



## Original article

# Musculoskeletal impact of the use of various types of electronic devices on university students in Hong Kong: An evaluation by means of self-reported questionnaire



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## ABSTRACT

**Introduction:** Despite the increasingly widespread popularity of electronic devices, there are limited comprehensive studies on the effects of usage and exposure to multiple electronic devices over extended periods of time. Therefore, this study explored the cumulative musculoskeletal implications of exposure to various electronic devices among university students.

**Methods:** A self-reported questionnaire was administered in the university in Hong Kong and students provided information about the frequency and duration of electronic devices use, including computers, mobile phones and game consoles, and reported on any musculoskeletal pain or discomfort that may relate to electronic devices usage in the immediate 12 months prior to the survey date.

**Results:** A total of 503 university students (59% males and 41% females) aged 18–25 years completed the questionnaire. The results showed that 251 (49.9%) respondents reported upper limb musculoskeletal symptoms, particularly in the neck and shoulder regions. Among these, 155 (61.8%) indicated that their discomfort was related to electronic device usage. Statistically significant differences in exposure to electronic devices and musculoskeletal outcomes between genders were found ( $p < 0.05$ ).

**Conclusion:** The use of electronic devices and habitual postures were associated with musculoskeletal problems among university students in Hong Kong. This phenomenon highlights the urgent need for ergonomics education and recommendations to increase students' awareness of musculoskeletal wellbeing.

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## 1. Introduction

Musculoskeletal disorders (MSDs) are among the most common occupational diseases worldwide and are a major cause of long-term pain and physical disability (Woolf and Pfleger, 2003; Brooks, 2006). Research involving adult subjects confirms that prolonged static posture and increased muscle loading associated with computer use can lead to MSDs in the neck, shoulders, back, elbows and wrists/hands (Blangsted et al., 2003; Gerr et al., 2004; Szeto et al., 2005). Similar to computer use, using mobile phones and playing electronic games may involve sustained gripping and repetitive movements with the thumbs and fingers (Gillespie, 2002; Briggs et al., 2004; Greig et al., 2005). MSDs affect not only workers in the workplace, but also students who excessively use various electronic devices on a daily basis for both education and

recreation (Ellahi et al., 2011). Young people nowadays spend less time playing outside and more time using computers, mobile phones or playing electronic games when compared to previous generations (Rideout et al., 2010), and consequently, students are also at high risk of developing MSDs.

In Hong Kong, a recent survey by the Census and Statistics Department (2015) showed that the number of households owning various types of personal computers increased from 71.1% in 2004 to 81.3% in 2014. Among students, the average time spent in using personal computers each week more than doubled from 10.5 h in 2000 to 22.7 h in 2009. This survey also reported that, 34.8% of them owned one personal computer, 26.1% owned two, and 39.1% owned three or more. These data may imply that Hong Kong students have a high degree of multiple electronic devices usage, which has raised public health concerns.

International studies have noted the long daily duration of computer use among students. Two-thirds of United States high

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school students aged 16–18 years reported using their tablet computers for more than 4 h per day (Sommerich et al., 2007). Australian students aged 10–17 years attending schools with mandatory laptop programmes reported an average of 3.2 h per day (Harris and Straker, 2000). Subsequent research has compared computer usage in college students and professional workers, showing that graduate students reported on average 33.7 computing hours per week, similar to the 35.2 h reported by professional workers (Noack-Cooper et al., 2009). Numerous epidemiological studies have indicated that a high prevalence of computer-related MSDs was found among not only adults, but also students, in colleges (Katz et al., 2000), as well as middle and elementary schools (Jacobs and Baker, 2002; Breen et al., 2007). Some research has concluded shoulder or back pain during childhood is a risk factor for developing MSDs in adulthood (El-Metwally et al., 2004; Ståhl et al., 2008). In a longitudinal study on a group of 8–14 year olds, symptoms of back pain and headache persisted until they were 28 years old, suggesting that problems were prolonged (Brattberg, 2004).

However, few researchers have explored the health effects of using handheld devices among students. A recent study conducted with young children showed that using handheld game devices for more than 2 h daily would significantly increase the risk of developing MSDs in different body sites (Lui et al., 2011). Another study found that handheld devices that promoted the predominant usage of thumb or only one finger while texting or using the controls were associated with a higher prevalence of MSDs (Sharan et al., 2014). In addition, several studies have reported the health consequences of excessive mobile devices usage, such as De Quervain's tenosynovitis (Ali et al., 2014; Eapen et al., 2014).

Although numerous studies have focused on the health effects of computer use, little research has examined risks associated with mobile devices. To date, no comprehensive study has directly focused on the adverse health effects of cumulative exposure to various electronic devices. This study was a novel attempt to fill this research gap by exploring the relationship between electronic devices exposures and musculoskeletal outcomes. Based on the findings, health promotion interventions designed to address this issue may be developed in the future.

The objective of the study was to investigate usage patterns of various types of electronic devices and their association with musculoskeletal complaints among university students in Hong Kong. This study tested the hypothesis that prolonged use of electronic devices was associated with higher prevalence of MSDs in students. These problems must be addressed at the developmental stage of emerging adulthood as it seems likely they may extend into adult life.

## 2. Methods

### 2.1. Participants

A convenience sample of university students aged 18–25 years at The Hong Kong Polytechnic University was recruited in 2014. All participants owned electronic devices and had already experienced long exposure to these devices. Students within different university departments were recruited so as to identify different usage patterns. Only one district was included, as the geographic location of this university facilitated the recruitment of a large population of students.

### 2.2. Procedures

Prior to commencement, ethical approval was obtained. Detailed information, including invitation letter, consent form,

information sheet, and questionnaire, were issued to selected departments. After gaining permission, a researcher attended a pre-arranged class to administer the questionnaire. Instructions were given verbally by the researcher and reinforced clearly on the front cover of the questionnaire, which took approximately 15–20 min to complete. Participation was voluntary and anonymous.

### 2.3. Questionnaire design

The questionnaire was designed using multiple-choice questions that included: (1) demographic data, such as age, gender, height and weight; (2) usage patterns of various electronic devices, such as time spent on computers, mobile phones and game consoles, as well as location arrangements; (3) personal habits and health conditions, such as exercise, habitual postures and experience of MSDs in the past 12 months; and (4) awareness of, and attitudes toward, MSDs management, such as seeking medical help and taking medication(s) for pain relief.

### 2.4. Data analysis

Data were analysed with SPSS version 18.0 (Chicago, IL) and *p* values of less than 0.05 indicated statistical significance. Independent *t*-test was used to compare the mean of variables between males and females. Chi-square test was used to assess univariate associations between variables and reported MSDs. Multiple logistic regression analysis was performed to determine which variables were independently associated with MSDs.

## 3. Results

Six hundred questionnaires were distributed, of which 503 were returned, representing a response rate of 83.8%. The remaining 16.2% of students either did not respond to the survey or did not provide valid answers.

### 3.1. Demographic characteristics of participants

Among respondents, 299 (59%) were males and 204 (41%) were females. Their ages ranged from 18 to 25 years with a mean of 19.7 years. Most respondents were classified within a body mass index range of 18–25 kg/m<sup>2</sup>. Of the total respondents, 167 (33.2%) exercised regularly (more than 3 times a month), 285 (56.7%) exercised occasionally (1–3 times a month), and 51 (10.1%) never exercised. Apart from exercise intensity, 397 (78.9%) respondents did household chores periodically. Nearly half (44.3%) had part-time jobs, while 27.4% of jobs involved repetitive hand movements, 12.1% involved forceful or strenuous hand movements, 9.4% required regular awkward posture of the wrists or hands, but only 1.8% exposed their hands to vibrations from tools, impact shock or rebound.

Statistically significant differences in height and weight factors between genders were expected (*p* < 0.001). There was an apparent difference between genders in terms of doing exercise and doing household chores, as well as part-time jobs (*p* < 0.001). Other factors such as working years, or daily and weekly working hours were similar among both genders. Details of the demographic characteristics are shown in Table 1.

### 3.2. Exposure patterns to various electronic devices

With regard to the emergence of new information technologies, a majority of respondents (368, 73.2%) reported that they were using either a combination of tablet, laptop, or desktop computers, or all of them in their daily lives. Almost all respondents (497,

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