

# Computer use and musculoskeletal complaints in the Lithuanian adolescent population

Research Article

Lina Skemiene, Ruta Ustinaviciene\*, Dalia Luksiene, Ricardas Radisauskas, Gintare Kaliniene

*Department of Environmental and Occupational Medicine, Medical Academy, Lithuanian University of Health Sciences, Kaunas LT -50161, Lithuania*

Received 21 September 2011; Accepted 27 November 2011

**Abstract:** The purpose of this study was to evaluate self-rated musculoskeletal complaints and their association with computer use time in the adolescent population in Lithuania. The cross-sectional study done in 2008-2009 in Lithuania. 1806 students aged 13–18 years from randomly selected schools were questioned (response rate 95.8%). Logistic regression analysis results show that musculoskeletal complaints in adolescence are associated with duration of computer use as related to age and gender. Compared with adolescents using computer <2 hours daily, a statistically significant probability of experiencing back pain was determined for younger boys and girls groups (13–15 years) who reported working on a computer >4 hours (OR=2.36 and OR=2.50, respectively) in older age groups (16–18 years); in girls only the ORs of back pain significantly increased with increased time of computer use. the probability of experiencing the neck-shoulder pain was determined only in girls aged 16–18 years who reported working on a computer 2–4 hours (OR=1.62, p=0.020). Musculoskeletal complaints in adolescence are related to duration of computer use. Increasing the time spent at the computer increased complaints of musculoskeletal pain among Lithuanian adolescents. The main guidelines for prevention point to restriction of time of computer use.

**Keywords:** *Adolescence • Computer use • Low back pain • Neck-shoulder pain • Wrist pain • Cross-sectional study*

© Versita Sp. z o.o.

## 1. Introduction

Today's children and adolescents are the first generation to have grown up with information communication technology and the use of computers in their everyday lives. With the increasing use of computers, the concern over potential computer-associated musculoskeletal complaints has increased [1]. These complaints affect various anatomical sites, are common in this age group, increase with age, and increase with the length of time spent at a computer. Pediatricians and other professionals in Sweden have noted that the number of children with psychiatric and psychosomatic symptoms is growing, and excessive computer use and TV viewing are among the major contributory problems [2].

Finnish researchers note that use of computers has increased dramatically among adolescents. Publications reveal that computer-related activities are an independent risk factor for neck, shoulder, and low back pain [3]. A number of other studies have

also investigated the association of computer-related activities with musculoskeletal symptoms. The Study of American Youth found a relationship between time spent at a computer and musculoskeletal discomfort that is described as musculoskeletal pain, such as back, neck, shoulder, and limb pain [4]. It is also assumed that risk factors influencing these symptoms are very similar in both adolescents and adults [5]. Adolescents with musculoskeletal disorders are at risk of displaying similar symptoms later in life [6].

Parental control, an intensive ergonomics approach, and education on workstation changes are the key factors for prevention of musculoskeletal complaints in adolescence. The relationship between self-rated health complaints such as musculoskeletal pain and computer-related activities has not previously been studied in a population of Lithuanian adolescents. The purpose of this study was to evaluate self-rated musculoskeletal complaints and their association with the computer use time in the adolescent population in Lithuania.

\* E-mail: ruta.ustinaviciene@med.kmu.lt

## 2. Material and Methods

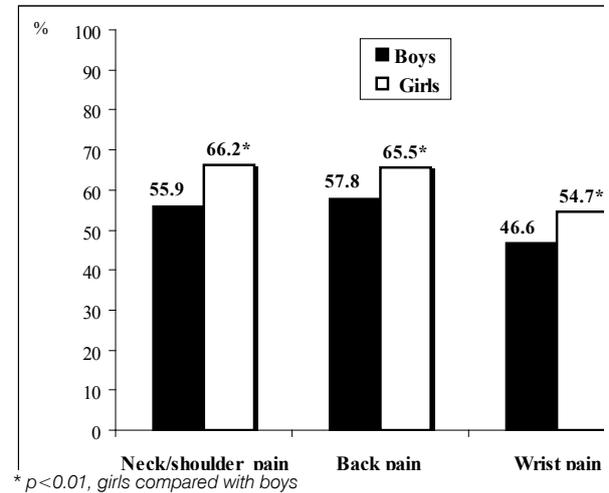
This cross-sectional study was done by researchers of the Department of Environmental and Occupational Medicine of Medical Academy of Lithuanian University of Health Sciences in 2008-2009. Students in the 9th and 11th grade of Lithuanian schools (n=20) randomly selected from a list of schools in a region were questioned. Classes were randomly selected from these schools, and groups of respondents were selected randomly in a two-stage process. Schools were randomly selected from the list of schools in a region. Classes were randomly selected from these schools.

Self-administered questionnaires were distributed among 1806 respondents participating in the study, and among them, 1730 students answered all questions: 869 (50.2%) boys and 861 (49.8%) girls (response rate 95.8%). The respondents ranged in age from 13 to 18 years. The questionnaire was anonymous and confidential. The respondents were allowed to mark one or more self-rated musculoskeletal complaints as neck/shoulder pain, back pain, and wrist pain. Computer exposure time was measured by asking how many hours respondents spent daily at the computer: <2 hours, 2–4 hours, and >4 hours. The duration of computer use while doing homework, playing games, chatting with the friends—among other questions—was also asked.

The study protocol has been approved by Department of Municipality Administration Education and Culture Education and Education Division of Kaunas (Protocol No. 35-2-703), and Lithuanian regional Ethical Committee of Biomedical Researches (Protocol No. BE-2-61).

Statistical analysis of data was performed using the software package „SPSS 13.0 for Windows“. The data were analyzed by assessing the differences between gender, age and the amount of time of computer use. Z and Chi-square ( $\chi^2$ ) tests evaluated statistical hypotheses on the difference in the distribution of variables between the groups of respondents. The Student’s t-test was used for evaluation of qualitative data. The relationship between the computer-use time and reports of self-rated

**Figure 1.** The prevalence of self-rated musculoskeletal complaints among boys and girls aged 13-18 years.



musculoskeletal complaints was assessed by odds ratio (OR) using multivariate regression analysis (data was adjusted by age and gender). To assess the prevalence of musculoskeletal disorders, the following independent factors were taken into consideration: gender, age, computer use time. The level of statistical significance was set at p < 0.05.

## 3. Results

To determine the prevalence of self-rated musculoskeletal complaints the question „Have you experienced neck/shoulder pain, or wrist pain during last year?“ was asked. 68.6% of boys and 75.9% of girls reported having any musculoskeletal complaints; 42.9% of boys and 51.7% of girls reported all three musculoskeletal complaints such as neck/shoulder pain, back pain, and wrist pain. Only 31.4% of boys and 24.1% of girls had no musculoskeletal complaints.

The data show that the rate of these complaints was significantly higher for girls than for boys. The distribution of self-rated musculoskeletal complaints among genders is shown in Figure 1.

**Table 1.** Self reported daily time spent at the computer by gender and age.

Computer use time, hours	Boys		Girls	
	13–15 years old	16–18 years old	13–15 years old	16–18 years old
<2	57 (18.1)	98 (17.7)	137 (38.5) a	176 (34.8) b
2–4	155 (49.2)	246 (44.4)	156 (43.8)	227 (45.0)
>4	103 (32.7)	210 (37.9)	63 (17.7) a	102 (20.2) b
Total	315 (100)	554 (100)	356 (100)	505 (100)

Number of cases (percent of total)

a – p < 0.001 compared with boys aged 13–15 years

b – p < 0.001 compared with boys aged 16–18 years

**Table 2.** The odds ratios and percentages of self-rated musculoskeletal complaints among 13–18-year-old boys and girls by daily time of computer use.

Time of computer use, hours	Boys				Girls			
	%	OR	95% CI	p	%	OR	95% CI	p
< 2	61.9	1			68.4	1		
2–4	68.3	1.32	0.90–1.93	0.156	77.8	1.64	1.17–2.30	0.004
> 4	72.2	1.61	1.61–2.42	0.023	85.5	2.75	1.68–4.52	0.001

OR – odds ratio; CI – confidence interval.

% – percentages of self-rated musculoskeletal complaints by daily time of computer use

**Table 3.** Relationship between daily time spent at the computer and self-rated neck/shoulder pain, back pain and wrist pain by gender and age.

Computer use time, hours	BOYS		GIRLS	
	13–15 years old OR (95% CI)	16–18 years old OR (95% CI)	13–15 years old OR (95% CI)	16–18 years old OR (95% CI)
<b>Neck/shoulder pain</b>				
<2	1	1	1	1
2–4	1.11 (0.60–2.06) p=0.738	0.91 (0.57–1.45) p=0.678	1.03 (0.62–1.70) p=0.911	1.62 (1.08–2.44) p=0.020
>4	1.31 (0.67–2.53) p=0.431	0.99 (0.61–1.60) p=0.956	1.88 (0.91–3.90) p=0.089	1.47 (0.89–2.43) p=0.135
<b>Back pain</b>				
<2	1	1	1	1
2–4	1.61 (0.87–2.97) p=0.130	1.06 (0.66–1.69) p=0.812	1.08 (0.67–1.75) p=0.753	1.80 (1.20–2.71) p=0.005
>4	2.36 (1.21–4.62) p=0.036	1.11 (0.68–1.80) p=0.662	2.50 (1.22–5.13) p=0.013	2.06 (1.22–3.48) p=0.007
<b>Wrist pain</b>				
<2	1	1	1	1
2–4	1.09 (0.55–2.17) p=0.796	0.73 (0.43–1.24) p=0.247	0.77 (0.45–1.29) p=0.316	1.27 (0.82–1.97) p=0.289
>4	1.56 (0.74–3.29) p=0.242	0.65 (0.38–1.11) p=0.648	0.97 (0.50–1.89) p=0.932	0.96 (0.57–1.64) p=0.890

OR - odds ratio; CI - confidence interval.

According to our study, the majority of pupils use a computer from 2 to 4 hours daily (46.1% of boys and 44.5% of girls). The majority of girls (irrespective of age) reported spending up to 4 hours at the computer, and the majority of boys (irrespective of age) reported that they spent more than 2 hours at the computer (Table 1).

Detailed analysis of computer-use time demonstrated that computer-use time differs by gender and age. We found a significant association with gender in both younger and older age groups ( $\chi^2=43.4$ ;  $df=3$ ;  $p<0.01$  and  $\chi^2=64.8$ ;  $df=3$ ;  $p<0.01$ ), respectively.

The computer-use activities distribution varied with gender. More than half of the boys (54.1%) reported that they were usually playing computer games, and a similar percentage of girls (56.3%) reported that their most frequent use was to communicate with friends.

Only 20.2% of girls and 7.4% of boys used a computer for homework.

Table 2 shows the odds and percentages of self-rated musculoskeletal complaints among 13–18 years old boys and girls according to daily amount of computer use.

The odds of self-rated musculoskeletal complaints for boys and girls increased with increasing computer-use time. A statistically significant probability of experiencing musculoskeletal pain complaints was determined for the boys who reported working at a computer >4 hours compared with the boys who spent <2 hours (OR=1.61). In girls, the ORs of musculoskeletal pain complaints increased with increasing time of computers use: girls who reported computer use 2–4 hours and >4 hours had a statistically significant probability of experiencing musculoskeletal pain compared with girls who spent

less than 2 hours working on a computer (OR=1.64 and OR=2.75, respectively). To evaluate in detail the association of musculoskeletal complaints with age and gender, a logistic regression model analysis was performed (the model included as the independent determinant the amount of time of daily computer use). Table 3 presents the ORs for boys and girls that demonstrate the probability of neck/shoulder pain, back pain, and wrist pain, depending on the number of hours spent at the computer.

A statistically significant probability of experiencing neck-shoulder pain was determined only for the girls aged 16–18 years who were working on a computer 2–4 hours compared with the girls who spent less than 2 hours (OR=1.62). Evaluation of a relationship between neck/shoulder pain and length of time computer use time did not reveal any significant associations among boys and younger girls. A statistically significant probability of experiencing back pain was estimated for boys and girls in the younger age group (aged 13–15 years) working at the computer >4 hours compared with the those who spent <2 hours (OR=2.36 and OR=2.50, respectively) (Table 3). In older girls (aged 16–18 years), the ORs of back pain increased with increasing time of computer use: girls who reported computer use 2–4 hours and >4 hours had a statistically significant probability of experiencing back pain compared with girls who spent <2 hours working at the computer (OR=1.80 and OR=2.06, respectively). Evaluation of a relationship between wrist pain and the amount of time of computer use did not reveal any significant associations among boys and girls, irrespective of age.

## 4. Discussion

The possible association between computer-related activities and self-rated health complaints has become a public health concern. The duration of children's computer-use time has increased, while at the same time their physical activity has decreased, resulting in musculoskeletal disorders [7].

According to the data of the present study, students usually spent 2–4 hours at a computer. According to the data of studies performed in different countries, students are using computers from 1.3 to 3.2 hours [8,9]. The Adolescent Health and Lifestyle Survey analyzed the data of questionnaires obtained from 6003 Finnish students aged 14–18 years, and the results showed that more than half of them reported using a computer 2–3 hours daily, although other students reported playing computer games 5 and more hours, daily [3]. Finnish researchers also indicated that the boys studied most

commonly reported playing computer games, and girls, communicating with friends [3]. According to our study, boys more frequently reported playing computer games, and girls used chat rooms for chatting with friends.

Computer use is an important risk factor for children's health, because neck/shoulder and back pain in adolescence may result in early onset of musculoskeletal degenerative dysfunction [10]. According to our results, 42.9% of boys and 51.7% of girls reported 3 musculoskeletal complaints, such as neck/shoulder, back, and wrist pain.

Some investigators have described the associations between musculoskeletal disorders and the amount of time a student uses a computer each day [3,11]. According to our results, the odds of self-reported musculoskeletal complaints in both boys and girls increased with increasing computer use time. The Finnish study has proposed a hypothesis that neck/shoulder and lower back pain symptoms for adolescents are associated with computer use: the risk for neck/shoulder pain symptoms rise with increasing computer use time [3]. However, some studies have also indicated psychological associations with such health complaints [2,6]. According to the data of a study conducted in Netherlands, musculoskeletal pain is associated with depression and stress but not with computer use [4].

Our logistic regression analysis shows that musculoskeletal complaints in adolescence are associated with duration of computer use and are related to both age and gender. The long-term study conducted in Finland presented data showing that the prevalence of neck/shoulder and low back pain symptoms increased with age: the higher prevalence of pain was observed among girls and increased with age [11]. In most studies, there is a higher incidence of complaints for girls than for boys; some investigators have found a higher frequency of complaints from children of other ethnic groups or children from socially disadvantaged families. That finding may be related to many factors; for instance, it is more acceptable for girls to complain about pain than boys.

Results in the literature show that musculoskeletal disorders and pain problems in adolescence is a serious problem [1,4,12,13]. Health care providers should evaluate children carefully, based not only on objective data, but also using a risk factor assessment. Investigations based only on objective evaluation versus subjective complaints do not show significant relationships. An objective assessment may show no abnormalities, but pain complaints interfere with everyday life [14,15]. Therefore, it is necessary to evaluate both the subjective symptoms and risk factors for their development. Not only our study, but other

studies as well, show that pain symptoms are related to time of computer use, gender, and age [12,16]. There are also studies showing a relationship between musculoskeletal complaints in adolescence with low back pain in adulthood. A 25-year prospective cohort study showed that low back pain in the adolescence and familial occurrence of back disease are important risk factors for low back pain later in life, with an observed probability of 88%—especially if both factors are present [17]. Those researchers noted that preventive measures in adolescence seem to be of great importance for prevention of musculoskeletal disorders in the future.

According to the scientific data, there is no unified strategy and opinion on how to reduce adolescents' computer-use time and to get them interested in other activities. Studies conducted in many countries demonstrate that, in every country, there are different social conditions, motivations, and public attitudes towards this issue; therefore, when dealing with the problem of too much time spent using computers, the differences among cultures and countries, and the expectations as well as priorities of children and adolescent population, should be taken into consideration [15,18,19]. Open communication as well as close parent-child relations are significant preconditions for psychological well-being and physical health in adolescence. Children who lack effective parental communication are more likely to spend more time in virtual space [20]. Nevertheless, adolescents' communication continue to become "computerized" in many countries, and has also increased the number of hours spent playing computer games [21,22].

## References

- [1] Hakala P.T., Saarni L.A., Ketola R.L., Rahkola E.T., Salminen J.J., Rimpelä A.H., Computer-associated health complaints and sources of ergonomic instructions in computer-related issues among Finnish adolescents: a cross-sectional study, *BMC Public Health*, 2010, 10, 11
- [2] Cederquist V.A., Psychiatric and psychosomatic symptoms are increasing problems among Swedish schoolchildren, *Acta Paediatr.*, 2006, 95, 901-903
- [3] Hakala P.T., Rimpelä A.H., Saarni L.A., Salminen J.J., Frequent computer-related activities increase the risk of neck – shoulder and low back pain in adolescents, *Eur. J. Public Health*, 2006, 16, 536-541
- [4] Jacobs K., Hudak S., McGiffert J., Computer-related posture and musculoskeletal discomfort in middle school students, *Work*, 2009, 32, 275-283
- [5] Boström M., Dellve L., Thomée S., Hagberg M, Risk factors for generally reduced productivity—a prospective cohort study of young adults with neck or upper-extremity musculoskeletal symptoms, *Scand. J. Work Environ. Health*, 2008, 34, 120-132
- [6] Diepenmaat A.C.M., van der Wal M.F., de Vet H.C.W., Hirasing R.A., Neck/shoulder, low back, and arm pain in relation to computer use, physical activity, stress and depression among dutch adolescents, *Pediatrics*, 2006, 117, 412-416
- [7] Chirita V., Chirita R., Stefanescu C., Chele G., Ilinca M., Computer use and addiction in Romanian children and teenagers—an observational study, *Rev. Med. Chir. Soc. Med. Nat. Iasi.*, 2006, 110, 526-532
- [8] Marshall S.J., Gorely T., Biddle S.J., A descriptive

## 4.1. There are some limitations to our study

In total, 76 respondents of 1806 who took part in the study did not fully complete the questionnaire. It is possible that respondents with musculoskeletal problems were more motivated to complete the questionnaire. The study is representative, because we had sufficient number of respondents (1730) and a 95.8% response rate. We investigated a limited age group (ages 15–18 years), leaving aside the younger respondents. This will be the subject of further research.

## 5. Conclusions

Results show that musculoskeletal complaints in Lithuanian adolescents are related to duration of computer use. Musculoskeletal complaints are growing along with the increasing time spent at the computer. Finally, we conclude that it is necessary to pay attention to self-rated musculoskeletal complaints in adolescence. There are many various preventive measures, but the main issue that must be addressed is a way to decrease the amount of time that adolescents spend at a computer.

## Acknowledgments

We wish to thank Education Division and schools administration, teachers and students for attention, patience and support. We express gratitude to our department colleagues for provided critical input in all phases of this study.

- epidemiology of screen-based media use in youth: a review and critique, *J. Adolesc.*, 2006, 29, 333-349
- [9] Koivusilta L.K., Lintonen T.P., Rimpelä A.H., Orientations in adolescent use of information and communication technology: a digital divide by sociodemographic background, educational career, and health, *Scand. J. Public Health*, 2007, 35, 95-103
- [10] Hope M., Cumming M.A.; Elizabeth A., Vandewater P., Relation of Adolescent Video Game Play to Time Spent in Other Activities, *Arch. Pediatr. Adolesc. Med.* 2007, 161, 684-689
- [11] Hakala P.T., Rimpelä A.H., Salminen J.J., Virtanen S.M., Back, neck, and shoulder pain in Finnish adolescents: national cross sectional surveys, *BMJ*, 2002, 325, 743
- [12] Zapata A.L., Moraes A.J.P., Leone C., Doria-Filho U., Silva C.A.A.S., Pain and musculoskeletal pain syndromes related to computer and video game use in adolescents, *Eur. J. Pediatr.*, 2006, 165, 408-414
- [13] Jacobs K., Baker N.A., The association between children's computer use and musculoskeletal discomfort, *Work*, 2002, 18, 221-226
- [14] Harreby M., Neergaard K., Hesselsøe G., Kjer J., Are radiologic changes in the thoracic and lumbar spine of adolescent's risk factors for low back pain in adults? A 25-year prospective cohort study of 640 school children, *Spine*, 1995, 20, 2298-2302
- [15] Ustinaviciene R., Skemiene L., Papeckyte J., Musculoskeletal disorders of school children and work with computer, *Public Health*, 2009, 2, 61-66 (in Lithuanian)
- [16] Szpalski M., Gunzburg R., Balagué F., Nordin M., Mélot C., A 2-year prospective longitudinal study on low back pain in primary school children, *Eur. Spine J.*, 2002, 11, 459-464
- [17] Harreby M.S., Neergaard K., Hesselsøe G., Kjer J., Are low back pain and radiological changes during puberty risk factors for low back pain in adult age? A 25-year prospective cohort study of 640 school children, *Ugeskr. Laeger.*, 1997, 159, 171-174
- [18] Haugland S., Wold B., Stevenson J., Aaroe L.E., Woynarowska B., Subjective health complaints in adolescence. A cross-national comparison of prevalence and dimensionality, *Eur. J. Public Health*, 2001, 11, 4-10
- [19] Smith L., Louw Q., Crous L., Grimmer-Somers K., Prevalence of neck pain and headaches: impact of computer use and other associative factors, *Cephalalgia*, 2009, 29, 250-257
- [20] Ștefănescu C., Chele G., Chiriță V., Chiriță R., Mavros M., Macarie G., et al., The effects of computer-use on adolescents, *Rev. Med. Chir. Soc. Med. Nat. Iasi.*, 2005, 109, 871-877
- [21] Heins E., Seitz C., Schuz J., Toschke A.M., Harth K., Letzel, et al., Bedtime, television and computer habits of primary school children in Germany, *Gesundheitswesen*, 2007, 69, 151-157
- [22] Wei R., Effects of playing violent videogames on Chinese adolescents' pro-violence attitudes, attitudes toward others, and aggressive behavior, *Cyberpsychol. Behav.*, 2007, 10, 371-380