Musculoskeletal symptoms and computer use among Finnish adolescents – intensity of pain and inconvenience of everyday life: A cross-sectional study

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Abstract

Background: Musculoskeletal symptoms among adolescents are related to the time spent on computer but there is little knowledge on how serious the symptoms are or how much they affect in everyday life. The purpose is to examine the intensity of musculoskeletal pain and inconvenience in everyday life, related to the time spent on computer.

Methods: In a survey, 436 school-children, 12-13 and 15-16 years of age filled in a questionnaire on frequency and intensity of musculoskeletal and computer-associated musculoskeletal symptoms (neck-shoulder; lower back; head; eyes; hands, fingers, wrists). Intensity of pain and inconvenience in everyday life were measured by a visual analogue scale. Based on the frequency and intensity three categories were formed for musculoskeletal pain and computer-associated musculoskeletal pain in each anatomic site: no, mild and moderate/severe. Associations with time spent on computer were analysed by multinominal logistic regression.

Results: Moderate/severe pain intensity was most often reported in neck-shoulders (21%), head (20%) and eyes (14%), and moderate/severe intensity of inconvenience in everyday life in head (29%), neck-shoulders (21%), and low back (16%). When weekly computer use was ≥14 hours, moderate/severe intensity of computer-associated musculoskeletal pain increased in all anatomic sites (OR=2.9-4.4), and moderate/severe intensity of inconvenience in everyday life in lower back (OR=2.5) and in head (OR=2.0) when compared to those who used computer <3.6 hours/week.

Conclusions: Musculoskeletal symptoms causing moderate/severe pain and inconvenience in everyday life are common among adolescent computer users. Daily computer use of two hours and more increases the risk in most anatomical sites.
Background

The explosion of information and communication technology (ICT) has become an important part of adolescents’ lives, as the majority use computers regularly for surfing in the Internet, chatting and playing games. Parallel to this, the prevalence of neck-shoulder and lower back pain has increased among adolescents in recent last decades [1]. Studies among adolescents confirm a connection between using ICT, especially computers, and musculoskeletal symptoms. Pain, for e.g. headache [2-4], neck-shoulder and lower back pain [4-7] have been observed to be more common among computer users than among non-users. The risk of developing pain has grown with an increase in time spent on the computer [5]. Moreover computer users’ own perceptions as to whether computer use causes symptoms have been elicited. The results have indicated that computer use induces pain and discomfort not only in the neck-shoulder or back regions, but also in the hands, fingers or wrists, as well as in the eyes and head [8-11]. Earlier studies have mainly focused on examining the relationships of pain with computer use while there is no information on how serious these symptoms are and how much they disturb adolescents’ everyday lives.

Among children and adolescents, the visual analogue scale (VAS) [12] has been used for the quantification of musculoskeletal pain severity [13-17], but very little is known about the intensity of pain due to computer use. Konijnenberg et al. [18] described and quantified impairment with chronic pain of unknown reason in a study with 149 children (mean age 11.8 years). The results showed that children reported impairment in functioning on multiple domains in daily life, e.g. musculoskeletal pain. In another study, Roth-Isigkeit et al. [19] investigated the prevalence and characteristics of pain (e.g. intensity) among 735 children and adolescents (aged 10 to 18 years). Girls evaluated their pain as being significantly more severe than did boys and half of the sample reported pain with duration of longer than three months. Among young computer users, Breen et al.
[20] investigated discomfort and posture while working on computers in a small sample of 68 schoolchildren (mean age 9.5 years). The results showed that 16% of the children reported pain, mostly in the neck or back region, at the beginning and at the end of a computer session. The pain intensity increased during the session [20].

Research questions are how serious computer-associated pain is and how much pain disturbs adolescents’ everyday lives. The purpose of study was to investigate the intensity of computer-associated musculoskeletal pain and the intensity of inconvenience in everyday life caused by musculoskeletal symptoms among young computer users. More precious, is time spent on computers related to the intensity of pain and the intensity of inconvenience in everyday life.

Methods

Subjects
This study was part of a longitudinal classroom study project intended, to study the association between ICT use, physical and mental stress and strain, and the development of school-aged children. The convenient sample size was 689 from seven schools in a major city in Finland (five elementary and two middle schools) in 2004. The follow-up survey, in 2006, was done in the same schools and classes as the baseline survey. In present cross-sectional study 436 respondents participated. Pupils aged 12 to 13 years (n=164, 37.6%) were from the 6th grade and those aged 15 to 16 years (n=272, 62.4%) from the 9th grade. More than half of the participants (53.7%) were girls.

Instruments
In this study, musculoskeletal pain was elicited with the question: “During the past half year, have you had some of the following symptoms and how often?” The response alternatives for each item
were a) seldom or not at all, b) about once a month, c) about once a week, and d) almost daily. Locations of the five anatomic sites were neck or shoulders, lower back, head, eyes and hands, fingers or wrists. Participants were asked to evaluate the intensity of inconvenience in everyday life due to pain using the visual analogue scale (VAS) [12]. The 100-mm vertical VAS scale was marked at one end as “not inconvenient at all” and at the other end as “very inconvenient indeed”. The amount of the intensity of inconvenience caused by pain was asked: “If you had musculoskeletal symptoms, how much inconvenience do they cause you in your everyday life?” The respondents were asked to make a mark on the line to indicate the severity of the inconvenience at the pain sites. The means for inconvenience were: head 20.7 mm (min 0, max 90), neck or shoulders 16.1 (0-91), lower back 12.7 (0-76), eyes 7.6 (0-77), hands, fingers or wrists 6.7 (0-68).

The computer-associated pain was elicited by: “Using computer may cause symptoms (pain, aches, discomfort) in the following anatomic locations in the body. Have you experienced such symptoms? Response alternatives were the same as before, but item a) was phrased as “not at all”. The locations of the five anatomic sites were the same as before. Participants were asked to evaluate the pain intensity on the VAS-scale by the question: “If you have had computer-associated symptoms, how severe have they been?”, and to make a mark the line to indicate the intensity of each symptom. Here the endpoints were “no pain at all” and “very severe pain”. The means for pain intensity were as follows: head 15.3 mm (min 0 mm, max 99 mm), neck or shoulders 15.1 (0-88), eyes 10.0 (0-100), lower back 10.0 (0-85) hands, fingers or wrists 5.3 (0-71). The VAS scores were divided into four groups; pain intensity and intensity of inconvenience categories were defined. VAS scores less than 5 mm were recorded as 0 (no pain), according to Hunfeld et al., who claimed that only a score of 5 mm or above indicated the presence of pain [15, 21, 22]. In both symptom groups, scores of 51 mm or more were considered to indicate severe pain
intensity or intensity of inconvenience in everyday life, 26-50 mm moderate pain intensity or intensity of inconvenience in everyday life, and 5-25 mm mild pain intensity or intensity of inconvenience in everyday life. Because of the small number of severe pain intensity and severe intensity of inconvenience in everyday life, the categories severe and moderate were combined into one variable “moderate/severe pain intensity” and “moderate/severe intensity of inconvenience in everyday life”.

New variables were formed by combining pain occurrence and pain intensity or intensity of inconvenience groups together. New variables were formed “intensity of computer-associated pain” for computer-associated pain and their VAS categories, and “intensity of inconvenience in everyday life caused by musculoskeletal pain” for musculoskeletal pain and their VAS categories. Alternatives with three groups were formed as follows: a) seldom/no pain, no pain intensity/intensity of inconvenience in everyday life, b) pain with mild intensity/intensity of inconvenience in everyday life, c) pain with moderate/severe intensity/intensity of inconvenience in everyday life. Those reporting having no or rare pain, but who evaluated their pain as mild, were treated as for item b.

Computer use was measured by an open question: “How many hours per week do you usually use a computer?” The responses were categorized according to the sample distribution into three groups as follows: (i) weekly 3.5 hours or less (corresponding ≤ ½ hour daily, N=106), (ii) weekly 3.6-13.99 hours (corresponding < 2 hours daily, N=166), (iii) weekly 14 hours or more (corresponding ≥ 2 hours daily, N=149). Those who did not use computers at all (N= 19) were excluded from the analysis.

Procedure
Before data collection the approval of the Ethical Committee of Pirkanmaa Hospital District (Code Nr. R04013) was granted. Permission was also obtained from the school principals. At each school an information meeting was held separately for each participating class, where the purpose of the study was explained and an information letter was delivered both to the schoolchildren and their parents. Written consent to participation was obtained from all children, and their parents/guardians. The participants completed questionnaires during school hours in spring 2006, guided by the authors and the research assistants.

Statistical analysis
Data were analyzed using SPSS for Windows, version 15.0. In the multinominal logistic regression model, variables “intensity of computer-associated pain” and “intensity of inconvenience in everyday life caused by musculoskeletal pain” were outcome variables with three different categories. Time spent on the computer was a predictor variable, sex and school grade (aged 12-13 and, 15-16 years) were considered as potential confounders and treated as covariates. We calculated the odds ratios and 95% confidence intervals (CI), and used P-values to show the differences between the age and sex groups. The statistical differences between the groups were tested using the chi-square test.

Results
Severe pain intensity and intensity of inconvenience in everyday life were reported most commonly in head, neck-shoulders and eyes, and least commonly in hands, fingers and wrists. The prevalence of moderate/severe pain intensity was 20.7 % in neck-shoulder, 19.7 % in head, and 13.8 % in eyes. The prevalence of moderate/severe intensity of inconvenience in everyday life was 28.3 % in head, 20.7 % in neck-shoulder, and 15.4 % in low back (Table 1). Pain intensity was reported as follows; girls reported more moderate/severe pain in all anatomic sites in computer-associated
musculoskeletal pain, except in lower back, where the prevalence were higher among the boys. The differences in pain intensity in neck-shoulders (p = 0.0001) and head (p = 0.0001) were statistically significant within the sex groups. Pain intensity increased with age, except in eyes, where the prevalence rates decreased. The results were statistically significant in neck-shoulders (p = 0.0001) and head (p = 0.0001) within the age groups among both sex groups. Intensity of inconvenience in everyday life was reported as follows; girls reported more moderate/severe inconvenience in everyday life caused by musculoskeletal pain than boys; head (p = 0.0001), neck-shoulders (p = 0.0001) and lower back (p = 0.034) were the most prevalent sites. The 9th grade pupils reported moderate/severe inconvenience in everyday life more often than the 6th graders, and the results were statistically significant for head (p = 0.011), neck-shoulders (p = 0.0001) and low back (p = 0.0001) (data not shown).

Of those who reported that they use computers, every third (35.4%) reported that they spend 14 hours or more in a week on them. Boys used computers more often than girls (p = 0.0001); half of the boys (50%, N=98) and every fourth of the girls (23%, N= 51) used computers weekly for 14 hours and more, which corresponds to two hours daily use or more. The time spent with computers increased with age (p = 0.0001) in both sex groups.

In the multinominal regression analysis, moderate/severe intensity of computer-associated musculoskeletal pain was related to all anatomic sites when weekly computer use was ≥ 14 hours. Moderate/severe pain intensity was also related to neck or shoulders and head, when weekly computer use was 3.6-13.99 hours. Moderate/severe intensity of inconvenience in everyday life caused by musculoskeletal pain was statistically significantly related to lower back and head when weekly computer use was ≥ 14 hours; and statistically significantly related to head when the weekly computer use was 3.6-13.99 hours (Table 2).
Mild pain intensity was statistically significantly related to lower back, head and eyes, when the weekly computer use was $\geq$ 14 hours and 3.6-13.99. Mild intensity of inconvenience everyday life was statistically significantly associated in lower back and eyes, when weekly computer use was $\geq$14 hours (Table 2).

**Discussion**

The levels of intensity of musculoskeletal pain and intensity of inconvenience in everyday life were low measured by two independent questions. Our results brought new knowledge suggesting that weekly computer use 14 hours and more (corresponding $\geq$ 2 hours daily) is related to severe or moderate computer-associated pain in all measured anatomical sites. Moreover weekly computer use of 14 hours and more was related to severe or moderate pain in lower back and head, which disturbed adolescents’ everyday lives. Girls reported greater pain intensity or intensity of inconvenience in everyday life at all anatomical sites than boys, and the prevalence rates increased with age.

To the best of our knowledge this is the first study to evaluate pain intensity and intensity of perceived negative impacts on adolescents’ everyday lives related to computer use. Our results suggest that computer use $\geq$ 14 hours weekly (estimated $\geq$ 2 hours daily) is related to severe or moderate pain intensity. Previous studies have also suggested that computer use exceeding 2 hours per day is a threshold for neck-shoulder pain [5] or found associations between neck or shoulder pain and $\geq$ 1 hour daily computing [11, 23].
In our study, the pain intensity levels were lower than in some previous studies [18, 19, 24], but about the same level as in the Finnish follow-up study by Saarni et al. with 88 participants [17]. Our results confirm earlier finding, that girls report more severe pain than do boys [18, 19].

In this study, the intensity levels of musculoskeletal pain were measured using the well documented visual analogue scale (VAS). VAS has been extensively researched and has shown good acceptability, responsivity and validity for most children aged 8 years and older [25]. Before the analysis of the data, pain severity categories were defined partly according to the findings of Collins et al. [26] Frequency of symptoms and pain intensity or inconvenience in everyday life were elicited by two independent questions, one concerning computer-associated symptoms, and the other concerning musculoskeletal symptoms perceived during the past half a year which gives a more reliable picture and a wider perspective to the association between musculoskeletal symptoms and use of computer.

Some limitations of our study need to be addressed. The convenience sample of present study does not necessarily represent the entire population of that age, although it is unlikely that this would influence the studied relationships. Due to the cross-sectional design of the study we are restricted to investigating temporal relations in our data, and thus causal inferences based on this study alone cannot be made. Respondents reported the weekly duration of using computers in response to an open question. There may be misreporting regarding the time spent with computers and responses and responses to musculoskeletal symptoms. It is however; likely that such misreporting would seriously affect the relationships between computer use time and symptoms.

**Conclusion**
This study suggests that musculoskeletal symptoms causing moderate and severe pain and inconvenience in everyday life are common among adolescent computer users. Daily computer use of two hours and more increases the risk in most anatomical sites.

**Competing interests**

The authors declare that they have no competing interest.

**Authors' contributions**

AHR, R-LP, MAW and C-HN initiated and designed the study, and LAS provided critical input in its all phases. PTH and AHR performed the main analysis, drafted the paper and co-ordinated subsequent revisions with the other authors. All authors read and approved the final manuscript.

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References


Additional files provided with this submission:

Additional file 1: BMC_Table1.doc, 39K
http://www.biomedcentral.com/imedia/4691925595827964/supp1.doc
Additional file 2: BMC_Table2.doc, 38K
http://www.biomedcentral.com/imedia/8615107535827964/supp2.doc