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ORIGINAL RESEARCH

University Students' Knowledge, Attitudes, and Practices Regarding Cervical Spine Health

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Introduction: Prolonged sedentary behavior and electronic device use jeopardize university students' cervical spine health. This study investigated their knowledge, attitudes, and practices (KAP) concerning cervical spine health.

Methods: From May 25 to June 16, 2023, a cross-sectional survey was conducted among students at various Chinese universities. Demographic data and KAP scores were collected using self-developed questionnaires. Using 60% and 80% as cut-off values, KAP levels were categorized into three tiers: knowledge (inadequate: 0–7, moderate: 8–11, good: 12–15), attitudes (negative: 8–23, neutral: 24–31, positive: 32–39), and practices (inappropriate: 7–20, moderate: 21–28, proactive: 29–35).

Results: Of 1,956 valid questionnaires, their mean age was 19.88 ± 1.40 years, with 71.8% of female gender. Notably, 75.9% reported daily electronic device use ≥4 hours. Regarding initial device acquisition, 37.1% obtained devices in middle school, 30.6% in high school, 22.5% in elementary school, and 9.9% in college. Mean knowledge, attitudes, and practices scores were 10.4 ± 2.1, 34.1 ± 3.9, and 20.9 ± 4.1. Multivariate logistic regression revealed that female students (OR = 1.39, 95% CI: 1.10–1.75), non-freshmen (OR = 1.74, 95% CI: 1.42–2.13), and acquiring knowledge through WeChat (OR = 1.86, 95% CI: 1.47–2.36) or community hospitals (OR = 1.60, 95% CI: 1.29–1.99) had higher probability of adequate knowledge. Non-medical majors (OR = 0.47, 95% CI: 0.39–0.58) and using electronic devices for 3–4 hours (OR = 0.67, 95% CI: 0.45–0.99) or ≥4 hours daily (OR = 0.64, 95% CI: 0.46–0.89) were negatively associated with attitudes. Positive attitudes (OR = 1.27, 95% CI: 1.22–1.31) and obtaining knowledge from medical experts (OR = 1.30, 95% CI: 1.03–1.63) were associated with better practices, while female students (OR = 0.56, 95% CI: 0.44–0.72) and frequent cervical discomfort (OR = 0.26, 95% CI: 0.13–0.53) were the opposite.

Conclusion: University students exhibited moderate knowledge, positive attitudes, and inappropriate practices regarding cervical spine health. Educational interventions are recommended, particularly for non-medical majors, individuals with prolonged digital device use, and freshmen.

Keywords: cervical spine health, knowledge, attitude, practice, university students

Introduction

Cervical spine health has garnered increasing attention due to the rising prevalence of musculoskeletal disorders linked to modern sedentary lifestyles.[1] Common cervical spine disorders include cervical spondylosis, myofascial pain syndrome, cervical radiculopathy, and tension-type headaches.[2,3] Symptoms range from mild neck discomfort and stiffness to chronic pain, restricted mobility, dizziness, and neurological deficits.[4] Global estimates indicate that in 2017, the age-standardized point prevalence of neck pain ranged between 2,400 and 6,150 cases per 100,000 people, with an annual incidence of 600–1,150 cases per 100,000 population.[5] In China, cervical spondylosis, the most prevalent cervical spine disorder, affects 13.76% of the population, with higher rates in urban and suburban areas.[6] In Beijing alone, 2.75 million individuals suffer from cervical spondylosis, which constitutes 13.75% of the city's population.[7] These statistics highlight the urgent need to understand its impact across diverse demographics and develop effective management strategies.

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University students face heightened vulnerability due to prolonged study hours and extensive electronic device use. The pervasive integration of digital technology into academic and social activities exacerbates postural imbalances, increasing the risk of cervical spine discomfort.[8] Poor ergonomic habits, such as sustained forward head posture, prolonged screen exposure, and inadequate neck support, further contribute to cervical spine dysfunction.[9] Research indicates that 48–78% of university students experience neck pain, a prevalence exceeding that of the general population.[10] A recent study in China reported a 42.4% prevalence of cervical spine dysfunction among university students, with a significant correlation between neck pain and smartphone dependence.[11] Cervical spine issues impair daily activities, reduce physical performance, and limit participation in academic and extracurricular pursuits.[5] Additionally, chronic neck pain correlates with diminished psychological, social, and academic functioning, lowering quality of life compared to pain-free peers.[12] Implementing preventive measures and therapeutic interventions is warranted to enhance university students' well-being, physical function, and mental health.

In such circumstance, the knowledge, attitudes, and practices (KAP) framework offers a holistic methodology to investigate university students' comprehension, attitudes, and actions related to cervical spine health.[13] For example, a study from Egypt revealed that dentists showed insufficient knowledge and inappropriate practice towards dental ergonomics, which impeded the prevention of occupation health hazards, including cervical spondylosis.[14] Besides, Waqar, Wilcock, Garner, Davies, Kotter[15] reported that medical students and physicians had unsatisfying knowledge and insufficient practice in managing degenerative cervical myelopathy. However, limited KAP evidence exists regarding cervical spine health among university students in China, hindering long-term health promotion efforts in academic institutions.

This study aimed to examine Chinese university students' KAP related to cervical spine health and its influencing factors. We hypothesized that knowledge positively affects attitudes and practices, and attitudes further enhance practices. Findings may inform strategies to improve awareness of cervical spine health and reduce the prevalence of cervical spine disorders among university students in China.

Materials and Methods

Research Design and Subjects

This cross-sectional study was carried out among students from various universities in China from May 25, 2023, to June 16, 2023. The school locations of the participants are detailed in Table S1. Ethical approval for the study protocol was obtained from the Ethics Committee of Quzhou People's Hospital (reference number 2023–047) and informed consent was obtained from all study participants through the electronic questionnaires. Inclusion criteria for participation encompassed: (1) University students; (2) Absence of pre-existing spinal disorders impacting limb mobility; and (3) No physical impediment precluding engagement in physical activities within the past six months. Exclusions were made for the following reasons: 1) Questionnaires with a completion time of less than 90 to 1800 seconds were excluded in consideration of the possibility of not taking the questionnaire seriously. 2) Refusal to participate in this study. 3) Logical anomalies such as age outside 16–35 years or enrollment in middle or high school. The data were collected through the distribution of electronic questionnaires via WeChat moments, employing a convenient sampling method. Subsequently, members of the research team meticulously reviewed all questionnaires for completeness, internal consistency, and logical coherence. All questions were mandatory, ensuring comprehensive data collection and minimizing missing information. The outline of the study design is given in Figure S1.

Questionnaire Design

The questionnaire was designed according to previous guidelines and literature.[16–18] Following the initial draft, revisions were made based on feedback from two chief of spinal surgery. After creating the initial draft, a pilot study was conducted with 97 participants, and the overall Cronbach's α coefficient was 0.7947, suggesting the favorable internal consistency.

The questionnaire encompassed four dimensions: demographic data, knowledge, attitude, and practice. Demographic data included nine items: age, gender, grade, major, parents' education level, daily electronic device usage, time when

first own an electronic device, Self-reported cervical spine status, and school region. The knowledge dimension consisted of 15 items, with one point awarded for correct answers and zero points for incorrect answers. Scores in the knowledge dimension ranged from 0 to 15 points. The attitude dimension comprised eight items, which were assessed on Likert scale ranging from strongly agree (5 points/4 points) to strongly disagree (1 point). Scores in the attitude dimension ranged from 8 to 39 points. The practice dimension included nine items, with seven employing a five-point Likert scale. Items P1, P3, P4, and P6 were positively scored from "Always" (5 points) to "Never" (1 point), while items P7, P8, and P9 were inversely scored from "Never" (5 points) to "Always" (1 point). Scores in the practice dimension ranged from 7 to 35 points.

To evaluate KAP levels, cutoff values of 60% and 80% of the total score were utilized. Participants were categorized into three levels based on their scores in each KAP dimension: good knowledge, positive attitude, and proactive practice (80–100%); moderate knowledge, neutral attitude, and moderate practice (60–79%); and inadequate knowledge, negative attitude, and inappropriate practice (below 60%).[19]

Sample Size Calculation

The calculation of sample size was as follows:[20]

$$n = \left(\frac{Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}}{\delta}\right)^2 \times p \times (1-p)$$

where n denoted the sample size, and p was assumed to be 0.5 to ensure the maximum sample size. α, also known as the type I error, was set to 0.05. In this case, $Z_{1-\frac{\alpha}{2}} = 1.96$. 1-β, the statistical powers, was determined as 0.8, and $Z_{1-\beta}$ was computed as 0.84. δ, the standard error, was assumed to be 0.05. Under the above parameters, the sample size as calculated as 784. Assuming an effective questionnaire recovery rate of 80%, the final target is to collect at least 980 completed questionnaires.

Statistical Methods

Statistical analysis was conducted using SPSS 26.0 (IBM, Armonk, NY, USA). Continuous data were expressed as means and standard deviations (SDs), while count data were presented as n (%). Data distribution was assessed using the Shapiro–Wilk test. For normally distributed data, comparisons between two groups were conducted using the Student's *t*-test, while non-normally distributed data were analyzed with the Mann–Whitney *U*-test. ANOVA was utilized for continuous variables involving three or more groups with normal distribution and equal variances. Kruskal–Wallis analysis was employed for categorical variables that deviated from a normal distribution.

To investigate the associations between demographic variables and KAP scores, both univariate and multivariate logistic regression analyses were employed. In the logistic analysis, a cut-off value of 70% was used to dichotomize the KAP score, with former group serving as the reference. Only items with $p < 0.05$ in the univariate logistic regression were included in the subsequent multivariate logistic regression. Statistical significance was set at $p < 0.05$.

Results

Characteristics of the Study Population

A total of 2211 questionnaires were gathered for this study. The following questionnaires were excluded: 217 completed in under 90 seconds; 2 instances of duplicate data; 123 instances of non-consent; 10 cases aged ≤10 or ≥55, with an additional 14 aged between 35 and 45; and 20 cases with anomalous grade entries (eg, junior high school, high school, or work). After removing these questionnaires, 1956 valid responses remained, yielding an effective response rate of 88.5%. The study analyzed 1956 valid questionnaires, demonstrating a Cronbach's alpha of 0.742 with a 95% confidence interval ranging from 0.726 to 0.757. The surveyed college students had an average age of 19.88 ± 1.40 years. The majority of participants were female (71.8%), freshmen (57.3%) majoring in medical and related fields (53.9%), and had parents with an education level of high school or below (71.1%). Approximately 75.9% of the participants reported using electronic devices for 4 hours or more daily, and 75.0% of them attended schools in Zhejiang province. Regarding the timing of

their first electronic device acquisition, 37.1% reported acquiring it during middle school, followed by 30.6% during high school, 22.5% during elementary school, and 9.9% during college. Notably, 60.8% of the participants occasionally experienced cervical discomfort without a formal diagnosis (Table 1).

Knowledge, Attitudes, and Practices Scores

Participants achieved an average knowledge score of 10.44 ± 2.07. Significantly higher knowledge scores were demonstrated in female participants (10.58 ± 2.04, $p < 0.001$), non-freshmen (10.72 ± 2.14, $p < 0.001$), and those majoring in medical and related fields (10.79 ± 2.1, $p < 0.001$) (Table 1). Within the knowledge section, correct response rates spanned from 24.7% to 99.4%. For instance, 99.4% of participants demonstrated awareness that using a high pillow and prolonged periods of looking down can contribute to cervical spondylosis (K4). In contrast, a mere 24.7% of participants were cognizant that tumors could be a causative factor of cervical spondylosis (K2-5). Furthermore, only 40.1% of participants correctly identified the physiological curve of the cervical spine (K3) (Table 2).

Participants demonstrated an average attitude score of 34.12 ± 3.85. Freshmen (34.26 ± 3.93, $p = 0.012$), those majoring in medical and related fields (34.74 ± 3.75, $p < 0.001$), individuals using electronic devices for less than 3 hours daily (34.83 ± 4.17, $p = 0.001$), and those who had never experienced cervical spine discomfort (35.04 ± 4.01, $p < 0.001$) exhibited significantly higher attitude scores (Table 1). Within the attitudes dimension, the rate of positive responses ranged from 53.1% to 95.9%. The majority (95.9%) of participants displayed a positive attitude regarding the necessity

Table 1 Baseline Information and KAP Dimension Scores Among Participants

	N (%)	Knowledge		Attitude		Practice	
		Mean±SD	P	Mean±SD	P	Mean±SD	P
Total Score		10.44±2.07		34.12±3.85		20.94±4.12	
Age	19.88±1.40						
Gender			<0.001		0.394		0.001
Male	552(28.2)	10.09±2.11		33.88±4.21		21.42±4.43	
Female	1404(71.8)	10.58±2.04		34.21±3.7		20.75±3.97	
Grade			<0.001		0.012		<0.001
Freshman	1120(57.3)	10.24±1.99		34.26±3.93		21.23±4.11	
Non-Freshman	836(42.7)	10.72±2.14		33.93±3.74		20.55±4.1	
Major			<0.001		<0.001		<0.001
Medical and related majors	1054(53.9)	10.79±2.1		34.74±3.75		21.6±4.06	
Other Majors	902(46.1)	10.05±1.96		33.39±3.84		20.16±4.04	
Parents' Education Level			0.779		0.263		0.043
High school and below	1390(71.1)	10.46±2.07		34.17±3.87		20.83±4.1	
Bachelor's degree or above	566(28.9)	10.41±2.07		33.98±3.8		21.22±4.15	
Daily Electronic Device Usage			0.240		0.001		<0.001
<3 hours	178(9.1)	10.18±2.38		34.83±4.17		23.48±4.00	
3–4 hours	294(15.0)	10.31±2.01		34.21±3.56		22.17±3.51	
4 hours or above	1484(75.9)	10.5±2.03		34.01±3.86		20.39±4.07	
Time When First Own an Electronic Device			0.286		0.321		0.087
Elementary school	440(22.5)	10.46±2.04		33.94±4.02		20.6±4.18	
Middle school	725(37.1)	10.48±2.06		33.99±3.95		20.86±4.1	
High school	598(30.6)	10.33±2.09		34.36±3.71		21.26±3.97	
College	193(9.9)	10.64±2.09		34.28±3.45		21.02±4.42	
Current Condition of Cervical Spine			0.424		<0.001		<0.001
Confirmed cervical spondylosis	48(2.5)	10.4±2.66		34.73±3.9		22.69±3.59	
Frequent cervical discomfort, not diagnosed	230(11.8)	10.35±2.13		33.25±4.01		19.68±3.70	
Occasional cervical discomfort, not diagnosed	1189(60.8)	10.51±2		33.88±3.68		20.70±3.92	
Never experienced discomfort	489(25.0)	10.33±2.14		35.04±4.01		21.95±4.53	
School Region							
Zhejiang	1467(75.0)	10.60±2.07		34.36±3.74		21.17±4.13	
Other Provinces	489(25.0)	9.98±2.00		33.38±4.09		20.25±4.00	

Table 2 Participants' Responses in the Knowledge Dimension

Knowledge	N (%)	
	Incorrect	Correct
K1 1. What type of disease is cervical spondylosis?	892(45.6)	1064(54.4)
K2-1 Cause of Cervical spondylosis - Injury	292(14.9)	1664(85.1)
K2-2 Cause of Cervical spondylosis - Inflammation	956(48.9)	1000(51.1)
K2-3 Cause of Cervical spondylosis - Degeneration	887(45.4)	1069(54.6)
K2-4. Cause of Cervical spondylosis - Development & Posture Abnormalities	204(10.4)	1752(89.6)
K2-5. Cause of Cervical spondylosis - Tumor	1473(75.3)	483(24.7)
K3 What is the physiological curve of the cervical spine?	1171(59.9)	785(40.1)
K4 Using a high pillow and prolonged periods of looking down can lead to cervical spondylosis	12(0.6)	1944(99.4)
K5 Catching a cold in the neck can induce cervical spondylosis	243(12.4)	1713(87.6)
K6 Prolonged and continuous use of electronic devices will not lead to cervical spondylosis	567(29.0)	1389(71.0)
K7 The main symptoms of cervical spondylosis are:	139(7.1)	1817(92.9)
K8 Which diagnostic method is of significant reference value for diagnosing cervical spondylosis?	280(14.3)	1676(85.7)
K9 Individuals displaying degenerative cervical changes on imaging but lacking clinical symptoms of cervical spondylosis may be diagnosed with cervical spondylosis	1010(51.6)	946(48.4)
K10 Non-surgical treatment is the preferred and fundamental approach for cervical spondylosis	192(9.8)	1764(90.2)
K11 What is the fundamental premise for preventing and treating cervical spondylosis?	593(30.3)	1363(69.7)

of timely medical treatment and professional care for cervical spondylosis (A5). Additionally, an equally significant portion (95.9%) held positive views about the positive impacts of healthy cervical spine on overall academic and daily life quality (A7). Conversely, almost half proportion of participants (53.1%) concurred with the notion related to contemporary university students' cervical spine condition (A8) (Table 3).

The participants exhibited an average practice score of 20.94 ± 4.12. Notably, male participants (21.42 ± 4.43, $p = 0.001$), freshmen (21.23 ± 4.11, $p < 0.001$), those majoring in medical and related fields (21.6 ± 4.06, $p < 0.001$), individuals whose parents held a bachelor's degree or higher (21.22 ± 4.15, $p = 0.043$), those using electronic devices for less than 3 hours daily (23.48 ± 4.00, $p < 0.001$), and participants with confirmed cervical spondylosis (22.69 ± 3.59, $p < 0.001$) achieved significantly higher practice scores (Table 1). Variability in practice adherence was observed among participants, with rates spanning from 10.0% to 54.0%. The majority of participants (54.0%) reported engaging in exercises or muscle relaxation for their neck and cervical spine (P6). Conversely, the smallest proportion (10.0%)

Table 3 Participants' Responses in the Attitude Dimension

Attitude	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
A1 What is your attitude towards cervical spondylosis?	927(47.4)	810(41.4)	196(10.0)	18(0.9)	5(0.3)
A2 Do you think self-management is important for preventing and managing cervical spondylosis?	1396(71.4)	475(24.3)	82(4.2)	1(0.1)	2(0.1)
A3 Are you willing to participate in health promotions and activities related to cervical spondylosis?	1112(56.9)	694(35.5)	124(6.3)	19(1.0)	7(0.4)
A4 Do you believe that controlling mobile phone usage time and habits is helpful for preventing and managing cervical spondylosis?	1161(59.4)	653(33.4)	112(5.7)	23(1.2)	7(0.4)
A5 Do you think timely medical treatment and professional care are necessary for cervical spondylosis?	1216(62.2)	659(33.7)	65(3.3)	8(0.4)	8(0.4)
A6 Are you willing to engage in cervical muscle relaxation during your free time to maintain cervical health?	1115(57.0)	699(35.7)	123(6.3)	13(0.7)	6(0.3)
A7 Do you agree that having a healthy cervical spine contributes to a higher quality of academic and daily life?	1281(65.5)	594(30.4)	68(3.5)	8(0.4)	5(0.3)
A8 What do you think about the cervical spine condition of contemporary college students?	244(12.5)	795(40.6)	551(28.2)	366(18.7)	0(0.0)

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indicated that they did not typically watch TV or use their phone while lying down (P9). Additionally, 10.6% of participants did not maintain a poor posture during extended periods of study or leisure activities (P7) (Table 4). In terms of information sources on cervical spine health, TikTok was cited by a significant proportion (69.4%), followed by official accounts such as WeChat (64.5%), community hospitals or medical experts (58.2%), and Weibo (48.7%). Additionally, a majority (64.3%) indicated a preference for preventing cervical spine discomfort through neck exercises (Table 5).

Univariable and Multivariable Analyses

Univariate logistic regression identified several independent factors associated with knowledge, including female gender, non-freshman status, non-medical majors, and knowledge acquisition through Weibo, official accounts (eg, WeChat), and community hospitals or medical experts (all $p < 0.05$). Multivariate analysis further confirmed that female participants (OR = 1.39, 95% CI: 1.10–1.75, $p = 0.006$), non-freshmen (OR = 1.74, 95% CI: 1.42–2.13, $p < 0.001$), non-medical majors (OR = 0.47, 95% CI: 0.39–0.58, $p < 0.001$), and those obtaining knowledge via official accounts (OR = 1.86, 95% CI: 1.47–2.36, $p < 0.001$) or community hospitals/medical experts (OR = 1.60, 95% CI: 1.29–1.99, $p < 0.001$) were independently associated with knowledge (Table 6).

For attitude, univariate analysis identified associations with non-freshman status, non-medical majors, daily electronic device usage (≥3 hours), absence of cervical spine discomfort, and knowledge acquisition through TikTok, Weibo, and community hospitals/medical experts (all $p < 0.05$). Multivariate regression confirmed that non-medical students (OR = 0.52, 95% CI: 0.42–0.63, $p < 0.001$), those using electronic devices for 3–4 hours (OR = 0.67, 95% CI: 0.45–0.99, p=0.044), or ≥4 hours (OR = 0.64, 95% CI: 0.46–0.89, $p = 0.008$), individuals without cervical discomfort (OR = 2.64,

Table 4 Participants' Responses in the Practice Dimension

Practice	Always n (%)	Usually n (%)	Sometimes n (%)	Occasionally n (%)	Never n (%)
P1 Do you proactively seek knowledge about cervical spine health?	253(12.9)	260(13.3)	726(37.1)	617(31.5)	100(5.1)
P3 Do you pay attention to whether your posture contributes to cervical spine health?	353(18.1)	445(22.8)	842(43.1)	274(14.0)	42(2.2)
P4 Do you engage in exercises or muscle relaxation for your neck and cervical spine?	344(17.6)	389(19.9)	826(42.2)	349(17.8)	48(2.5)
P6 Do you avoid using a high pillow when sleeping?	653(33.4)	403(20.6)	473(24.2)	312(16.0)	115(5.9)
P7 Do you adopt a poor posture while studying or engaging in leisure activities for prolonged periods?	475(24.3)	633(32.4)	641(32.8)	173(8.8)	34(1.7)
P8 Do you avoid using electronic devices continuously for a long time?	236(12.1)	268(13.7)	820(41.9)	525(26.8)	107(5.5)
P9 Do you usually watch TV or use your phone while lying down?	420(21.5)	709(36.3)	632(32.3)	159(8.1)	36(1.8)

Table 5 The Prevalence and Response Rate of P2 and P5 Items in the Practice Dimension

Item	Option	N	Prevalence (%)	Response Rate%
P2 Through which channels do you usually or prefer to obtain information about cervical spondylosis?	A. Tiktok	1358	69.4	28.8
	B. Weibo	952	48.7	20.2
	C. Official accounts (eg, WeChat)	1261	64.5	26.8
	D. Community hospitals or medical experts	1138	58.2	24.2
P5 Which exercise method would you choose to prevent cervical spondylosis?	A. Swimming	567	29.0	14.8
	B. Badminton	910	46.5	23.8
	C. Neck exercises	1257	64.3	32.8
	D. Walking	1097	56.1	28.6

Table 6 Univariate and Multivariate Logistic Regression Analysis of Knowledge Dimension

Variables	Univariate Logistic Regression Analysis		Multivariate Logistic Regression Analysis	
	OR(95% CI)	P	OR(95% CI)	P
Gender				
Male	REF		REF	
Female	1.51(1.21–1.89)	<0.001	1.39(1.10–1.75)	0.006
Grade				
Freshman	REF		REF	
Non-Freshman	1.59(1.31–1.93)	<0.001	1.74(1.42–2.13)	<0.001
Major				
Medical and related majors	REF		REF	
Other Majors	0.45(0.37–0.55)	<0.001	0.47(0.39–0.58)	<0.001
Parents' Education Level				
High school and below	REF			
Bachelor's degree or above	0.95(0.77–1.18)	0.649		
Daily Electronic Device Usage				
<3 hours	REF			
3–4 hours	0.90(0.61–1.35)	0.620		
4 hours or above	0.90(0.65–1.26)	0.547		
Time When First Own an Electronic Device				
Elementary school	REF			
Middle school	1.07(0.83–1.38)	0.604		
High school	1.02(0.78–1.34)	0.880		
College	1.24(0.87–1.78)	0.240		
Current Condition of Cervical Spine				
Confirmed cervical spondylosis	REF			
Frequent cervical discomfort-not diagnosed	0.79(0.41–1.53)	0.482		
Occasional cervical discomfort-not diagnosed	0.95(0.52–1.76)	0.880		
Never experienced discomfort	0.84(0.44–1.57)	0.575		
Source of Knowledge				
TikTok	1.06(0.86–1.31)	0.582		
Weibo	1.46(1.21–1.77)	<0.001	1.00(0.80–1.24)	0.983
Official accounts(WeChat)	2.16(1.74–2.67)	<0.001	1.86 (1.47–2.36)	<0.001
Community hospitals or medical experts	1.91(1.56–2.33)	<0.001	1.60(1.29–1.99)	<0.001

95% CI: 1.34–5.19, p = 0.005), and those obtaining knowledge via TikTok (OR = 1.73, 95% CI: 1.38–2.18, p < 0.001) were independently associated with attitude (Table 7).

Univariate regression identified several predictors of practice, including attitude score, female gender, non-freshman status, non-medical majors, daily electronic device use (≥3 hours), first-time device ownership in high school, current cervical spine condition, and knowledge acquisition through TikTok, Weibo, and community hospitals/medical experts (all p < 0.05). Multivariate analysis confirmed that attitude score (OR = 1.27, 95% CI: 1.22–1.31, p < 0.001), female gender (OR = 0.56, 95% CI: 0.44–0.72, p < 0.001), non-medical majors (OR = 0.74, 95% CI: 0.59–0.92, p = 0.007), electronic device use ≥4 hours daily (OR = 0.35, 95% CI: 0.24–0.50, p < 0.001), frequent cervical discomfort (OR = 0.26, 95% CI: 0.13–0.53, p < 0.001), occasional cervical discomfort (OR = 0.39, 95% CI: 0.21–0.73, p = 0.003), and knowledge acquisition from community hospitals/medical experts (OR = 1.30, 95% CI: 1.03–1.63, p = 0.027) were independently associated with practice (Table 8).

Table 7 Univariate and Multivariate Logistic Regression Analysis of Attitude Dimension

Variables	Univariate Logistic Regression Analysis		Multivariate Logistic Regression Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge Score	0.97(0.93–1.01)	0.168		
Gender				
Male	REF			
Female	1.03(0.84–1.27)	0.765		
Grade				
Freshman	REF		REF	
Non-Freshman	0.78(0.65–0.95)	0.011	0.91(0.74–1.11)	0.344
Major				
Medical and related majors	REF		REF	
Other Majors	0.47(0.39–0.57)	<0.001	0.52(0.42–0.63)	<0.001
Parents' Education Level				
High school and below	REF			
Bachelor's degree or above	0.91(0.74–1.12)	0.358		
Daily Electronic Device Usage				
<3 hours	REF		REF	
3–4 hours	0.58(0.4–0.84)	0.004	0.67(0.45–0.99)	0.044
4 hours or above	0.52(0.38–0.71)	<0.001	0.64(0.46–0.89)	0.008
Time When First Own an Electronic Device				
Elementary school	REF			
Middle school	1.1(0.85–1.41)	0.478		
High school	1.19(0.92–1.55)	0.179		
College	1.04(0.73–1.48)	0.847		
Current Condition of Cervical Spine				
Confirmed cervical spondylosis	REF		REF	
Frequent cervical discomfort, not diagnosed	0.67(0.33–1.37)	0.277	0.68(0.33–1.40)	0.291
Occasional cervical discomfort, not diagnosed	1.28(0.67–2.45)	0.456	1.19(0.61–2.30)	0.612
Never experienced discomfort	2.86(1.48–5.54)	0.002	2.64(1.34–5.19)	0.005
Source of Knowledge				
TikTok	1.88(1.52–2.33)	<0.001	1.73(1.38–2.18)	<0.001
Weibo	1.42(1.18–1.71)	<0.001	1.21(0.99–1.47)	0.068
Official accounts (WeChat)	1.19(0.98–1.45)	0.083		
Community hospitals or medical experts	1.23(1.02–1.48)	0.033		

Table 8 Univariate and Multivariate Logistic Regression Analysis of Practice Dimension

Variables	Univariate Logistic Regression Analysis		Multivariate Logistic Regression Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge Score	0.96(0.92–1.01)	0.104		
Attitude Score	1.29(1.25–1.34)	<0.001	1.27(1.22–1.31)	<0.001
Gender				
Male	REF		REF	
Female	0.68(0.55–0.83)	<0.001	0.56(0.44–0.72)	<0.001
Grade				
Freshman	REF		REF	
Non-Freshman	0.77(0.64–0.94)	0.009	0.89(0.72–1.10)	0.287

(*Continued*)

Table 8 (Continued).

Variables	Univariate Logistic Regression Analysis		Multivariate Logistic Regression Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Major				
Medical and related majors	REF		REF	
Other Majors	0.56(0.46–0.68)	<0.001	0.74(0.59–0.92)	0.007
Parents' Education Level				
High school and below	REF			
Bachelor's degree or above	1.04(0.84–1.27)	0.745		
Daily Electronic Device Usage				
<3 hours	REF		REF	
3–4 hours	0.62(0.42–0.90)	0.011	0.71(0.47–1.09)	0.113
4 hours or above	0.31(0.23–0.43)	<0.001	0.35(0.24–0.50)	<0.001
Time When First Own an Electronic Device				
Elementary school	REF		REF	
Middle school	1.11(0.86–1.44)	0.408	1.00(0.75–1.34)	0.998
High school	1.31(1.00–1.70)	0.047	1.03(0.76–1.38)	0.870
College	1.07(0.74–1.54)	0.729	0.88(0.58–1.34)	0.559
Current Condition of Cervical Spine				
Confirmed cervical spondylosis	REF		REF	
Frequent cervical discomfort, not diagnosed	0.22(0.12–0.43)	<0.001	0.26(0.13–0.53)	<0.001
Occasional cervical discomfort, not diagnosed	0.40(0.22–0.71)	0.002	0.39(0.21–0.73)	0.003
Never experienced discomfort	0.73(0.41–1.33)	0.307	0.52(0.27–1.00)	0.05
Source of Knowledge				
TikTok	1.54(1.25–1.91)	<0.001	1.25(0.97–1.61)	0.088
Weibo	1.42(1.17–1.71)	<0.001	1.19(0.95–1.51)	0.133
Official accounts (WeChat)	1.20(0.98–1.46)	0.078		
Community hospitals or medical experts	1.46(1.20–1.77)	<0.001	1.30(1.03–1.63)	0.027

Discussion

University students possessed moderate knowledge, positive attitudes, and inappropriate practices towards cervical spine health. The influential factors of KAP were also determined, including gender, grade, major, daily electronic device usage, and source knowledge.

Our study represented the first exploration of KAP towards cervical spine health among university students, which bridged the gap in the KAP studies primarily focused on medical personnels. For instance, a study conducted in Egypt revealed that dentists exhibited insufficient knowledge and suboptimal practices related to dental ergonomics for preventing cervical spondylosis.[14] The findings jointly underscored the critical need to enhance educational efforts and promote practical measures pertaining to cervical spine health among university students.

In the knowledge dimension, the encouraging finding indicated that a substantial portion of the surveyed students already aware that using high pillow and prolonged periods of looking down can contribute to cervical spondylosis. Conversely, the correct response rate of 40.13% for correctly identifying the physiological curve of the cervical spine indicated a moderate level of understanding among participants. Understanding the natural curvature of the cervical spine is fundamental in comprehending how abnormal posture and prolonged positions could lead to structural changes and cervical spondylosis.[21]

The majority displayed positive attitude regarding the necessity of timely medical treatment and professional care for cervical spondylosis. The positive attitude was encouraging from public health perspective, as early intervention and proper medical care can significantly improve the prognosis of cervical spondylosis[22] Healthy cervical spine was essential for maintaining good posture, reducing discomfort, and preventing long-term complications.[23,24] Participants'

recognition of the relationship suggested that they understood the importance of preventive measures and healthy lifestyle choices in preserving cervical spine health.

In the practice dimension, the smallest proportion (9.97%) indicated that they did not typically watch TV or use their phone while lying down. This behavior was noteworthy as prolonged screen time in a lying-down position can lead to poor neck posture and increased strain on the cervical spine. Additionally, only 10.58% did not maintain poor posture during extended periods of study or leisure activities. The findings emphasized the need for educational campaigns and interventions that raised awareness about the potential risks associated with improper screen usage and poor neck posture. Regarding the sources for obtaining information about cervical spine health, a substantial portion (69.43%) mentioned TikTok, which has gained popularity for its short-form health-related content. This finding suggested the potential for utilizing digital platforms to deliver accurate and accessible health information to university students.

Demographic factors associated with KAP were identified. Firstly, non-freshmen outperformed freshmen in knowledge scores, which could be attributed to the extended exposure to educational content and deeper familiarity with cervical spine health. Non-freshmen were lower than that of freshmen in attitudes, and practices scores, which could be attributed to Chinese middle and high schools have recess exercises, and schools intervene in students' behavior, and the effect of this intervention continues to the university with the delay of time. It suggests that university institutions should also base their physical activity interventions on schools to improve physical health.[25] Secondly, students majoring in fields other than medicine consistently exhibited lower KAP scores compared to their medical counterparts. The lower knowledge scores could be attributed to differences in curriculum focus and exposure to relevant topics, which subsequently affect attitudes and practices of cervical spine health. Therefore, it might involve curriculum adjustments, interdisciplinary collaboration, or targeted support to ensure that all students have equal opportunities for cervical spine health. Thirdly, individuals obtaining knowledge through official and credible channels, such as WeChat or community hospitals and medical experts, showed higher KAP scores. To cultivate well-informed individuals and mitigate the risk of cervical spine discomfort, educational institutions should encourage students to seek information from authoritative sources and develop critical thinking skills.[26] Fourthly, detrimental effects of prolonged screen time on attitude and practice scores were determined. This underscored the importance of balanced digital engagement and the need for strategies to mitigate the potential negative impacts of excessive device usage among university students.

This study had several limitations. Firstly, the use of cross-sectional design might limit the establishment of causality among variables. Nevertheless, the findings offered valuable insights into the current KAP status of university students towards cervical spine health. Secondly, it was important to acknowledge the potential influence of social desirability bias on KAP scores. This bias might lead to an overestimation of scores as participants tended to provide responses that conform to social norms rather than accurately reflecting their actual behaviors and knowledge.[27] Finally, the study's sample is predominantly drawn from Zhejiang and heavily comprises medical students, thus limiting its generalizability to broader contexts.

Conclusion

In summary, university students exhibited moderate knowledge, positive attitudes, and inappropriate practices towards cervical spine health. Besides, the positive association between attitude and practice were observed. Moreover, the implementation of educational interventions and behavior modification strategies were recommended, particularly among specific subgroups, such as non-medical students, individuals with prolonged digital device usage, and freshmen.

Abbreviation

KAP, knowledge, attitude and practice.

Data Sharing Statement

All data generated or analysed during this study are included in this published article and its supplementary information files.

Ethics and Consent

This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. This work was approved by the Ethics Committee of Quzhou People's Hospital (reference number 2023-047). Written informed consent was obtained from all participant.

Author Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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