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Work-related physical, psychosocial and individual factors associated with musculoskeletal symptoms among surgeons: Implications for ergonomic interventions

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ABSTRACT

This study evaluated the effect of physical, psychosocial and individual factors on the presence of musculoskeletal symptoms (MSS) among surgeons ($n = 312$) in Iran. Data were collected using questionnaires and analysed by multivariate logistic regression. The prevalence of MSS, particularly in the knees (48.7%), neck (45.8%), low back (42.3%) and shoulders (40.1%) was relatively high. Work-related factors including time spent on surgeries each week (>25 h/week), number of hours working in standing position per day (>4 h/day), moderate to high levels of work–family conflict, duration of each surgery (>3 h), number of years worked as a surgeon (>10 years) and surgical specialty (particularly cardiothoracic and obstetric/gynecologic surgeries) were independently associated with the presence of MSS in different body regions. Individual factors including gender (being female) and little or no involvement in sport and physical activity were also independently associated with the occurrence of complaints. Implications of the findings for further research and development work for improving the working conditions and consequently reducing MSS among this working group are discussed.

1. Introduction

Musculoskeletal symptoms (MSS) are a major health problem in almost all occupations and countries (Buckle and Devereux, 2002; Punnett and Wegman, 2004; Widanarko et al., 2014; Dianat and Karimi, 2016). MSS can result in severe long-term pain and physical disability among individuals and have serious economic impacts on communities (Brooks, 2006; Woolf et al., 2012). The current burden of MSS is high in both developed and developing countries, and is predicted to increase in the future (Brooks, 2006; Hoy et al., 2014).

Surgeons are a group of healthcare professionals who are at great risk for developing MSS, which may be attributable to a number of risk factors including awkward static postures (sitting or standing) that have to be maintained during the whole operating time, highly repetitive hand and arm movements and the use of various surgical tools (Szeto et al., 2009; Soueid et al., 2010). Surgical tasks often involve quick and fine manipulative skills, coordination of hands and eyes, and forward inclined head and trunk positions imposed by the need for better view of the surgical field. This, together with other job demands such as responsibility for patient safety, ability of taking important decisions quickly at critical moments, working under time pressure, and communication with patients and their families, suggests that surgeons are exposed to high levels of physical and psychosocial workload, which may eventually lead to the development of MSS in this group.

So far, a number of studies have been conducted on the prevalence of MSS among surgeons in various specialties such as Gynecologic (Adams et al., 2013), orthopedic (Auerbach et al., 2011; Knudsen et al., 2014; AlQahtani et al., 2016; Alzahrani et al., 2016; Bernstein et al., 2017), dental (Shaik et al., 2011; Kazancioglu et al., 2013; Rambabu and Suneetha, 2014), otolaryngologic (Babar-Craig et al., 2003; Vijendren et al., 2016) and dermatologic (Liang et al., 2012) surgeons. The percentage of surgeons with MSS

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in these studies has varied between 47% and 90%. MSS among surgeons can have several negative consequences such as reduced surgical performance, increased sick leave, seeking medical care and early retirement (Babar-Craig et al., 2003; Soueid et al., 2010; Alzahrani et al., 2016; Vijendren et al., 2016). Understanding the characteristics of the MSS and associated risk factors is, therefore, an essential step for reducing these consequences. It also has important implications in terms of quality of care and patient outcomes (Davis et al., 2014).

Previous research has demonstrated that MSS have a multifactorial etiology, which includes socio-demographic, physical, psychosocial and organizational factors (Buckle and Devereux, 2002; Szeto et al., 2009; Widanarko et al., 2014; Dianat et al., 2015). However, despite a number of studies on MSS among surgeons, very few of these have focused on the relationship between the occurrence of such complaints and their associated risk factors. More specifically, while some of these studies have highlighted some of the physical aspects of this occupation such as surgical table height, use of surgical tools and prolonged static postures (Szeto et al., 2009; Soueid et al., 2010), little is known about the influence of psychosocial risk factors. Szeto et al. (2009) examined the physical (based on several questions regarding posture, repetition, forceful exertion and environmental factors) and psychosocial (e.g. some behavioural and cognitive aspects of surgical task such as social reactivity, sense of responsibility and work pressure) factors among 135 general surgeons in Hong Kong and found that both physical and psychosocial factors were associated with the occurrence of MSS in surgeons. Nevertheless, still little is known about the effect of a number of work-related factors such as characteristics of operations performed by surgeons, surgical specialty, perceived pressure due to work, job satisfaction, work–family conflict, etc. on the occurrence of MSS in this occupation group. Therefore, in an attempt to address this issue, this study was performed to evaluate the occurrence of MSS and their contributing risk factors (including work-related physical, psychosocial and individual factors) among surgeons. The findings can be used to highlight areas that need further attention and to develop ergonomic interventions to improve the working conditions of this occupational group.

2. Materials and methods

2.1. Study design, sample and procedure

This cross-sectional, descriptive-analytical study was performed in fifteen large hospitals in three major cities of Iran (Tehran, Tabriz and Mazandaran). Study hospitals were selected using purposeful sampling in order to cover a range of surgeons. All surgeons (involved in open, minimally invasive, or both approaches) working at least for one year in their current job were asked to participate in the study. There were approximately 500 eligible surgeons in the selected hospitals at the time of study, and all of these were asked to participate in the study. Data for work-related physical, psychosocial and socio-demographic, as well as MSS were recorded using a questionnaire. A total of 500 questionnaires were distributed by the researchers to the eligible surgeons in their work setting, of which 312 surgeons voluntarily completed and returned the questionnaires to them. This represented a response rate of 62.4%. The questionnaire took approximately 10 min to complete. All participating surgeons signed a written informed consent form prior to the study. The study protocol was approved by the ethics committee of the Tabriz University of Medical Sciences.

2.2. Outcome measurements

The standardised Nordic Musculoskeletal Questionnaire (NMQ) (Kuorinka et al., 1987) was applied to record the frequency of MSS in different body regions. The NMQ has been translated and revised into Persian language and has an established reliability and validity (Dianat and Salimi, 2014; Dianat et al., 2015). The prevalence of MSS was assessed by asking the participants if they had experienced any ache, pain, discomfort or numbness (including all MSS, both attributable and non-attributable to work) in the last 12 months in nine different body regions (neck, shoulders, upper back, low back, elbows, hands/wrists, hips/thighs/buttocks, knees, and ankles/feet). A body map was used for this purpose. A scale (from 0 – no pain to 5 – very high pain) was also used to record the severity of the symptoms in each of the different body areas. In addition, consequences of MSS such as disruption of normal activities due to MSS (no, yes) was also recorded.

Socio-Demographic details included surgeons' age, gender, weight, height, body mass index (BMI – weight/height^2), marital status (single, married), living with children (no, yes), being involved in regular sport and physical activities each week, sleeping time and smoking habits (no, yes). Work-related items were selected based on prior knowledge and literature review (Szeto et al., 2009; Soueid et al., 2010; Dianat and Salimi, 2014; Dianat et al., 2015) and included: work setting (public or private), surgical specialty, number of years worked as a surgeon, number of hours worked per day and week, number of surgeries per day and week, surgery hours per week, duration of each surgery, number of hours working in sitting and standing position per day, job satisfaction ("How much are you satisfied with your job?" low, moderate and high) and perceived pressure due to work ("Do you feel pressure due to work?" no, yes). There were also questions regarding the work–family conflict which was measured using the valid and reliable Work–Family Conflict scale (Netemeyer et al., 1996). This is a widely used tool to address how work can interfere with family life and consists of 5 items with a 5-point response format, ranging from strongly disagree (1) to strongly agree (5). Scores on this measure range from 5 to 25, with higher scores indicating greater work–family conflict. The English version of this scale was translated into Persian language and verified for content validity by a panel of experts in psychology and ergonomics. The final version of this scale in Persian language was prepared based on the suggestions made and was used in this research. Cronbach's α for this scale was 0.88. The summed responses were divided into three categories as low, intermediate and high (scores of 5–12, 13–17 and 18–25, respectively) (Kim et al., 2013) for logistic regression analyses.

A pilot study was conducted among a sample of volunteered surgeons (n = 30) to test the questionnaire used in the study, and based on their comments, some minor adjustments were made on some items of the questionnaire. In addition, the test-retest reliability (stability) of the questionnaire items was good (Kappa coefficients ranged from 0.81 to 0.97).

2.3. Statistical analysis

The analysis of the data was carried out using SPSS software version 21.0 (SPSS Inc., Chicago, IL, USA). The work-related physical, psychosocial and socio-demographic details of the studied surgeons were tabulated as mean (standard deviation – SD) and percentages (%). Gender differences were assessed using chi square and *t*-test (for work-related and socio-demographic variables) as well as by binary and ordinal logistic regression (for the prevalence and severity of MSS, respectively) analyses. Among all body regions, knee, neck, low back and shoulder symptoms had the highest