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# Prevalence of upper extremity musculoskeletal symptoms and ergonomic risk factors at a Hi-Tech company in Israel

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## Abstract

This cross-sectional study examines the relationship between ergonomic risk factors and upper extremity musculoskeletal symptoms (UEMSS) in VDT workers at a Hi-Tech company, while taking into account individual and work organizational factors, and stress. The study population of 84 workers (92% response rate) is comprised of computer programmers, managers, administrators, and marketing specialists. Data on UEMSS, individual and organizational factors, and stress were derived from a questionnaire, while ergonomic data were collected through two direct observations via the rapid upper limb assessment (RULA) method. Results of the RULA observations indicate excessive postural loading with no employee in acceptable postures (all scores  $\geq 3$ ). Hand/wrist/finger symptoms were related to the RULA arm/wrist score (in a logistic regression model) as well as working with a VDT between 7.1 and 9 h a day, and working in Hi-Tech companies for more than 2 years. Neck/shoulder symptoms were related to: gender (female), working  $> 10$  h a day, working at the Hi-Tech company for more than 2 years, and being uncomfortable at the workstation. The results underline the need for implementing an intervention program focusing on arm/wrist posture, and for taking into account the special needs of subgroups: gender, working 10 h a day, working 7.1–9 h a day with a VDT, and employees experiencing discomfort at workstations.

*Relevance to industry:* Upper extremity musculoskeletal disorders and ergonomic research have not focused enough on the Hi-Tech industry. Even with the .com crash, this industry remains a major force in the world economy. VDT work in the Hi-Tech industry has unique risk factors, which might lead to specific needs for intervention.

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## 1. Introduction

Ample research has been conducted on the prevalence of upper extremity musculoskeletal disorders (UEMSD) in VDT workers. Such

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research has focused on the multi-factorial etiology of work-related UEMSD (Bernard, 1997; WHO, 1989). Different aspects of VDT work—i.e., physical, work organizational and psychosocial—interact and lead to UEMSD in VDT users (Bergqvist et al., 1995b; Punnett and Bergqvist, 1997). For example, hand/wrist disorders are caused by extensive use of the keyboard, which poses a combination of ergonomic risk factors (mechanical pressure on the soft tissue of the forearm and wrists) and work organizational factors (hours of keying a day). Additionally, in an extensive review by Bongers et al. (2002), high-perceived job stress was consistently associated with UEMSD in cross-sectional studies. High-perceived job stress might, in turn, cause physiological changes leading to musculoskeletal problems.

Most of the research done has focused on the telecommunication industry, banks, and newspapers, all VDT jobs that involve data entry, word processing, computer–telephone tasks, and CAD (Cook et al., 2000; Hales et al., 1994; Karlqvist et al., 1994, 1996; Ferreira et al., 1997; Polanyi et al., 1997; Sauter et al., 1991; Yun et al., 2001). To the best of our knowledge, no studies examining work-related UEMSD, using Hi-Tech companies as the setting, have been published. In addition, scant research has centered on computer programmers. In a study by Jensen et al. (2002), programmers comprised 3% of the sample, and in a study by Karlqvist et al. (2002), 9.7% of the sample were programmers. Neither study focused on specific risk factors and prevalence rates of UEMSD among computer programmers.

Computer programmers and other Hi-Tech workers might encounter specific risk factors compared with those found in other VDT work, especially when taking into account the numerous hours worked a week, the high job stress setting, the young age of employees and high education level. Some studies have found that working with a VDT for 2 h a day is considered a risk factor for musculoskeletal disorders (MSD), so what is the effect of working 10, 11, or even 12 h a day with a VDT (Faucett and Rempel, 1994; Karlqvist et al., 2002; Oxenburgh et al., 1985)?

This study examines musculoskeletal symptoms in a Hi-Tech communication company in northern Israel.

The aims of the study are:

- (i) To determine the prevalence of upper extremity musculoskeletal symptoms (UEMSS) stratified by the following risk factors: individual, occupational characteristics, and job stress.
- (ii) To examine the association between ergonomic workplace risk factors and UEMSS.

## 2. Methods

### 2.1. Subjects

The entire software communication Hi-Tech company was included in the study. Out of 91 employees, three from management declined, three were on vacation, and one employee was on maternal leave. Thus, seven employees did not participate due to the above-mentioned reasons, resulting in a 92% response rate.

The study examined a relatively small Hi-Tech company, which agreed to participate in this study. More than 10 medium and large Hi-Tech companies from northern and central Israel declined to participate in the research.

### 2.2. Methods of collecting data and analysis

Data were gleaned from a questionnaire and direct observation. This questionnaire was based on the Nordic Musculoskeletal Questionnaire (Kourinka et al., 1987). Subjects were asked to report musculoskeletal symptoms both in the last year and the last week in the neck, shoulder, hand/wrist, and fingers. The neck and shoulder symptoms were placed into one category. Therefore, an employee reporting having trouble (ache, pain, discomfort) in the neck and/or the shoulder was defined as suffering from UEMSS in the neck/shoulder region. Additionally, hand/wrist and finger symptoms were also brought into one category. Hence, an employee reporting having trouble in the hand/wrist and/or the fingers was

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