



Factors related to smartphone use and neck pain among physiotherapy university students – a cross-sectional study

Czynniki związane z użytkowaniem smartfonów i bólem szyi wśród studentów fizjoterapii – badanie przekrojowe

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Abstract

Introduction and Objective. Smartphones have penetrated everyone's lives, including students. Smartphones force the user to maintain a certain head position in order to look at the phone's small monitor and perform repetitive movements in one position for a long time, which may cause musculoskeletal disorders. Socio-demographic factors, such as gender, age and body mass index, are thought to be associated with musculoskeletal pain associated with use of the electronic device. Given the high prevalence of musculoskeletal disorders among students and the growing number of people using smartphones, the aim of the study was to determine the factors related to smartphone use and neck pain among physiotherapy university students.

Materials and Method. This study involved 142 men and women, aged between 18-26 years. All participants completed an original survey containing questions about smartphone use and neck pain.

Results. Statistically significant effect of gender ($\chi^2=7.67$, $p=0.006$), age when first owning a mobile phone ($\chi^2=7.28$, $p=0.03$), pain in the thumb ($\chi^2=4.86$, $p=0.03$), and self-assessment of spending too much time using the phone ($\chi^2=7.27$, $p=0.007$) were found. There was no statistically significant relationship between neck pain and situations where students use their phones.

Conclusions. People, especially women, who received a cell phone at a younger age are more likely to report neck pain. While there is no statistically significant association between neck pain and situations in which students use cell phones, efforts should be made to educate students about digital hygiene.

Key words

digital hygiene, mobile phone, musculoskeletal disorders

Streszczenie

Wprowadzenie i cel pracy. Smartfony przeniknęły do życia wszystkich ludzi, a zatem są używane również przez studentów. Urządzenia te zmuszają użytkownika do utrzymywania określonej pozycji głowy, aby mógł on patrzeć na mały monitor telefonu i wykonywać powtarzające się ruchy w jednej pozycji przez długi czas, co może prowadzić do zaburzeń w układzie mięśniowo-szkieletowym. Uważa się, że czynniki społeczno-demograficzne, takie jak płeć, wiek i wskaźnik masy ciała, są związane z bólem układu mięśniowo-szkieletowego oraz z korzystaniem z urządzeń elektronicznych. Biorąc pod uwagę wysoką częstość występowania schorzeń układu mięśniowo-szkieletowego wśród studentów i rosnącą liczbę osób korzystających ze smartfonów, sformułowano cel badania, którym jest określenie czynników związanych z korzystaniem ze smartfonów i bólem szyi wśród studentów fizjoterapii.

Materiał i metody. W badaniu wzięło udział 142 mężczyzn i kobiet w wieku od 18 do 26 lat. Wszyscy uczestnicy wypełnili oryginalną ankietę zawierającą pytania dotyczące korzystania ze smartfona i doświadczania bólu szyi.

Wyniki. Stwierdzono statystycznie istotny wpływ płci ($\chi^2 = 7,67; p = 0,006$), wieku, w którym uczniowie po raz pierwszy otrzymali własny telefon komórkowy ($\chi^2 = 7,28; p = 0,03$), bólu kciuka ($\chi^2 = 4,86; p = 0,03$) oraz określenia przez ucznia, iż spędza on zbyt dużą ilość czasu na korzystaniu z telefonu ($\chi^2 = 7,27; p = 0,007$). Nie stwierdzono statystycznie istotnego związku między bólem szyi a sytuacjami, w których uczniowie korzystają ze swoich telefonów.

Wnioski. Kobiety i osoby, które otrzymały telefon komórkowy w młodszym wieku, częściej zgłaszają ból szyi. Chociaż nie ma statystycznie istotnego związku między bólem szyi a sytuacjami, w których uczniowie korzystają z telefonów komórkowych, należy podjąć wysiłki, aby edukować ich na temat higieny cyfrowej.

Słowa kluczowe

higiena cyfrowa, telefon komórkowy, zaburzenia mięśniowo-szkieletowe

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INTRODUCTION

The widespread availability of Internet access has transformed the way individuals engage in professional activities, communicate with one another, and acquire knowledge [1]. As of June 2021, the number of smartphone users has reached 3.95 billion, which accounts for 50% of the total population [2]. Smartphones have penetrated everyone's lives, including students. The main users of smartphones are usually young people [3]. Young students use smartphones more often and are more dependent on them than any other age group [4, 5]. University students use the Internet not only for educational and academic tasks, but also for other purposes, such as searching for information, navigation, entertainment, communication, social networking, and online shopping [6, 7]. Most young people spend 3–4 hours a day using their smartphone [8].

A musculoskeletal disorder is defined as damage to the musculoskeletal structures resulting from repetitive movements, forces and positions during specific tasks [9]. Smartphones force the user to maintain a certain head position in order to look at the phone's small monitor and perform repetitive movements in one position for a long time, which may cause musculoskeletal disorders [10–12]. This may lead to biomechanical changes, the most visible of which is the position of the head in protraction, characterized by the head and neck moving forward in relation to the shoulder girdle and torso [13, 14].

Although physiotherapy students engage in a lot of physical activities, they are also exposed to many hours in a sitting position during classes and while learning [15]. In a study evaluating university students, it was observed that the region with the highest incidence of musculoskeletal pain symptoms was the neck [16]. About 60% of undergraduate students experience neck pain [17]. 69% of undergraduate physiotherapy students of university of Balochistan Quetta, Pakistan, were suffering from neck pain [18]. Research shows that the reasons that make undergraduate students susceptible to neck pain include lack of physical activity, the stress of studying, and the widespread use of various digital gadgets [17, 19].

The incidence of pain was also associated with psychological stress and smartphone use time [16]. In Hong Kong and Thailand, neck pain was reported by 68.2% and 90% of university students aged 18–24 using smartphones, respectively [20]. Long-term neck flexion while using a smartphone affects our health and leads to overload in the musculoskeletal system. The forward head bending position significantly increases the load on the cervical spine. This greater tension can potentially lead to premature wear and degeneration, and may lead to the need for surgery in the future [21]. This is supported by research showing that the risk factors for neck pain include poor posture and smartphone use [22–24]. Additionally, frequent use of smartphones and other electronic devices can cause pain in various other areas of the body [25]. Some studies show an association between the incidence of musculoskeletal pain and the size of the smartphone, and time spent on daily use of the smartphone [26].

Socio-demographic factors such as gender, age and body mass index are also considered to be associated with musculoskeletal pain associated with the use of an electronic device. Factors such as smoking, attending the final year of

university, personal characteristics, and physical activity also have an impact [27–29].

Given the high prevalence of musculoskeletal disorders among students and the growing number of people using smartphones, the aim of the study was to determine the factors related to smartphone use and neck pain among physiotherapy university students. It was hypothesized that the number of factors, including smartphone usage behaviour, is related to neck pain.

MATERIALS AND METHOD

The study involved 142 men and women, aged between 18–26 years (78 females, 64 males). The study was approved by the Bioethics Committee at the Medical University in eastern Poland (Approval No. KE-0254/257/12/2022), and carried out in accordance with the ethical principles of the Declaration of Helsinki. All participants were informed about the aims of the study, given the opportunity to ask any questions, withdraw at any point, and provided written consent to participate in the study. All participants completed an original survey containing questions about smartphone use and neck pain.

The author's questionnaire included the following questions: 'Have you recently experienced neck pain?' 'From what age have you had your own mobile phone or smartphone?' 'In what position do you most often use the phone?' 'Over the last week, have you experienced pain or discomfort in your thumb or wrist while using your smartphone?' 'Do you think you spend too much time using your smartphone?' 'Have you ever tried to limit your smartphone use?' 'In what situations do you most often use your smartphone?' 'Do you know the meaning of the term: Text Neck Syndrome (TNS)?'

Data analysis. Data analysis was conducted using Statistica software (ver. 13.1, TIBCO Software Inc., Palo Alto, CA, USA). The data are presented as a number of responders (N), and percentage of responders (%). In the case of multiple choice questions, the number of responses and percentage of responses were also reported. A chi-squared test was utilized to compare differences in categorical variables. The Phi coefficient assumes the value from 0 (indicating no relationship) to 1 (indicating a perfect relationship), and indicates the effect size. The significance level was set at $p=0.05$.

RESULTS

Participants who reported a cervical spine injury were excluded from the study. 67 (46%) students of physiotherapy reported neck pain not related to the injury. Statistically significant effect of gender ($\chi^2=7.67$; $p=0.006$), age when first owning a mobile phone ($\chi^2=7.28$; $p=0.03$), pain in the thumb ($\chi^2=4.86$; $p=0.03$) and self-assessment of spending too much time using the phone ($\chi^2=7.27$; $p=0.007$) were found (Tab. 1). Women and those who received the mobile phone at a younger age more often report neck pain. Also, those who felt pain in the thumb more frequently suffered from neck pain. Self-assessment of spending too much time using the phone was related to neck pain; however, no relationship was found between neck pain and attempts to limit phone use.

Table 1. Factors related to the presence of neck pain

Variable	Neck pain			
	N/%	Yes	No	
Gender	Female	N	45	33
		%	57.69	42.31
	Male	N	22	42
		%	34.38	65.63
	chi=7.67 p=0.006 phi=0.23			
	Age when first owning a mobile phone	<13	N	51
%			53.13	46.88
13-16		N	14	29
		%	32.56	67.44
>16		N	2	0
		%	100	0
chi=7.28 p=0.03 phi=0.22				
Position during using the phone	Sitting	N	47	45
		%	51.09	48.91
	Lying	N	17	23
		%	42.50	57.50
	Standing	N	2	6
		%	25.00	75.00
chi=2.49 p=0.29 phi=0.13				
Pain in thumb	Yes	N	14	6
		%	70.00	30.00
	No	N	53	69
		%	43.44	56.56
	chi=4.86 p=0.03 phi=0.19			
	Too much time on the phone	Yes	N	59
%			53.15	46.85
No		N	8	23
		%	25.81	74.19
chi=7.27 p=0.007 phi=0.23				
Attempt to limit phone use		Yes	N	18
	%		46.15	53.85
	No	N	49	54
		%	47.57	52.43
	chi=0.02 p=0.87 phi=0.01			
	Familiarity with TNS	Yes	N	28
%			56.00	44.00
No		N	39	53
		%	42.39	57.61
Chi=2.41 p=0.12 phi=0.13				

There was no significant relationship between the position of using the phone, familiarity with the TNS, and neck pain frequency.

Students most often use smartphones during their free time and leisure activities.

Percentage of responses – 26.83; percentage of participants – 77.46); use of smartphone: before bedtime – 25.37%; 73.24%) waiting for the bus – 17.32%; 50.00%, and during meals -17.07%; 49.30%. (Tab. 2).

There was no statistically significant relationship between neck pain and situations where students use their phones.

Table 2. Results of multiple choice questions related to situations when students use their phones the most frequently

Category	Count N	Responses %	Cases %
Waiting for a bus	71	17.32	50
Walking along the pavement	7	1.71	4.93
Rest and free time	110	26.83	77.46
Housework	22	5.37	15.49
Work/classes/lessons	23	5.61	16.2
Meals	70	17.07	49.3
Bedtime	104	25.37	73.24
Meetings with friends	3	0.73	2.11
Total	410	100	288.73

The way of using phones was similar in both groups (with and without neck pain) (Table 3).

Table 3. Results of the relationship between using phones in specific situations and neck pain presence

Category	Neck pain		Statistics
	Yes	No	
Waiting for a bus	N	31	40
	Responses (%)	16.85	17.70
	Respondents (%)	46.27	53.33
Chi=0.71 p=0.40 phi=0.07			
Walking along the pavement	N	2	5
	Responses (%)	1.09	2.21
	Respondents (%)	2.99	6.67
Chi=1.02 p=0.31 phi=0.08			
Rest and free time	N	51	59
	Responses (%)	27.72	26.11
	Respondents (%)	76.12	78.67
Chi=0.13 p=0.72 phi=0.03			
Housework	N	9	13
	Responses (%)	4.89	5.75
	Respondents (%)	13.43	17.33
Chi=0.41 p=0.52 phi=0.05			
Work/classes/lessons	N	9	14
	Responses (%)	4.89	6.19
	Respondents (%)	13.43	18.67
Chi=0.71 p=0.40 phi=0.07			
Meals	N	30	40
	Responses (%)	16.30	17.70
	Respondents (%)	44.78	53.33
Chi=1.04 p=0.31 phi=0.09			
Bedtime	N	52	52
	Responses (%)	28.26	23.01
	Respondents (%)	77.61	69.33
Chi=1.24 p=0.27 phi=0.09			
Meetings with friends	N	0	3
	Responses (%)	0.00	1.33
	Respondents (%)	0.00	4.00
Chi=2.74 p=0.10 phi=0.14			

DISCUSSION

The aim of the study was to determine the factors related to smartphone use and neck pain among physiotherapy university students. The results showed that women and those who had owned a mobile phone at a younger age more often reported neck pain. Meanwhile, the age at which children begin active participation in virtual space

has already decreased to 7 years of age [30]. According to the Polish Press Agency (PAP), parents give their children their first smartphone at the age of about 7–8 years, and spend statistically 2.5 hours a day using it, as indicated in a survey among parents conducted by F-Secure and Polkomtel companies [31]. Jawad's research on 207 participants under 18 years of age showed that smartphone use was associated with severe neck flexion in all subjects. Children and adolescents spent an average of 5 and 7 hours a day using smartphones and mobile devices in poor head positions [32]. Children who used smartphones for more than 60 minutes a day were 10 times more likely to develop musculoskeletal disorders than students who used them for less than 60 minutes [33].

When writing messages and using a smartphone, the muscles of the thumb and hand are intensively used. Holding the phone for long periods of time and repetitive movements of the fingers and thumb are the main factors that can lead to the related syndrome [34]. The current study shows that students who felt pain in the thumb more frequently suffered from neck pain. Posture when using a smartphone requires neck flexion, shoulder flexion and abduction, elbow flexion, wrist and finger flexion, and repetitive thumb movements while typing. Excessive strain on the arm and hand muscles while using a smartphone may lead to disability [35]. S. Ahmed et al. reported smartphone addiction is associated with neck pain and thumb pain among college students [34]. Additionally, Sharan et al. concluded that intensive texting had an adverse effect on the musculoskeletal system of the hand. The pathologies described were tendinitis of the extensor pollicis longus, myofascial pain syndrome of the thenar muscles and 1st interossei, and de Quervain's syndrome [36].

The results of the current study indicate that students most often use smartphones during their free time and leisure activities, before bedtime, waiting for a bus, and during meals. The proliferation of smartphones in recent years has led to their widespread adoption as a versatile leisure tool. Such ubiquitous and portable devices have enabled users to harness the potential of smartphones as a form of relaxation that they can be accessed at any time. This unique opportunity to use smartphones as a way of relaxing is due to the convenience and accessibility that smartphones offer, as they can accompany people in everyday activities. Results obtained by Tükel show that leisure satisfaction and smartphone addiction among students are high, and students who participate in active sports, social, artistic and cultural activities, have low smartphone addiction. Smartphone addiction among students significantly reduces their leisure satisfaction [37]. Other results show that having more free time management skills among students is associated with a lower risk of smartphone addiction. The reason for this phenomenon may be the tendency of some students to spend their free time in front of a smartphone due to their lack of management skills [38]. Reaching for a smartphone seems to be most common in situations when alone and the activity does not require much attention, e.g. while waiting for a bus, giving a sense of 'filling time' [39].

Sleep is a very important and necessary time for resting the brain, which is constantly focused on the flow of information throughout the day [40]. Smartphone use before bed is leading to a growing public health concern and an urgent need to understand its impact on personal well-being and individual performance [41]. Sleep problems cause various

behavioural disorders. Excessive use of smartphones before bed among students may cause smartphone addiction [42]. Results obtained by Boonluksiri P. showed that overuse of smartphones during sleep among medical students is related to sleep problems [43]. Whereas research by Klein-Murdock et al., showed a significant relationship between an increased number of text messages sent and subjectively worse sleep quality [44]. The authors showed that turning-off the phone at night and placing it out of reach normalizes sleep disorders and improves the quality of night rest. Also, the blue light emitted by a smartphone may have a negative effect on an individual's circadian rhythms, leading to negative sleep consequences, such as going to bed later than intended, thus reducing overall sleep time [45].

A recent study found that smartphone addiction was correlated with body mass index (BMI) and eating disorders among college students [46]. As the study Gonçalves R. et al. shows, the use of new technologies during meals may contribute to increasing caloric intake, depending on gender and age of young adults [47].

In the results obtained in the current study there was no statistically significant relationship between neck pain and situations where students use their phones; the way of using phones was similar in both groups, with and without neck pain. It is known that neck pain is a multifactorial disease, and one of the most important factors is the posture of the head and spine. A large-scale cross-sectional study among students at two Universities in Hong Kong found that physiotherapy and general nursing students have significantly higher neck pain rates when compared to business students after adjusting female gender, year of study, height, anxiety level, smartphone usage, and the presence of concurrent low back pain. Physiotherapy students had the highest prevalence of neck pain in the past 12 months, 7 days, and currently [17]. Due to the nature of their work, physiotherapists often adopt uncomfortable positions during treatments with patients, for example, during clinical practices and internships, which may lead to overloads and injuries, including in the neck area [48].

In a study involving 779 students from Khon Kaen University, Thailand, Namwongsa et al. showed that both the individual smoking factor and the ergonomic factor of neck flexion posture were associated with the occurrence of neck musculoskeletal disorders in smartphone users [4]. Prolonged smartphone use may increase mechanical load on the cervical spine and change neck muscle activation patterns, leading to pain [49]. Sileshi et al. conducted a cross-sectional study on a sample of 845 smartphone-using students at the University of Ethiopia to determine the prevalence of neck pain and its associated factors. Being in the final year of college, smoking, lack of regular exercise, using a smartphone every day for long periods of time, and using other electronic devices, were associated with neck pain among smartphone users [29]. A previous study by the authors of the current study involving 146 physiotherapy students, showed that the longer the time spent using a smartphone, the more significant the neck disability [50].

There are a few limitations to the study. The time spent using a smartphone and other electronic devices (laptop, computer) and hours spent studying were not taken into account. In future, it would also be worth asking whether using a smartphone before bed is associated with poorer sleep quality and more difficulty in falling asleep. Students' physical

activity and smoking were also not taken into account. It would be interesting to repeat the study on professional physiotherapists and include such factors as stress.

CONCLUSIONS

Women, and those who received a cell phone at a younger age, are more likely to report neck pain, while those who experience thumb pain are also more likely to suffer from neck pain. Although there is no statistically significant relationship between neck pain and situations in which students use mobile phones, efforts should be made to educate them in the field of digital hygiene. Students most often use a smartphone during their free time, before bed time or during mealtimes, which could potentially lead to negative health outcomes in the future.

REFERENCES

- Pinho C, Franco M, Mendes L. Application of innovation diffusion theory to the E-learning process: higher education context. *Educ Inf Technol*. 2021;26(1):421–440. <https://doi.org/10.1007/s10639-020-10269-2>
- Wah SW, Chatchawan U, Chatprem T, et al. Prevalence of Static Balance Impairment and Associated Factors of University Student Smartphone Users with Subclinical Neck Pain: Cross-Sectional Study. *Int J Environ Res Public Health*. 2022;19(17):10723. <https://doi.org/10.3390/ijerph191710723>
- Szeto GPY, Tsang SMH, Dai J, et al. A field study on spinal postures and postural variations during smartphone use among university students. *Appl Ergon*. 2020;88:103183. <https://doi.org/10.1016/j.apergo.2020.103183>
- Namwongsa S, Puntumetakul R, Neubert MS, et al. Factors associated with neck disorders among university student smartphone users. *Work*. 2018;61(3):367–378. <https://doi.org/10.3233/WOR-182819>
- Chen B, Liu F, Ding S, et al. Gender differences in factors associated with smartphone addiction: a cross-sectional study among medical college students. *BMC Psychiatry*. 2017;17(1):341. <https://doi.org/10.1186/s12888-017-1503-z>
- Adorjan K, Langgartner S, Maywald M, et al. A cross-sectional survey of internet use among university students. *Eur Arch Psychiatry Clin Neurosci*. 2021;271(5):975–986. <https://doi.org/10.1007/s00406-020-01211-1>
- Maqableh M, Jaradat M, Azzam A. Exploring the determinants of students' academic performance at university level: The mediating role of internet usage continuance intention. *Educ Inf Technol*. 2021;26(4):4003–4025. <https://doi.org/10.1007/s10639-021-10453-y>
- Murugavishwanathan R, Sudharsan S, Yadhav K, et al. Muscle Fatigue and Head Flexion Angle Analysis while using Smartphone. IOP Conference Series: Materials Science and Engineering; 2020 Feb 24–29; Chennai, India; Volume 912;2020.
- Bernard BP, Putz-Anderson V. Musculoskeletal disorders and workplace factors; a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Published online 1997.
- Lee J, Seo K. The comparison of cervical repositioning errors according to smartphone addiction grades. *J Phys Ther Sci*. 2014;26(4):595–598. <https://doi.org/10.1589/jpts.26.595>
- Mahmoud NF, Hassan KA, Abdelmajeed SF, et al. The Relationship Between Forward Head Posture and Neck Pain: a Systematic Review and Meta-Analysis. *Curr Rev Musculoskelet Med*. 2019;12(4):562–577. <https://doi.org/10.1007/s12178-019-09594-y>
- Namwongsa S, Puntumetakul R, Neubert MS, et al. Ergonomic risk assessment of smartphone users using the Rapid Upper Limb Assessment (RULA) tool. *PLOS ONE*. 2018;13(8):e0203394. <https://doi.org/10.1371/journal.pone.0203394>
- Haghighat F, Moradi R, Rezaie M, et al. Added Value of Diaphragm Myofascial Release on Forward Head Posture and Chest Expansion in Patients With Neck Pain: A Randomized Controlled Trial; 2020. <https://doi.org/10.21203/rs.3.rs-53279/v1>
- Shah P, Sheth M. Correlation of smartphone use addiction with text neck syndrome and SMS thumb in physiotherapy students. *Int J Community Med Public Health*. 2018;5(6):2512–2516. <https://doi.org/10.18203/2394-6040.ijcmph20182187>
- Grasdalsmoen M, Engdahl B, Fjeld MK, et al. Physical exercise and chronic pain in university students. *PLOS ONE*. 2020;15(6):e0235419. <https://doi.org/10.1371/journal.pone.0235419>
- Alsalamah AM, Harisi MJ, Alduayji MA, et al. Evaluating the relationship between smartphone addiction/overuse and musculoskeletal pain among medical students at Qassim University. *J Fam Med Prim Care*. 2019;8(9):2953–2959. https://doi.org/10.4103/jfmpc.jfmpc_665_19
- Chan LLY, Wong AYL, Wang MH, et al. The prevalence of neck pain and associated risk factors among undergraduate students: A large-scale cross-sectional study. *Int J Ind Ergon*. 2020;76(1):102934. <https://doi.org/10.1016/j.ergon.2020.102934>
- Sachdev S, Talreja S, Ansari I ul islam, et al. Prevalence of neck pain among the undergraduate physical therapy students of university of Balochistan, Quetta, Pakistan. *J Nov Physiother Phys Rehabil*. 2021;8(1):020–023. <https://doi.org/10.17352/2455-5487.0000088>
- Behera P, Majumdar A, Revadi G, et al. Neck pain among undergraduate medical students in a premier institute of central India: A cross-sectional study of prevalence and associated factors. *J Fam Med Prim Care*. 2020;9(7):3574–3581. https://doi.org/10.4103/jfmpc.jfmpc_206_20
- Woo EHC, White P, Lai CWK. Effects of electronic device overuse by university students in relation to clinical status and anatomical variations of the median nerve and transverse carpal ligament. *Muscle Nerve*. 2017;56(5):873–880. <https://doi.org/10.1002/mus.25697>
- Hansraj KK. Assessment of stresses in the cervical spine caused by posture and position of the head. *Surg Technol Int*. 2014;25(25):277–279.
- Glowinski S, Bryndal A, Grochulska A. Prevalence and risk of spinal pain among physiotherapists in Poland. *PeerJ*. 2021;9:e11715. <https://doi.org/10.7717/peerj.11715>
- Jahre H, Grotle M, Smedbråten K, et al. Risk factors for non-specific neck pain in young adults. A systematic review. *BMC Musculoskelet Disord*. 2020;21(1):366. <https://doi.org/10.1186/s12891-020-03379-y>
- Sarraf F, Varmazyar S. Comparing the effect of the posture of using smartphones on head and neck angles among college students. *Ergonomics*. 2022;65(12):1631–1638. <https://doi.org/10.1080/00140139.2022.2047229>
- Baabdullah A, Bokhary D, Kabli Y, et al. The association between smartphone addiction and thumb/wrist pain: A cross-sectional study. *Medicine (Baltimore)*. 2020;99:e19124. <https://doi.org/10.1097/MD.00000000000019124>
- Walankar PP, Kemkar M, Govekar A, et al. Musculoskeletal Pain and Risk Factors Associated with Smartphone Use in University Students. *Indian J Occup Environ Med*. 2021;25(4):220–224. https://doi.org/10.4103/ijoem.ijoem_351_20
- Toh SH, Coenen P, Howie EK, et al. The associations of mobile touch screen device use with musculoskeletal symptoms and exposures: A systematic review. *PLoS One*. 2017;12(8):e0181220. <https://doi.org/10.1371/journal.pone.0181220>
- Saueressig IB, Oliveira VMA de, Xavier MKA, et al. Prevalence of musculoskeletal pain in adolescents and its association with the use of electronic devices. *Rev Dor*. 2015;16:129–135. <https://doi.org/10.5935/1806-0013.20150025>
- Ayhualem S, Alamer A, Dabi SD, et al. Burden of neck pain and associated factors among smart phone user students in University of Gondar, Ethiopia. *PLOS ONE*. 2021;16(9):e0256794. <https://doi.org/10.1371/journal.pone.0256794>
- Piecuch A. Cyfrowy świat dzieci i młodzieży. *Lub Rocznik Pedagog*. 2017;36(4):75–90.
- Demkow M, Jakubczyk A. Problematic mobile phone use. Review of literature. *Alcohol Drug Addict Narkom*. 2019;32(3):211–236. <https://doi.org/10.5114/ain.2019.91003>
- Fares J, Fares MY, Fares Y. Musculoskeletal neck pain in children and adolescents: Risk factors and complications. *Surg Neurol Int*. 2017;8:72. https://doi.org/10.4103/sni.sni_445_16
- Mongkonkansai J, Veerasakul S, Tamrin SBM, et al. Predictors of Musculoskeletal Pain among Primary School Students Using Smartphones in Nakhon Si Thammarat, Thailand. *Int J Environ Res Public Health*. 2022;19(17):10530. <https://doi.org/10.3390/ijerph191710530>
- Ahmed S, Akter R, Pokhrel N, et al. Prevalence of text neck syndrome and SMS thumb among smartphone users in college-going students: a cross-sectional survey study. *J Public Health*. 2021;29(2):411–416. <https://doi.org/10.1007/s10389-019-01139-4>
- Ahmed S, Mishra A, Akter R, et al. Smartphone addiction and its impact on musculoskeletal pain in neck, shoulder, elbow, and hand among

- college going students: a cross-sectional study. *Bull Fac Phys Ther.* 2022;27(1):5. <https://doi.org/10.1186/s43161-021-00067-3>
36. Selvaganapathy K, Karthikeyan R, Hung Dee T. The effect of smartphone addiction on craniocervical angle and depression status among university students. *Int J Integr Med Sci.* 2017;4:537–542. <https://doi.org/10.16965/ijims.2017.118>
37. Tükel Y. Investigation of the Relationship between Smartphone Addiction and Leisure Satisfaction of University Students. *Int J Technol Educ Sci.* 2020;4(3):218–226. <https://doi.org/10.46328/ijtes.v4i3.108>
38. Gezgin DM, Mihci C, Gedik S. The Effect of Free Time Management Skills upon Smartphone Addiction Risk in University Students. *J Educ Sci Environ Health.* 2021;7(4):354–366. <https://doi.org/10.21891/jeseh.991910>
39. Vorderer P, Krömer N, Schneider FM. Permanently online – Permanently connected: Explorations into university students' use of social media and mobile smart devices. *Comput Hum Behav.* 2016;63:694–703. <https://doi.org/10.1016/j.chb.2016.05.085>
40. Göz E. The relationship between screen exposure and neck disability, headache, stress, depression, and anxiety in university students. *Ağrı – J Turk Soc Algol.* 2023;35(4):195–204. <https://doi.org/10.14744/agri.2023.48657>. PMID: 37886871
41. Lin YH, Wong BY, Lin SH, et al. Development of a mobile application (App) to delineate “digital chronotype” and the effects of delayed chronotype by bedtime smartphone use. *J Psychiatr Res.* 2019;110:9–15. <https://doi.org/10.1016/j.jpsychires.2018.12.012>
42. Li L, Wang L, Wang X. Effect of smartphone use before bedtime on smartphone addiction behaviors among Chinese college students. *Front Psychol.* 2022;13. <https://doi.org/10.3389/fpsyg.2022.1023245>
43. Boonluksiri P. Effect of smartphone overuse on sleep problems in medical students. *Asia Pac Sch.* 2018;3(2):25–28. <https://doi.org/10.29060/TAPS.2018-3-2/OA1039>
44. Murdock KK, Horissian M, Crichlow-Ball C. Emerging Adults' Text Message Use and Sleep Characteristics: A Multimethod, Naturalistic Study. *Behav Sleep Med.* 2017;15(3):228–241. <https://doi.org/10.1080/15402002.2015.1120203>
45. Höhn C, Schmid SR, Plamberger CP, et al. Preliminary Results: The Impact of Smartphone Use and Short-Wavelength Light during the Evening on Circadian Rhythm, Sleep and Alertness. *Clocks Sleep.* 2021;3(1):66–86. <https://doi.org/10.3390/clocksleep3010005>
46. Tayhan Kartal F, Yabancı Ayhan N. Relationship between eating disorders and internet and smartphone addiction in college students. *Eat Weight Disord – Stud Anorex Bulim Obes.* 2021;26(6):1853–1862. <https://doi.org/10.1007/s40519-020-01027-x>
47. Gonçalves RF da M, Barreto D de A, Monteiro PI, et al. Smartphone use while eating increases caloric ingestion. *Physiol Behav.* 2019;204:93–99. <https://doi.org/10.1016/j.physbeh.2019.02.021>
48. salik sengul Y, Edeer A. Work-related musculoskeletal disorders: A survey of physical therapists in Izmir-Turkey. *BMC Musculoskelet Disord.* 2004;5:27. <https://doi.org/10.1186/1471-2474-5-27>
49. Park JH, Kang SY, Lee SG, et al. The effects of smart phone gaming duration on muscle activation and spinal posture: Pilot study. *Physiother Theory Pract.* 2017;33(8):661–669. <https://doi.org/10.1080/09593985.2017.1328716>
50. Czepińska A, Zawadka M, Gawda P. Neck pain, disability and mobile phone usage among physiotherapy students – a cross-sectional study. *Ann Agric Environ Med.* 2024;31(1):125–130. <https://doi.org/10.26444/aaem/174679>