms
Influence at work
-.16
.24
Social support