



The frequency of the use of information and communication technologies in school age children and musculoskeletal disorders connected with their use

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ABSTRACT

Introduction: Information and communication technology (ICT) has multiplied its availability and use, causing enormous use, particularly in school age children that use them 7.5 h a day on average. The time that adolescents spend in front of electronic screens has significantly increased between the 10th and 14th year, but there are significant changes in gender. In boys that increase is 41.6 min a day, whereas in girls, it is 22.7 min during a day.

Methods: The study is designed as an epidemiological, cross-sectional, descriptive-analytical, and comparative study. The study is conducted in a form of online questionnaire on Microsoft Forms platform in a period from December 15, 2021 to December 30, 2021. The respondents could access with a link and QR code at the request for consent that was previously signed by a parent/guardian and gave consent that can children participate in this study.

Results: The results of this study show that school-age children usually use mobile phones with a touch screen every day during the working week (39.2%) and TV (39.5%) in the period between 2 and 3 h. The pain in the past 12 months caused by ICT use was mostly present in the area of neck/shoulders (42.4%), while the pain during the previous month was mostly present in lower extremities (29.1%).

Conclusion: Increased use of ICT devices related to higher levels of musculoskeletal symptoms. Higher exposure to pain in various segments of the body is a reason of concern, and further research on the implication of their use among adolescents is necessary and justified.

Keywords: Information and communication technology; children; musculoskeletal symptoms

INTRODUCTION

The access to information and services on the internet became so important that several national governments, including that the governments of Spain, France, Finland, Greece, Costa Rica, and Estonia have officially admitted access to the internet as a human right (1).

The children grow up with digital platforms, such as YouTube and Instagram, and use tablet devices before they can verbally communicate with the environment. The children grow, play, study, and communicate through the virtual world. Until 2015, 91% of school children, aged 15 that took the PISA program test (Program for International Student Assessment) said that they had access to a smartphone, 60% of school children had access to a laptop, while

53% of school children had access to a tablet device that is connected to the Internet (2).

Information and communication technology (ICT) has multiplied its availability and use, causing enormous use, particularly in school age children that use them 7.5 h a day on average (3).

In Saudi Arabia, 94% of children said that they own a laptop or computer at home, and 85% said they use a computer for more than 2 h a day (4).

Americans spend 3 h and 23 min a day on their smartphones, not counting the time that is spent when they speak on the phone (5).

According to a survey that was conducted by Limelight Networks, the children in America who play video games spend 6.44 h a week on electronic consoles, which is more than the global average of 5.96 h (6).

The time that adolescents spend in front of electronic device screens has significantly increased between the 10th and 14th year, but there are significant differences in gender. In

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boys that increase is 41.6 min a day, while in girls, it is 22.7 min a day (7).

In the USA, 89% of adolescents, aged 13–17, have a smartphone, more than double compared with the period of 6 years ago. The social networks are used by 70% of adolescents several times during a day (8).

The percentage of adolescents from Ontario (Canada) who admitted that they spent more than 5 h using social networks increased to 20% in 2017. The analysis of Australian longitudinal surveys shows that 86% of students own a smartphone in the eighth grade, and that percentage increases to 93% in the 11th-grade students (9).

With increased use of ICT devices, the concern related to musculoskeletal problems is higher due to their ever increasing use. The epidemiological survey of smartphone users conducted in the Republic of Korea showed that 18.8% of smartphone users reported musculoskeletal disorders at least in one part of the body, especially in the area of the neck, upper part of the back, including upper extremities (10).

Kim and Kim concluded that the neck is the most painful area of the body as a consequence of smartphone use (55.8%) (11). In a cross-sectional study, it is concluded that the pain in the area of the shoulder and neck among mobile phone users with touch screen had the highest prevalence rate ranging from 26.3% to 60% (12).

The prevalence of pain in the thoracic spine caused by ICT in adolescent in Portugal is 13.2%, in Australia, it is 20%, in the region of south Denmark, it is 36% (13), in Canada, it is 59% (14), while in the south of Brazil, in Rio Grande city, it is 26.2%, in Peltas, it is 36.9% (15).

In Shanghai (China), the prevalence of lower back pain connected with long-term use of various modern technology devices in adolescents was 33.1%, while in Brazil was 13.7% (16).

The incidence of pain in the lower part of the back due to computer work is higher in girls, compared to boys (17).

Toh found that in the previous month, girls had a significantly higher prevalence of symptoms in the neck/shoulder area compared to boys. The prevalence of symptoms of all parts of the body increases with attendance at higher grades of school (18).

During the use of mobile phone with a touch screen, angles of neck flexion and wrist are present, including a bigger flexion of the head (19).

An observational study of sending messages showed that smartphone use results in a significant increase in the neck bending angle and the angle of inclination of the head (20).

Watching TV daily longer than 3 h, using a laptop and a mobile phone in lying and semi-lying positions longer than 3 h a day, as well as using a tablet longer than 3 h a day, causes that girls have about 1.7 times higher possibility to develop pain in the lower part of the back compared to boys (21,22).

Smartphone use presents a risk for musculoskeletal symptoms because as every hour of smartphone use increases on a daily basis, the chances for discomfort and pain became higher from 4% to 7% (23).

Musculoskeletal symptoms in the areas that control *nervus medianus* can be connected with the increased use of ICT,

especially while using a laptop, which indicates the risk of carpal tunnel syndrome (24).

It has been proven that children, while using a smartphone for a longer period of time take a non-physiological position, so that the neck is in a flexion position, upper and lower part of the back are bent, shoulders are in contraction, elbows are also bent, forearms are supinated, and hips, knees, and ankle joints are in constant flexion (25).

Author Kamiya states that advancements in musculoskeletal analysis have been achieved by adopting deep learning technology in image recognition and analysis. Unlike musculoskeletal modeling based on computational anatomy, deep learning-based methods can obtain muscle information automatically. Through analysis of image features, both approaches can obtain muscle characteristics such as shape, volume, and area, and derive additional information by analyzing other image textures (26).

The goal of this survey was to determine the frequency of the use of information and communication technologies and to examine the frequency and localization of pain during their use.

METHODS

The study is designed as an epidemiological, cross-sectional, descriptive-analytical, and comparative study that involved all the respondents that met all the criteria to participate in this study.

In this study, 549 respondents were involved that is students of all classes of the sixth, eighth, and ninth grades of elementary schools in the area of the Republic of Srpska (Bosnia and Herzegovina). Of the total number of respondents, 266 were male, while 283 were female. The survey was conducted in all four geographic regions of Republic Srpska: Banja Luka region, Doboj-Bijeljina, East Sarajevo, Zvornik, and Trebinje-Foča region.

The respondents were divided into two groups, with the division of respondents based on the territorial affiliation of the elementary schools.

- Survey Group 1 – included all school age children that attend schools in the urban areas of the Republic of Srpska region ($n = 258$)
- Survey Group 2 – included all school age children that attend schools in rural areas of the Republic of Srpska region ($n = 291$).

Following the code of ethics regarding conducting studies with children (Children's Council of Bosnia and Herzegovina-2006), the research was conducted after the decision of the University Senate regarding the adoption of the Commission report of September 29, 2021 (number: 01-14-179/21), with the consent of the Ministry of Education (number: 07.041/059–2318/21) and Culture of the Government of the Republic of Srpska, and written consent from the parents/guardian of the children that participated in the survey. The survey was conducted in the form of online questionnaire with the Microsoft Forms platform in the period from December 15, 2021 to December 30, 2021.

The instrument that was used in the survey was The Technology Use Questionnaire-TechU-Q, that was adjusted to our research. The authors of the questionnaire

planned to examine the pain in 2 time intervals, for the past 12 months and for the last month, to compare the obtained data, with the aim of determining the incidence of pain for the specified parts of the body.

The respondents could access this questionnaire with a link and QR code with the request for the consent that the parent/guardian previously signed for the purpose of children's approval to participate in this research.

The link was also accessible with the school address that was provided by the State Pedagogical Institute of the Republic of Srpska, through which schools were also requested to give consent for the purpose of the research.

After every signed questionnaire, information reached respondents by electronic post about the successfully fulfilled questionnaire, whose identity remained anonymous even to the researcher itself.

The results of the study are presented in a form of charts, with classical methods of descriptive statistics, depending on the nature of the data and measurement scale. To describe the sample depending on nature of the data, adequate methods of classical descriptive statistics were used: Absolute frequency (n) and relative frequency (%).

The results are shown in contingency tables (numbers with two decimals). The level of significance was set at $p = 0.05$.

RESULTS

The study encompassed 549 respondents of early adolescent age. All respondents were aged 10–16. Of the total number of respondents, 266 (48.5%) were male, while 283 (51.5%) were female.

The review of the duration of use of electronic devices within a working week shows that respondents from rural areas used the TV and tablet longer, while respondents from urban areas used a laptop and mobile phone with a touch screen. All recorded differences are not statistically significant. Of the total number of respondents, the respondents from both areas usually use the TV every day during a working week for <1 h (40.6%) and between 2 and 3 h (39.5%). Regarding the laptop, the respondents use it usually for <1 h (23%), while it is the same case with the tablet (16.8%). The mobile phone with a touch screen is usually used for 2–3 h (39.2%), while 41 (7.5%) respondent use the same device longer than 10 h every day during a working week (Table 1).

The use of electronic devices at the weekend is statistically significantly different only when it comes to TV use. The prevalence of non-use of the TV was higher in respondents in urban areas (15.5%), compared to the respondents from rural areas (7.6%). Of the total number of respondents, the respondents from both areas usually use TV in on both days of the weekend for <1 h (35.5%), and between 2 and 3 h (39.3%). The respondents use the laptop usually <1 h (17.9%), while the same case is with the tablet (14.9%). The mobile phone with touch screen is usually used for 2–3 h (37.3%), while 42 (51.5) of respondents use the same device for longer than 10 h on both days of the weekend (Table 2).

Of the total number of respondents, the pain in the area of the neck/shoulder during the past 12 months was present

in 233 (42.4%) respondents and in 112 (43.4%) respondent in urban areas and 121 (41.6%) respondents in rural areas, without significant differences between the areas. Of the total number of respondents, the pain during the previous month in the area of the shoulder/neck was present in 127 (23.1%) respondents and in 60 (23.3%) respondents of urban and 67 (23.0%) respondents in rural areas, without any significant difference (Table 3).

Of the total number of respondents the pain in the past 12 months in the upper part of the back was present in 171 (31.1%) respondents and in 79 (30.6%) respondents in urban and 92 (31.6%) respondents in rural areas, without significant difference between the areas. Of the total number of respondents in the past month, pain in the area of the upper back was present in 107 (19.5%) respondents, and in 47 (18.2%) respondents in urban and 60 (20.6%) respondents in rural areas without significant difference.

Of the total number of respondents, pain in the past 12 months in the lower part of the back was present in 150 (27.3%) respondents, and in 76 (29.5%) respondents in urban and 76 (25.4%) respondents in rural areas, without significant difference between the areas. Of the total number of respondents, the pain in the past month was present in 93 (16.9%) respondents, and in 48 (18.6%) respondents in urban and 45 (15.5%) respondents in rural areas, without significant difference (Table 4).

Of the total number of respondents pain in the past 12 months in arms was present in 150 (27.3%) respondents, and in 73 (28.3) respondents in urban and 77 (26.5%) respondents in rural areas without significant difference between the areas. Of the total number of respondents, the pain in the past month in arms was present in 92 (16.8%) respondents, and in 40 (15.5%) respondents in urban and 52 (17.9%) respondents in rural areas, without significant difference (Table 5).

Of the total number of respondents pain during the past 12 months in the wrist/hand was present in 119 (21.7%) respondents, and in 57 (22.1%) respondents in urban and 62 (21.3%) respondents in rural areas, without significant difference between the areas. Of the total number of respondents, the pain during the past month in the wrist/hand was present in 80 (14.6%) respondents, and in 33 (12.8%) respondents in urban and 47 (16.2%) of respondents in rural areas without significant difference (Table 6).

Of the total number of respondents, pain in the lower extremities during the past 12 months was present in 211 (38.4%) respondents, in 100 (38.8%) respondents in urban areas and 111 (38.1%) respondents in rural areas, without significant difference between areas. Of the total number of respondents, pain during the past month in the lower extremities was present in 160 (29.1%) respondents, in 71 (27.5%) respondents in urban and 89 (30.6%) respondents in rural areas, without significant difference (Table 7).

Correlation analysis of the frequency of pain in the past month of statistically significant variables in relation to the time of using ICT devices shows that, with an increase in the time of using tablets by 1 h during the week, the probability of the frequency of pain in the wrist/hand increases by 9.8% ($\rho = 0.098$; $p < 0.05$), while an increase in the use of a mobile phone with a touch screen for 1 h on a

TABLE 1. The review of the duration of use of electronic devices within a working week (Monday–Friday) according to areas

Electronic devices	Not use	<1 h	2–3 h	4–5 h	6–7 h	8–9 h	10+h	<i>p</i>
TV								
Urban								
n	20	110	99	17	7	2	3	$\chi^2=7.502; p=0.277$
%	7.8	42.6	38.4	6.6	2.7	0.8	1.2	
Rural								
n	15	113	118	35	5	1	4	
%	5.2	38.8	40.5	12.0	1.7	0.3	1.4	
Total								
n	35	223	217	52	12	3	7	
%	6.4	40.6	39.5	9.5	2.2	0.5	1.3	
Laptop								
Urban								
n	151	65	26	10	2	1	3	$\chi^2=6.54; p=0.365$
%	58.5	25.2	10.1	3.9	0.8	0.4	1.2	
Rural								
n	194	61	27	6	2	0	1	
%	66.7	21.0	9.3	2.1	0.7	0.0	0.3	
Total								
n	345	126	53	16	4	1	4	
%	62.8	23.0	9.7	2.9	0.7	0.2	0.7	
Tablet								
Urban								
n	198	45	11	3	0	0	1	$\chi^2=1.658; p=0.849$
%	76.7	17.4	4.3	1.2	0.0	0.0	0.3	
Rural								
n	230	47	9	3	1	0	1	
%	79.0	16.2	3.1	1.0	0.3	0.0	0.3	
Total								
n	428	92	20	6	1	0	2	
%	78.0	16.8	3.6	1.1	0.2	0.0	0.4	
Mobile phone with a touch screen								
Urban								
n	7	28	96	64	29	14	20	$\chi^2=5.762; p=0.450$
%	2.7	10.9	37.2	24.8	11.2	5.4	7.8	
Rural								
n	12	42	119	60	22	15	21	
%	4.1	14.4	40.9	20.6	7.6	5.2	7.2	
Total								
n	19	70	215	124	51	29	41	
%	3.5	12.8	39.2	22.6	9.3	5.3	7.5	

weekly basis increases the probability of upper back pain frequency by 15.1% ($\rho = 0.151; p < 0.01$), neck/shoulders by 14.0% ($\rho = 0.140; p < 0.01$) and legs by 13.1% ($\rho = 0.131; p < 0.01$) (Graph 1).

An increase in the total time of using electronic devices by 1 h/week increases the probability of upper back pain by 15.4% ($\rho = 0.154; p < 0.01$), legs by 13.0% ($\rho = 0.130; p < 0.01$), and neck/shoulders by 12.6% ($\rho = 0.126; p < 0.01$).

Correlation analysis of the frequency of pain in the past month of statistically significant variables in relation to work activities on ICT devices and sedentary activities without the use of ICT devices shows that, with an increase in the time of doing schoolwork by 1 h during the week, the probability of the frequency of pain in the upper back increases for 12.3% ($\rho = 0.123; p < 0.01$) and wrist/hand by 8.7% ($\rho = 0.087; p < 0.05$), while the increase in the use of social networks by 1 h on a weekly basis increases the probability of the

frequency of pain in the upper back by 19.9% ($\rho = 0.199; p < 0.01$), neck/shoulders by 12.0% ($\rho = 0.120; p < 0.01$), legs by 10.2% ($\rho = 0.102; p < 0.05$), and the lower back by 9.8% ($\rho = 0.098; p < 0.05$) (Graph 2).

Correlation analysis revealed that an increase in watching video content by 1 h per week increases the probability of upper back pain by 16.7% ($\rho = 0.167; p < 0.01$) and legs by 11.2% ($\rho = 0.112; p < 0.01$), while an increase in playing video games by 1 h per week increases the likelihood of leg pain by 12.1% ($\rho = 0.121; p < 0.01$) and upper back pain by 10.9% ($\rho = 0.109; p < 0.05$).

An increase in the use of ICT devices for other purposes by 1 h per week increases the probability of upper back pain by 21.6% ($\rho = 0.216; p < 0.01$), neck/shoulders by 12.6% ($\rho = 0.126; p < 0.01$), and legs by 12.3% ($\rho = 0.123; p < 0.01$), while an increase in activity in a sitting position without the use of ICT devices for 1 h during the week

TABLE 2. The review of using electronic devices at the weekend (Saturday–Sunday) according to areas

Electronic devices	Not use	<1 h	2–3 h	4–5 h	6–7 h	8–9 h	10+h	<i>p</i>
TV								
Urban								$\chi^2=14.027; p=0.029$
n	40	93	87	30	3	3	2	
%	15.5	36.0	33.7	11.6	1.2	1.2	0.8	
Rural								
n	22	102	129	26	6	2	4	
%	7.6	35.1	44.3	8.9	2.1	0.7	1.4	
Total								
n	62	195	216	56	9	5	6	
%	11.3	35.5	39.3	10.2	1.6	0.9	1.1	
Laptop								
Urban								$\chi^2=4.463; p=0.614$
n	174	48	22	7	3	3	1	
%	67.4	18.6	8.5	2.7	1.2	1.2	0.4	
Rural								
n	209	50	25	3	2	2	0	
%	71.8	17.2	8.6	1.0	0.7	0.7	0.0	
Total								
n	383	98	47	10	5	5	1	
%	69.8	17.9	8.6	1.8	0.9	0.9	0.2	
Tablet								
Urban								$\chi^2=11.247; p=0.046$
n	208	31	13	4	0	2	0	
%	80.6	12.0	5.0	1.6	0.0	0.8	0.0	
Rural								
n	231	51	7	0	1	1	0	
%	79.4	17.5	2.4	0.0	0.3	0.3	0.0	
Total								
n	439	82	20	4	1	3	0	
%	80.0	14.9	3.6	0.7	0.2	0.5	0.0	
Mobile phone with a touch screen								
Urban								$\chi^2=9.519; p=0.146$
n	6	28	89	65	36	13	21	
%	2.3	10.9	34.5	25.2	14.0	5.0	8.1	
Rural								
n	12	43	116	60	24	15	21	
%	4.1	14.8	39.9	20.6	8.2	5.2	7.2	
Total								
n	18	71	205	125	60	28	42	
%	3.3	12.9	37.3	22.8	10.9	5.1	5.1	

TABLE 3. The review of respondents with the pain in the neck/shoulder

Body region and time interval	Total	Areas		<i>p</i>
		Urban	Rural	
Pain during the past 12 months in the neck/shoulder				
n	233	112	121	$\chi^2=0.187;$
%	42.4	43.4	41.6	$p=0.364$
Pain during the past month in the neck/shoulder				
n	127	60	67	$\chi^2=0.004;$
%	23.1	23.3	23.0	$p=0.514$

increases the probability of pain frequency in the lower in the back by 11.3% ($\rho = 0.113; p < 0.01$).

DISCUSSION

In this study, 549 respondents of early adolescent age were included in the study. All respondents were aged 10–16. Of

the total number of respondents, 266 (48.5%) were male, while 283 (51.5%) were female.

Alghadir in a study of the relationship between television viewing, computer use, physical activity, and food preferences according to body mass index in 214 respondents aged 12–18 attending various schools in Riyadh (Saudi Arabia) found that about 87% of boys from Saudi Arabia and about 69% of boys from non-Saudi Arabia (respondents from Australia, India, Pakistan, Afghanistan, South Africa, and Egypt who attend classes in Riyadh) said that they watched television for more than 2 h a day, while girls, also, a high percentage said that they watched television for more than 2 h a day (girls from Saudi Arabia (76%) and girls from other countries (63%). Among boys, 98% from Saudi Arabia and 80% from other countries use a computer more than 2 h every day, while 89% of girls from Saudi Arabia and 74% boys from other

TABLE 4. The review of respondents with pain in the upper part of the back and the lower back

Body region and time interval	Areas		Total	p
	Urban	Rural		
Pain during the last 12 months in the upper part of the back				
n	79	92	171	$\chi^2=0.063$;
%	30.6	31.6	31.1	$p=0.437$
Pain during the last month in the upper part of the back				
n	47	60	107	$\chi^2=0.503$;
%	18.2	20.6	19.5	$p=0.274$
Pain during the last 12 months in the lower part of the back				
n	76	74	150	$\chi^2=0.959$;
%	29.5	25.4	27.3	$p=0.193$
Pain during the last month in the lower part of the back				
n	48	45	93	
%	18.6	15.5	16.9	

TABLE 5. The presence of pain in arms

Body region and time interval	Areas		Total	p
	Urban	Rural		
Pain during the past 12 months in the arms				
n	73	77	150	$\chi^2=0.232$;
%	28.3	26.5	27.3	$p=0.350$
Pain during the past month in the arms				
n	40	52	92	$\chi^2=0.549$;
%	15.5	17.9	16.8	$p=0.459$

TABLE 6. The presence of pain in the wrist/hand

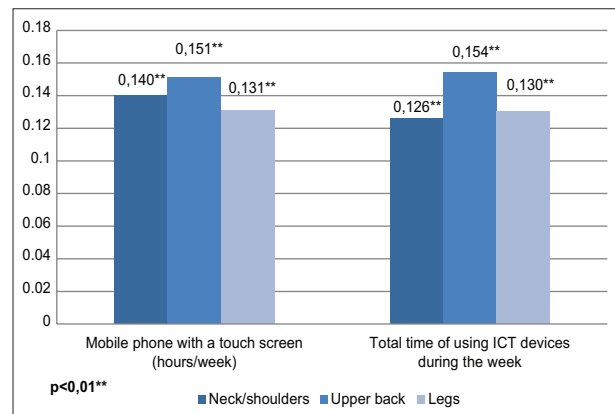
Body region and time interval	Areas		Total	p
	Urban	Rural		
Pain during the last 12 months in the wrist/hand				
n	57	62	119	$\chi^2=0.050$;
%	22.1	21.3	21.7	$p=0.452$
Pain during the past month in the wrist/hand				
n	33	47	80	$\chi^2=1.241$;
%	12.8	16.2	14.6	$p=0.160$

TABLE 7. The presence of pain in lower extremities

Body region and time interval	Areas		Total	p
	Urban	Rural		
Pain in the lower extremities during the past 12 months				
n	100	111	211	$\chi^2=0.022$;
%	38.8	38.1	38.4	$p=0.476$
Pain during the past month in the lower extremities				
n	71	89	160	$\chi^2=0.622$;
%	27.5	30.6	29.1	$p=0.244$

countries also use the computer more than 2 h a day (4). A study from Saudi Arabia is significantly different than ours, because respondents from both areas use a laptop between 2 and 3 h a day during a working week (9.7%) and at the weekend (8.6%).

A cross-sectional survey of 934 students from the 5th–12th grade in Australian school in Perth using the questionnaire on technology use (TechU-Q) concluded that respondents used ICT in their free time 7.4 h a day. The use of ICT in free time was lower ($p < 0.001$) in girls (6.4 h) compared to boys (8.7 h) (27), which is significantly higher compared to our surveys.

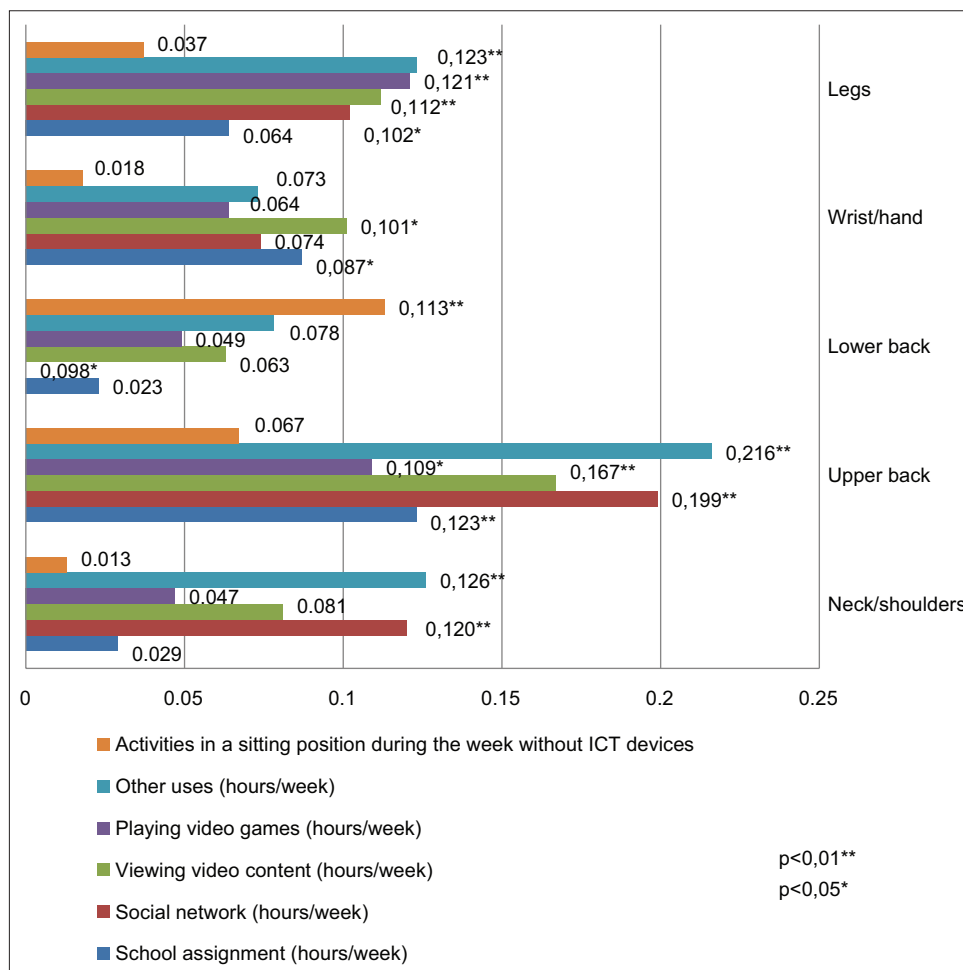
**GRAPH 1.** Correlation analysis of the frequency of pain in the past month of statistically significant variables in relation to the time of using ICT devices.

The cohort study summarized week hours that adolescents spend using digital devices for watching TV, playing videogames, communication, education, audio entertainment, and other recreation as a primary or secondary activity in the period of 2002–2003 and 2014–2016. The participation of adolescents in using technology is higher for 17% between groups, from 28.2 h during the week to 33-week rate ($p < 0.001$). Technology use in adolescents as the primary activity decreased about 1 h a week between groups (22.3 h in the younger group, compared with 21.4 h in the older group), but increased for more than 8 h a week as a secondary activity (7.6 h a week compared with 16.2 h during a week ($p < 0.001$)). The time that is spent playing a video game or for educational purposes as a primary activity, and communication, playing video games or audio entertainment as a secondary activity, increased during the period ($p < 0.001$). Between 2002–2003 and 2014–2016, the number of adolescents that play video games increased for two-thirds ($p < 0.001$), the number of those using it for entertainment for a half ($p < 0.001$), and for communication by one quarter ($p < 0.001$) (28).

A longitudinal survey in 1393 respondents aged 14–18 in Sao Paulo (Brazil) concluded that the incidence of pain in the lower part of the back was caused using ICT and was found in 143 respondents (18.9%; 95% CI: 16.2; 21.8). Based on the data about the use of electronic devices, the highest incidence of pain in the lower part of the back was found among the respondents that used mobile phones (OR = 1.81; 95% CI: 1.01; 3.33). Significant predictors for pain in the lower part of the back were mobile phone use for more than 3 h in a supine position (OR = 1.49; 95% CI: 1.05; 2.12), including tablet use at the same time interval with the same position (OR = 3.21; 95% CI: 1.41; 7.30) (CI – confidence interval; OR – odds ratio) (17).

A cross-sectional study by Toh in 1884 respondents aged 10–18 in Singapore concluded that musculoskeletal disorders in a previous month were mostly reported in the area of the neck/shoulder (42.4%), then in arms (33.3%), the upper part of the back (29.1%), wrist/hand (26.8%), and in the lower part of the back (22.7%). The respondents (26.1%) said that their musculoskeletal symptoms in the previous months were “common or always present” for all parts of the body (18).

A cross-sectional study in 779 respondents from Thailand in which standard nordic questionnaire was used that



GRAPH 2. Correlation analysis of the frequency of pain in the past month of statistically significant variables in relation to work activities on ICT devices and activities in a sitting position without the use of ICT devices.

analyzed smartphone uses and musculoskeletal disorders in the past 12 months concluded that the prevalence of musculoskeletal disorders is the highest in the area of the neck (32.5%), then in shoulders (26.91%), the upper part of the back (20.69%), and the wrist and hand (19.75%). The musculoskeletal disorders were less present in the lower part of the back (17.26%), hips and thighs (9.8%), knees (7.31%), ankles and feet (6.69%), and elbow (4.97%) (29).

A cross-sectional study by Falkenberg of children aged 10–13 in Norway showed that the most reported symptoms when using smartphones or tablet devices in all respondents were pain in the neck (29%) (30).

In a descriptive study of 240 respondents aged 9–15 in the city of Beni-Suef (Egypt) reported musculoskeletal disorders (83.75%) caused by ICT devices use in a period of 4 months after the first control study. Pain in the neck and shoulders reported (82.5%) respondents, while (61.25%) said that they experienced pain in the shoulders and wrist (31).

In our study, the pain in the past 12 months that is caused by ICT use was mostly present in the area of the neck/shoulder (42.4%), then in lower extremities (38.4%), in the upper part of the back (31.1%), lower part of the back and arms (27.3%), while the smallest percentage of the pain was in the wrist/hand (21.7%). Compared with the studies of other authors, the data are similar for certain segments of the body, while in others, our findings are significantly different.

Furthermore, in our study, the pain in the past month caused by ICT use was present in lower extremities (29.1%), than in the area of the neck/shoulder (23.1%), upper part of the back (19.5%), lower part of the back (16.9%), and arms (16.8%). Compared with the studies of other authors, the data are similar for certain segments of the body, while in other are significantly different.

The limitation of this study

The study was conducted during the period of the COVID-19 pandemic, and in this regard, it was impossible to directly access the respondents, but the entire research was conducted in the form of an online questionnaire through the Microsoft Forms platform.

CONCLUSION

The school age children from the Republic of Srpska (Bosnia and Herzegovina) usually use mobile phones with touch screen, within a working week and at the weekend. The survey showed that children use ICT during the day, regardless of what period of the week it is. Compared with the surveys of other authors all over the world, the results of our study are somewhat more positive when it comes to the recommendations of the World Health Organization on daily ICT use for school age children, and this should be one hour. A higher frequency of the use of ICT devices was

connected with higher levels of musculoskeletal symptoms. High exposure to pain in various segments of the body is reason for concern, and further research on the implications of ICT use among adolescents is necessary and justified.

DECLARATION OF INTERESTS

The authors declare no conflicts of interest.

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