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Original Article

Association of Regional Musculoskeletal Symptoms With Pain Intensity in Adults Reporting Prolonged Screen Use: A Cross-Sectional Study

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ABSTRACT

Background: Extended use of phones, computers, and other screen-based devices is common in education and employment. Musculoskeletal discomfort is frequently reported among users, although associations between regional symptoms and overall pain intensity require careful interpretation. Objective: To describe musculoskeletal symptoms and examine their association with usual pain intensity among adults reporting prolonged daily screen use. Methods: This cross-sectional survey included 334 adults aged 19–40 years from educational and occupational settings in Lahore, Pakistan. Participants were selected by convenience sampling under an eligibility criterion of more than approximately 5–6 hours of daily screen use. Regional musculoskeletal symptoms were assessed using a modified Nordic Musculoskeletal Questionnaire, and usual pain intensity was assessed using the Numeric Pain Rating Scale (0–10). Descriptive statistics and Pearson correlation coefficients were reported. Results: The mean age was 24.66 ± 5.065 years; 220 participants (65.9%) were female. In the preceding 12 months, symptoms were most frequent in the neck (61.7%), shoulder (46.7%), low back (42.5%), upper back (39.2%), wrists/hands (36.2%), and elbow (18.0%). Mean usual pain intensity was 3.31 ± 2.244. Weak positive correlations with pain intensity were reported for neck ($r = 0.225$, $p < 0.001$), shoulder ($r = 0.124$, $p = 0.024$), wrists/hands ($r = 0.144$, $p = 0.009$), upper back ($r = 0.207$, $p < 0.001$), and low back symptoms ($r = 0.157$, $p = 0.004$). The elbow correlation was not statistically significant ($r = 0.079$, $p = 0.149$). Conclusion: Neck symptoms were the most commonly reported musculoskeletal complaint in this sample of frequent screen users. Regional symptom variables showed weak correlations with usual pain intensity; these data do not establish an independent effect of screen duration or a causal relationship. Keywords: cross-sectional study; digital devices; musculoskeletal symptoms; Nordic Musculoskeletal Questionnaire; pain intensity; screen time.

INTRODUCTION

Digital technology is embedded in communication, education, entertainment, shopping, and work. Smartphone, tablet, television, computer, and gaming-device use contributes to the time individuals spend viewing screens. The transition toward remote learning and working arrangements during the COVID-19 pandemic brought additional attention to daily screen exposure [1, 2]. In a population-based study of emerging adults, Wagner et al. [3] documented changes in recreational screen-time practices during the pandemic. Screen exposure encompasses both occupational or educational activities and discretionary activities, and its context may be relevant when considering possible health outcomes [4].

Musculoskeletal symptoms can involve the neck, shoulder, elbow, wrist, hand, thoracic spine, lumbar spine, and lower extremities. Pain may coexist with stiffness, aching, fatigue, tingling, numbness, or restricted activity. Digital-device use often involves sustained postures, repeated small movements, and workstation arrangements that may influence physical loading. However, posture, ergonomic conditions, activity patterns, and individual susceptibility can also contribute to symptoms; therefore, symptom reports cannot by themselves identify screen use as the cause [5, 6, 7].

Potential indirect pathways warrant consideration. Screen-based sedentary activities can displace physical activity, while sleep disturbance and psychosocial factors may coexist with prolonged screen use. Studies of students and working populations have reported relationships between physical activity, lifestyle, sleep, and musculoskeletal symptoms, although the direction and magnitude of such relationships vary according to setting and measurement [8, 9, 10]. The burden of pain is relevant not only to older individuals but also to young adults who use digital devices intensively for study and work.

Regional symptoms and perceived pain severity represent related but distinct constructs. The Nordic Musculoskeletal Questionnaire provides a standardized framework for reporting symptoms at different anatomical sites and whether

these affect normal activities [11]. The Numeric Pain Rating Scale (NPRS) provides a brief measure of perceived pain intensity and has been studied in populations with musculoskeletal pain [12, 13]. These instruments may be used together to describe symptom distribution and pain intensity, although a regional symptom indicator should not be interpreted as a direct measure of screen exposure.

Previous research has established that symptoms are common among populations using electronic devices. Still, distributions across anatomical sites and their relationships with overall pain ratings may differ across age groups, occupations, and assessment procedures. Examining both regional symptom occurrence and pain intensity among frequent screen users can provide a descriptive basis for subsequent studies that directly quantify screen exposure, ergonomics, and other contributors. The present cross-sectional survey therefore characterizes reported musculoskeletal symptoms and assesses their relationships with usual pain intensity among adults meeting a prolonged-screen-use eligibility criterion.

In a cross-sectional study of 249 young smartphone users, Mustafaoglu et al. [14] examined smartphone addiction and musculoskeletal symptom prevalence using the modified Nordic questionnaire. Upper-back, neck, wrist, and hand complaints were frequently reported. This study supports the relevance of regional symptoms in technology-using populations, but its emphasis on smartphone addiction differs from the present study's analysis of regional symptoms against general pain intensity. A systematic review by Zirek et al. [6] likewise described musculoskeletal complaints associated with mobile-phone use, emphasizing that device behaviors and study methods vary.

Studies involving children and adolescents provide contextual evidence but are not directly comparable to a sample of adults. Delisle Nyström et al. [15] assessed physical activity and screen time in a large Swedish sample of children and adolescents across 2018–2021. Cheung et al. [16] studied 200 early adolescents aged 10–14 years, examining computer use, trunk asymmetry, and health-related quality of life. Abdel-Aziem et al. [17] compared head and neck postures in elementary-school children by smartphone viewing duration and body position. Joergensen et al. [18] investigated spinal pain in pre-adolescents in relation to screen time and physical activity. Collectively, these reports highlight postural and behavioral dimensions that should not be assumed to have been measured in the current adult survey.

Among adults working with computers, Kaya Aytutuldu et al. [19] evaluated musculoskeletal pain, disability, and individual or work-related factors in 150 Turkish office workers. Their findings linked symptoms with personal and occupational characteristics, indicating the importance of factors other than screen duration. Kirsch Micheletti et al. [10] investigated associations between lifestyle and musculoskeletal pain in a large working population, with physical activity and other lifestyle factors relevant to interpretation. In Pakistan, Hanif et al. [20] examined screen time and shoulder pain or disability among office workers in Rawalpindi and Islamabad. Khan et al. [21] described screen-time-related musculoskeletal symptoms among adolescents in Pakistan, with neck and lower-back complaints among the outcomes reported.

More focused work addresses device handling and repetitive movement. Tanzila et al. [22] used the Nordic Body Map in 416 students undertaking online learning and examined laptop position, use duration, and musculoskeletal disorders. Wang et al. [23] investigated thumb muscle activity and perceived discomfort during smartphone gaming, providing a task-specific example of repetitive hand loading. Lam et al. [7] described musculoskeletal concerns among elite mobile esports players. The populations, exposures, and outcome measures in these investigations differ substantially, limiting direct comparison of numerical prevalence estimates.

The wider consequences of intensive device use have also been investigated. Basuodan et al. [24] examined pain, physical activity, screen time, and age in young children during the COVID-19 pandemic; their pediatric sample offers contextual rather than directly comparable evidence for adult symptom patterns. Yilmaz and Göz [25] evaluated screen exposure alongside headache, neck disability, emotional symptoms, and sleep outcomes in university students. Pandya and Lodha [2] reviewed excessive screen time and mental health during the pandemic, while Ghekiere et al. [9] investigated sleeping difficulties, inactivity, and screen time in European adolescents. These reports place musculoskeletal complaints in a broader behavioral context without demonstrating that the present sample's pain ratings were caused by screen use.

Taken together, the literature supports examining regional symptoms among people who regularly use digital devices but demonstrates the need to separate screen exposure, regional symptom occurrence, and pain intensity analytically. The current study contributes frequency estimates for selected body regions and unadjusted correlations with reported pain intensity in a convenience sample of Pakistani adults.

Objectives and Hypotheses

The primary objective was to examine the association between reported musculoskeletal symptoms in the neck, shoulders, elbows, wrists/hands, upper back, and low back and usual pain intensity among adults reporting prolonged daily screen use. A secondary objective was to describe symptom frequencies across these anatomical regions during the preceding 12 months and 7 days, including interference with normal activities.

Null hypothesis: There is no correlation between the measured regional musculoskeletal symptom variables and usual pain intensity.

Alternative hypothesis: At least one regional musculoskeletal symptom variable is correlated with usual pain intensity.

Operational Definitions

Screen time was defined as time spent using screen-based digital devices for educational, occupational, communication, or recreational activities, including smartphones, tablets, computers, laptops, and gaming devices [2, 4]. Prolonged screen use was an eligibility criterion expressed in the study protocol as more than 5–6 hours per day; it was not the exposure variable in the reported correlation analyses.

Musculoskeletal symptoms were self-reported complaints related to anatomical body regions, assessed using a modified Nordic Musculoskeletal Questionnaire. The questionnaire covered the neck, shoulders, upper back, elbows, wrists/hands, lower back, hips/thighs, knees, and ankles/feet, as well as symptom-related interference with usual work [11, 26]. Results available for this study concern six anatomical regions.

Pain was understood as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage [27]. Usual pain intensity was represented by the participant's NPRS response on a scale from 0 (no pain) to 10 (worst imaginable pain), with higher scores indicating greater reported intensity [12].

MATERIALS AND METHODS

Study design and settings

A cross-sectional observational survey was conducted in Lahore, Pakistan. The recruitment settings identified in the study were Next Bridge Pvt Ltd Company, University of Lahore, Punjab University, Fatima Memorial College of Medicine and Dentistry, Lahore College, and Nur International University. Data collection was conducted over a six-month period following synopsis approval and commenced after institutional review board approval.

Study population and sampling

The study included 334 adult participants recruited by convenience sampling from educational and occupational environments. The inclusion criteria were age 18–40 years, use of electronic screen-based devices (including phones, tablets, computers, laptops, and gaming devices), and daily screen exposure exceeding approximately 5–6 hours. Participants with systemic disease, disability, neuromuscular disorders such as stroke or seizures, pregnancy, or recent surgery were excluded [20]. The observed age range in the analyzed sample was 19–40 years.

Sample size estimation

The sample-size estimate used a single-proportion formula, $n = Z^2p(1 - p)/d^2$, with 95% confidence ($Z = 1.96$), an anticipated proportion of 0.68, and an absolute precision of 0.05. This yielded an approximate estimate of 334 participants; 334 were included in the reported analysis. As the analysis was correlational and the sample was selected by convenience, the precision-based estimate does not by itself establish power for every regional correlation.

Study instruments

The modified Nordic Musculoskeletal Questionnaire was used to characterize symptoms by anatomical region, including reports over the previous 12 months and 7 days and whether problems had prevented normal work during the preceding 12 months. The Nordic questionnaire is commonly used for descriptive screening of musculoskeletal complaints in occupational and population research; reliability and validity have been reported in other populations [11, 26]. Kakaraparthi et al. [28] have reviewed its clinical and occupational research applications. Usual pain intensity was measured with the 0–10 NPRS [12, 13].

Data collection and ethical procedures

After approval from an institutional review board, potentially eligible individuals were informed about the purpose of the study and screened against eligibility criteria. Informed consent was obtained before questionnaire administration. Participants completed the modified Nordic questionnaire and NPRS. Confidentiality and anonymity were maintained during data collection and analysis. The data were entered for statistical analysis using SPSS software.

Statistical analysis

Descriptive statistics summarized participant age, sex, occupation, pain intensity, and symptom occurrence. Categorical variables were presented as frequencies and percentages, while age and NPRS ratings were summarized using means and standard deviations. Pearson correlation coefficients were used to assess the relationships between the recorded regional musculoskeletal symptom variables and usual pain intensity.

Two-sided p values were reported for each region, with $p < 0.05$ used for interpreting statistical significance. The reported associations were unadjusted; no multivariable analysis of screen duration, posture, ergonomics, or other potential confounding factors formed part of the reported findings.

RESULTS

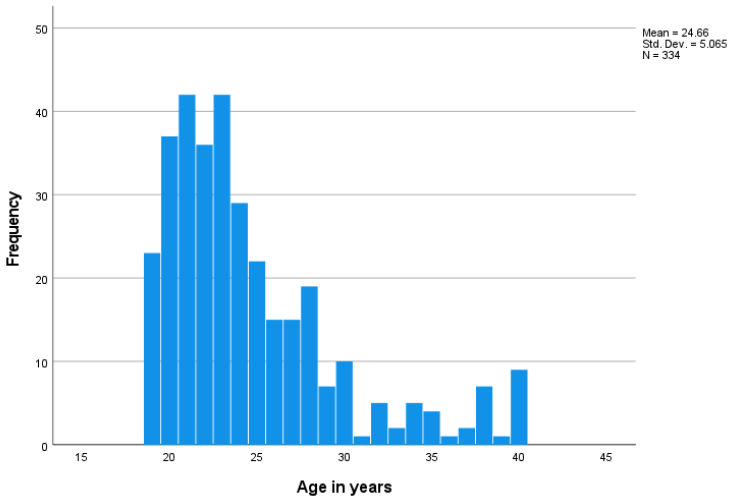
A total of 334 respondents were included, of whom 220 (65.9%) were female and 114 (34.1%) were male. Ages ranged from 19 to 40 years (mean 24.66 ± 5.065 years). The reported occupational categories comprised 214 students (64.1% of the overall sample), 72 IT workers (21.6%), and 47 teachers (14.1%). Table 1 summarizes participant characteristics.

Table 1. Demographic and occupational characteristics of the study sample

Characteristic	Value
Participants analyzed	334
Age, years: mean ± SD	24.66 ± 5.065
Age, years: range	19–40
Female	220 (65.9%)
Male	114 (34.1%)
Student	214 (64.1%)
IT worker	72 (21.6%)
Teacher	47 (14.1%)

The three reported occupational categories account for 333 of the 334 participants; all percentages are based on the full sample (N = 334).

Figure 1. Distribution of age among participants (histogram)

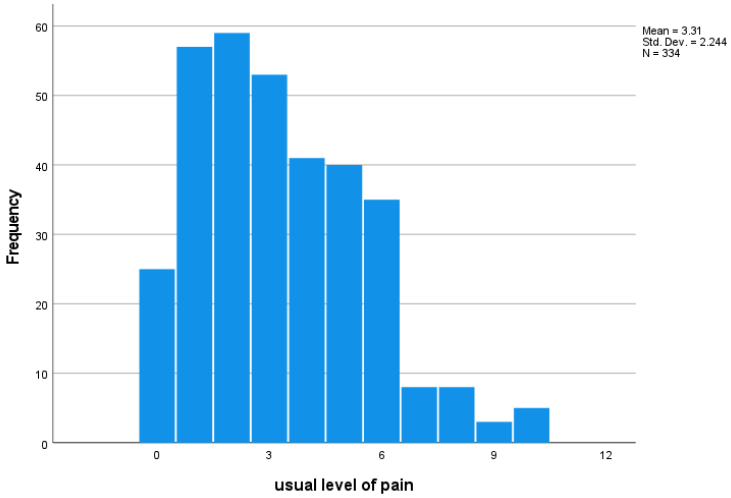


Pain intensity, Usual pain intensity was assessed in 334 participants and ranged from 0 to 10. The mean reported score was 3.31 ± 2.244 (Table 2). The distribution of NPRS values is shown in Figure 2. This represents a sample-average score rather than a region-specific estimate, and the summary cannot establish the clinical severity of each individual participant's symptoms.

Table 2. Descriptive statistics for usual pain intensity (NPRS)

Measure	N	Minimum	Maximum	Mean	SD
Usual pain intensity	334	0	10	3.31	2.244

Figure 2. Distribution of usual pain intensity (histogram)



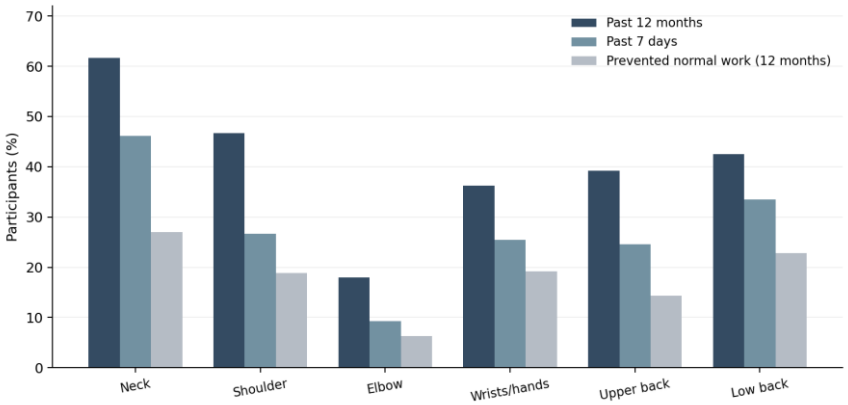
Regional musculoskeletal symptoms, During the preceding 12 months, the neck was the most frequently reported anatomical site of discomfort (206/334, 61.7%), followed by the shoulder (156/334, 46.7%), low back (142/334, 42.5%), upper back (131/334, 39.2%), wrists/hands (121/334, 36.2%), and elbow (60/334, 18.0%). Symptoms during the preceding 7 days were reported most frequently in the neck (154/334, 46.1%) and low back (112/334, 33.5%). Lower frequencies were reported for shoulders (26.6%), wrists/hands (25.4%), upper back (24.6%), and elbows (9.3%).

Symptom-related interference with normal work over the preceding 12 months was reported most often for the neck (90/334, 26.9%), low back (76/334, 22.8%), wrists/hands (64/334, 19.2%), shoulders (63/334, 18.9%), upper back (48/334, 14.4%), and elbows (21/334, 6.3%). Frequencies, denominators, and periods of recall appear in Table 3; the distributions are illustrated in Figure 3.

Table 3. Musculoskeletal symptoms across anatomical regions (N = 334)

Anatomical region	Past 12 months, n (%)	Past 7 days, n (%)	Prevented normal work in past 12 months, n (%)
Neck	206 (61.7)	154 (46.1)	90 (26.9)
Shoulder	156 (46.7)	89 (26.6)	63 (18.9)
Elbow	60 (18.0)	31 (9.3)	21 (6.3)
Wrists/hands	121 (36.2)	85 (25.4)	64 (19.2)
Upper back	131 (39.2)	82 (24.6)	48 (14.4)
Low back	142 (42.5)	112 (33.5)	76 (22.8)

Figure 3. Percentage of participants reporting regional symptoms and interference with normal work



Correlations between regional symptoms and pain intensity Table 4 presents Pearson correlation coefficients relating each recorded regional symptom variable to usual pain intensity. Positive correlations were observed for neck ($r = 0.225$, $p < 0.001$), shoulders ($r = 0.124$, $p = 0.024$), wrists/hands ($r = 0.144$, $p = 0.009$), upper back ($r = 0.207$, $p < 0.001$), and low back ($r = 0.157$, $p = 0.004$). The correlation for elbow symptoms ($r = 0.079$, $p = 0.149$) was not statistically significant at the stated threshold. All six coefficients were small in magnitude. These associations concern the recorded regional symptom variables and pain intensity, not a comparison of different screen-time exposure durations. Statistical significance should therefore not be interpreted as evidence of a clinically large relationship or a causal effect of digital device use.

Table 4. Correlations of regional musculoskeletal symptom variables with usual pain intensity

Region	Pearson r	p value
Neck	0.225	<0.001
Shoulder	0.124	0.024
Elbow	0.079	0.149
Wrists/hands	0.144	0.009
Upper back	0.207	<0.001
Low back	0.157	0.004

DISCUSSION

This cross-sectional study describes a high frequency of self-reported musculoskeletal symptoms among 334 adults who met a prolonged-screen-use eligibility criterion. Neck symptoms were the most common complaint over the preceding year, followed by shoulder and low-back symptoms. In addition to describing symptom frequency and activity interference, the study reported weak positive correlations between several region-specific symptom variables and overall pain intensity. The elbow correlation was not statistically significant. These findings are descriptive and correlational; because screen exposure itself was not compared across categories or modeled as a continuous predictor, they cannot establish that increasing screen time leads to higher pain intensity.

The neck predominance resembles findings from prior reports on smartphone and digital-device use. Walankar et al. [29] identified neck, thumb, and low-back symptoms in university students using smartphones, while Ayhualem et al. [30] reported neck pain and associated factors among smartphone-using students at the University of Gondar. Mustafaoglu et al. [14] described high frequencies of upper-back, neck, and wrist/hand symptoms among 249 young adults. These comparisons support the clinical relevance of the neck and upper extremities, although variation in population, exposure definition, questionnaire wording, and sampling precludes treating the reported percentages as directly interchangeable.

Studies from Pakistan also provide context. Khan et al. [21] reported musculoskeletal complaints among adolescents in the twin cities, with neck and low-back symptoms among the regions assessed. Hanif et al. [20] considered shoulder pain and disability in office workers from Rawalpindi and Islamabad. The present study includes a broader mixture of students, IT workers, and teachers, and reports 12-month symptom frequencies of 61.7% for the neck and 46.7% for the shoulders. However, the present sample is not population-representative; differences from these reports should not be interpreted as changes over time or excess risk attributable to screen exposure.

The current findings also accord broadly with studies of occupational and ergonomic conditions. Kaya Aytutuldu et al. [19] reported that musculoskeletal pain among computer-based office workers was related to individual and work-related factors. Tanzila et al. [22] examined laptop position and duration in students undertaking online learning. Toh et al. [5] assessed musculoskeletal and visual outcomes associated with touch-screen use among adolescents in Singapore, and Abdel-Aziem et al. [17] examined posture during smartphone viewing in children. Together, these investigations suggest that time spent using devices may interact with workstation setup, posture, movement frequency, and age. None of these factors was measured as a covariate in the correlations reported here, so they remain plausible alternative explanations rather than demonstrated mechanisms.

Repetitive tasks and localized loading may be particularly relevant to upper-extremity discomfort. Wang et al. [23] examined thumb muscle responses during smartphone gaming, while Lam et al. [7] described health risks and musculoskeletal complaints in elite mobile esports players. Such studies address specialized activities and cannot be used to infer that the same mechanisms explain all wrist/hand symptoms in this sample. Similarly, evidence on postural asymmetry in early adolescents [16] and spinal pain in pre-adolescence [18] contributes biological and behavioral context but does not establish equivalent effects among the adults studied here.

An additional contribution of the present survey is its distinction between reporting symptoms, experiencing symptoms in a recent recall window, and having symptoms interfere with normal work. For example, 61.7% reported neck symptoms during the preceding year, 46.1% during the preceding week, and 26.9% reported neck-related interference with usual work during the year. These questions capture different dimensions of symptom burden and should not be merged into a single prevalence or disability estimate. The same distinction applies to low-back, upper-back, shoulder, elbow, and wrist/hand complaints. Because responses were self-reported, the figures reflect perceived symptoms rather than clinically confirmed musculoskeletal disorders.

The unadjusted correlation results require cautious interpretation. Neck symptoms had the largest coefficient ($r = 0.225$), followed by upper-back symptoms ($r = 0.207$); all reported coefficients were weak. A small p value does not imply

a strong association or meaningful difference in clinical outcome. The positive correlations may also partly reflect conceptual overlap between the presence of musculoskeletal symptoms and the NPRS measure of overall pain intensity. The analysis does not separate the contribution of daily screen duration from the presence of symptoms, nor does it adjust for age, occupation, physical activity, health status, device type, or workstation ergonomics. Consequently, its central finding is that the recorded symptom indicators are weakly related to a general pain rating within a selected sample.

The broader literature reinforces the importance of non-device-specific influences. Kirsch Micheletti et al. [10] linked lifestyle factors with musculoskeletal pain in working adults, while Hendi et al. [8] examined musculoskeletal disorders in relation to physical activity among health students. Ghekiere et al. [9] investigated screen time, inactivity, and sleep difficulties among European adolescents. Yilmaz and Göz [25] reported screen-exposure associations with headache, neck disability, and psychological symptoms among university students. These results indicate that musculoskeletal outcomes may occur alongside behavioral and psychosocial factors, none of which can be disentangled by the present unadjusted regional correlations.

The results have practical relevance for symptom awareness and for planning more definitive research. Neck and back discomfort, as well as symptom-related restriction of usual activity, merit clinical attention when individually indicated. Reviews of musculoskeletal pain management discuss pharmacological and nonpharmacological approaches [31], and Shariat et al. [32] described stretching and strengthening exercises for computer-based workers. These sources may inform future intervention research, but this study did not test ergonomic advice, exercise, rest breaks, or clinical treatment, and no treatment efficacy claim follows from its findings.

Several features strengthen the descriptive value of the study: it sampled individuals from multiple educational and occupational settings, used established symptom and pain instruments, and reported site-specific frequencies for two recall periods together with work interference. Nevertheless, the interpretation should remain restricted to convenience-sampled adults who already reported substantial daily screen exposure. Objective duration tracking, a broader exposure gradient, occupation-specific analyses, and direct measurement of ergonomics and physical activity would be required to assess whether screen-time duration independently predicts musculoskeletal pain. Larger or more representative studies could also examine whether correlations differ across occupations, age strata, and device-use patterns.

LIMITATIONS

The cross-sectional design precludes temporal or causal inference. Convenience sampling from selected institutions restricts generalizability, and eligibility based on prolonged daily screen exposure prevented comparison with individuals using screens for shorter periods. Exposure was not reported as an analyzable duration variable in the published correlations. Both regional symptoms and pain intensity relied on self-report and may be influenced by recall or shared measurement of pain-related constructs. Important potential confounders, including workstation ergonomics, physical activity, posture, psychosocial factors, occupational demands, and comorbidities, were not included in adjusted models. The absence of regional variable-coding details and confidence intervals limits reproducibility and precision in the interpretation of associations. Although the questionnaire can capture additional body regions, the analysis summarized six regions.

RECOMMENDATIONS

Future research should collect screen-use duration as a quantitative or prespecified categorical variable across a broader exposure range, allowing direct analysis of exposure–response relationships. Studies should document symptom-variable coding, use appropriate statistical models for regional outcomes, and adjust for important personal, ergonomic, occupational, and behavioral confounders. Recruitment across additional Pakistani regions and occupational sectors, with improved sampling strategies, could increase representativeness. Intervention studies may evaluate structured ergonomic education, regular movement breaks, stretching, and exercise for prevention or management of musculoskeletal discomfort in screen-using populations; effectiveness should not be assumed from the present observational findings [31, 32]..

CONCLUSION

Among 334 adults reporting prolonged daily screen use, neck symptoms were most common, followed by shoulder and low-back complaints. Selected region-specific musculoskeletal symptom variables showed weak positive correlations

with usual pain intensity, while the elbow correlation was not statistically significant. The study provides descriptive information about symptom burden in this selected sample but does not establish whether screen-use duration independently influences musculoskeletal pain. Further investigations with explicit exposure measurements and control of confounding are warranted.

ETHICAL CONSIDERATIONS

Data collection began after institutional review board approval. Individuals were informed about the study, and informed consent was obtained before participation. Participant anonymity and confidentiality were maintained.

DECLARATIONS

Authors' Contributions:	**Concept: AN, AS; Design: AN, AS, MH; Data Collection: MH, HJ, MA; Analysis: AN, AS, HJ; Drafting: AN, AS, MH, HJ, MA.**
Ethical Approval:	The institution responsible for ethical review was Fatima Memorial College of Medicine and Dentistry, Lahore, Pakistan
Informed Consent:	Written informed consent was obtained from all participants before enrolment.
Conflict of Interest:	The authors declare no conflict of interest.
Funding:	No external funding was received for this study.
Data Availability:	De-identified data may be available from the corresponding author on request, subject to participant consent and institutional confidentiality requirements.
Acknowledgments:	None.
AI Declaration:	Generative AI tools were used solely for language and grammatical refinement. The authors verified the final manuscript and remain fully responsible for its accuracy, integrity, and scientific content.

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