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Original Article

Perceived impact of a smartphone application: Knowledge, awareness, attitudes, and intention to change an abnormal neck posture among smartphone-addicted undergraduates

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ABSTRACT

Objectives: This study explored the perceived impact of a smartphone app on awareness, knowledge, attitudes, help-seeking, behavior change, and intention to change an abnormal posture of the neck while using smartphones among undergraduates addicted to smartphone use.

Patients and methods: This descriptive survey involved smartphone-addicted undergraduates recruited between February 2022 and July 2022. The self-administered questionnaires used for gathering the data were a smartphone addiction survey and a mobile app rating scale on app-specific query assessing changes in awareness, knowledge, attitude, intention to change, health-seeking, and behavior change.

Results: The questionnaire was completed by 316 participants (218 females, 98 males; mean: 20.7±2.6 years; range, 16 to 35 years). One hundred forty-two (44.9%) of the respondents strongly agreed that the app improved awareness, while 143 (45.3%) strongly agreed that the app improved knowledge about the significance of addressing abnormal posture of the neck while using smartphones. One hundred thirty-two (41.8%) were of the opinion that the app could change participant attitudes, and 135 (42.7%) agreed that the app could increase intentions toward improving abnormal posture of the neck. One hundred eighteen (37.3%) participants agreed that the app could promote help-seeking for abnormal posture of the neck. Respondents' age had a negative weak correlation with intention to treat ($r=-0.191$, $p=0.001$) and help-seeking ($r=-0.199$, $p=0.0001$).

Conclusion: Most of the respondents in this study agreed that the CerviTech app could increase awareness, knowledge, attitude, intention to change, help-seeking, and behavior change of abnormal posture of the neck while using smartphones, with significant impact according to the age of the respondents regarding the intention to change and help-seeking behavior.

Keywords: Attitude, intention, posture, smart app, smartphone.

In Nigeria, the number of people using smartphones has been predicted to rise to about 140 million in the next two years, but the current estimate is about 40 million users.[1] An average Nigerian undergraduate spends 16 out of 24 h daily on a smartphone.[2] A study by Neupane et al.[3] reported that above 50% of the population within the age range of 18 to 44 years make use of their phones most of the time, leaving just 2 h without holding their smartphones. It has been noted that students give too much attention to their smartphones irrespective of the situation, and this behavior is referred to as smartphone addiction.[4] Smartphones have their own merit and demerit with respect to messaging and calculation on young people's social activities, educational skills, accomplishments, and associations with the environment. However, the usage of a smartphone can lead to physical and psychological problems despite the benefits it brings to the lives of the masses.[4] The most important problem caused

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by smartphone usage is probably the development of behavioral habits. Behavioral addiction is the inability of an individual to stop themselves from doing the relevant behavior, and the individual may show tension and disturbance they face with prevention.[5]

Addiction to the usage of smartphones is a result of abuse of the internet or addiction to the internet. It is hardly the phone that causes the addiction but the games, smartphone apps, and the virtual world it offers.[6] The increase in smartphone usage has resulted in individuals experiencing disorders of the musculoskeletal system,[7,8] which predisposes the individual to pain and discomfort.[9]

Positioning of the neck in a nonneutral flexed posture is a recognized reason for the development of pain in the structures around the cervical vertebrae.[10] The flexed posture of the neck increases forward head posture and reduces the craniovertebral angle.[9] This may increase the occurrence of severe or nonsevere neck and shoulder pain cases, which if not properly managed, may increase the economic burden on healthcare. Smartphone app usage in the health sector is quite rampant lately, particularly as a substitute to clinical management.[11,12] For proper neck posture to be assumed by people using smartphones, a system to observe and estimate angle of the neck of smartphone users when using their phones was proposed by Lawanont et al.[13] Higher mobile technology is now an essential part of the healthcare industry. Due to the increase in the usage of smartphones globally, mobile health app development has become a vital part of digital health.[14]

Currently, there is a shortage of data on the effect of mobile phone apps on the musculoskeletal system of the African population addicted to smartphone use. This creates a gap in this crucial area, particularly on its perceived impact on the musculoskeletal system of adolescents in Africa, specifically Lagos, Nigeria. Hence, this study aimed to determine the perceived impact of a smartphone app on the change in knowledge, attitudes, help-seeking behavior, and intentions to change an abnormal posture of the neck while using smartphones among undergraduates addicted to smartphone use.

PATIENTS AND METHODS

This descriptive survey was conducted with smartphone-addicted undergraduates from Lagos, Nigeria, between February 2022 and July 2022. The participants were volunteer undergraduate students of the College of Medicine, University of Lagos selected from a population of 1,822 with multistage sampling technique, and 350 students were eligible for participation in the study. The participants were drawn from four faculties, Faculty of Basic Medical Sciences, Faculty of Clinical Sciences, Faculty of Dental Sciences, and Faculty of Pharmacy, from each of the degree programs (Medicine and Surgery, Dental Surgery, Physiotherapy, Pharmacology, Physiology, Radiography, Medical Laboratory Sciences) and Nursing Science, Biochemistry, and Pharmacy. A proportionate method of sampling was used in determining the number of male and female undergraduates required for each level, having drawn these numbers from a list of the student distribution stratified according to years and sex for each program. The undergraduate students from first to sixth year for both MBBS and BDS, first to fifth year for Physiotherapy, Medical Laboratory Science, Pharmacy, and Nursing, and first to fourth year for Physiology and Biochemistry participated in the survey. The participants were educated on the objective of the survey. The participants had been using smart phone with the Android operating system (Alphabet Inc., Mountain View, CA, USA) for a period of one year. Undergraduates who did not use smartphones and those using smartphones with the iOS operating system (Apple Inc., Cupertino, CA, USA) were excluded. The CerviTech smartphone app (version 1.13, android 5) was used by the participants in this study.

An app-specific section in the Mobile App Rating Scale (MARS) assessing the perceived impact of a smartphone app on the user's knowledge, attitude, and intentions to change, in addition to the likelihood of actual change of abnormal posture of the neck while using smartphones, was utilized. This scale consists of six subsections: awareness, knowledge, attitudes, intention to change, help-seeking, and behavior change. The 5-point Likert scale, ranging from strongly disagree to strongly agree, revealed excellent internal consistency (alpha=0.90), interrater reliability, and intraclass correlation (intraclass correlation coefficient=0.79).[15]

The Smartphone Addiction Scale, Short Version (SAS-SV) was used to estimate the level of addiction to smartphones of the respondents. This self-administered scale has 10 items and addresses five domains: *(i)* daily-life disturbance, *(ii)* withdrawal, *(iii)* cyberspace-oriented relationship, *(iv)* overuse, and *(v)* tolerance with a 6-point Likert scale, ranging from

strongly disagree to strongly agree. The maximum score for the SAS-SV is 60. Scores obtained were used to classify participants into excessive (>30) and nonexcessive (≤30) users. A reliability study of the SAS-SV revealed a Cronbach's alpha of 0.911, with a sensitivity and specificity of 0.875 and 0.886, respectively.[16]

Data were collected both face-to-face and through an online survey (Google Forms; Alphabet Inc., Mountain View, CA, USA). First, patients were asked to complete a smartphone addiction questionnaire to decide the eligibility of the participants. Participants were then asked to fill out a form that included their age, sex, class, department, and religion after qualifying for the eligibility criteria. The second step was the completion of the app-specific section of the MARS, which was done after instructing the participants to download the app on their smartphones and use it for at least one month following the method of Stoyanov et al.[17] After using the app, the participants were told to fill out the app-specific section of the MARS.

Statistical analysis

The sample size was determined using G*Power version 3 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) with the Cochran formula, where Z=standard normal variate is 5%), type 1 error (p<0.050) is 1.96, and p=53% is the prevalence of smartphone addiction, based on prior research by Akodu et al.,[7] with 10% attrition rate.

Data were analyzed using IBM SPSS version 25.0 software (IBM Corp., Armonk, NY, USA) and the 2007 version of Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Data were summarized using descriptive statistics of mean and standard deviation, median, interquartile range, frequency, and percentages. Difference in the awareness, knowledge, attitude, intention to change, help-seeking, and behavior change between both sexes was determined using the Mann-Whitney U test. The Spearman correlation coefficient was used to correlate smartphone addiction and sociodemographic characteristics with awareness, knowledge, attitude, intention to change, help-seeking, and behavior change. A p-value <0.05 was considered statistically significant.

RESULTS

Of the 350 undergraduate students qualified to participate in this study, 316 (218 females, 98 males; mean age: 20.7±2.6 years; range, 21 to 30 years) completed the questionnaire and were suitable for analysis, resulting in a response rate of 90.3%. One hundred forty-seven (46.5%) of the respondents were between the ages of 21 to 25 years, while 12 (3.8%) were between 26 to 30 years. Eighty-two (25.90%) of the participants were in the second year, while 74 (23.40%) were in the fourth year. Two hundred forty-nine (78.80%) of the participants were Christian. The mean SAS-SV score of the participants was 38.15±6.20 (Table 1).

One hundred forty-two (44.9%) of the respondents strongly agreed that the app increased awareness about the significance of addressing abnormal posture of the neck while using smartphones, while 128 (40.5%) respondents agreed, and 36 (11.4%) participants were neutral to the statement. One hundred forty-three (45.3%) of the respondents strongly agreed that the app increased knowledge/understanding about the abnormal posture of the neck while using smartphones, while four (1.3%) respondents disagreed. One hundred and thirty-two (41.8%) of the respondents agreed that the app could change participants' attitudes toward the improvement of abnormal posture of the neck while using smartphones, while 124 (39.2%) participants strongly agreed. One hundred thirty-five (42.7%)

TABLE 1
Sociodemographic variables of the participants (n=316)

Variables	n	%	Mean±SD
Age (year)			20.7±2.6
16-20	154	48.70	
21-25	147	46.50	
26-30	12	3.80	
31-35	3	0.90	
Sex			
Male	98	31.00	
Female	218	69.00	
Religion			
Christianity	249	78.80	
Islam	65	20.60	
Atheist	1	0.30	
Traditional	1	0.30	
Class level			
100	64	20.30	
200	82	25.90	
300	36	11.40	
400	74	23.40	
500	40	12.70	
600	20	6.30	
Smartphone addiction	316	100.00	38.15±6.20

SD: Standard deviation.

participants agreed that the app could raise the intentions to address abnormal posture of the neck while using smartphones, whereas 117 (37.0%) strongly agreed to this statement. One hundred eighteen (37.3%) of the participants agreed that the app could inspire more help-seeking behavior for the abnormal posture of the neck while using smartphones, while 109 (34.5%) strongly agreed with this statement. One hundred thirty participants (41.1%) strongly agreed that the app could increase/decrease behavioral transformation to the assumption of abnormal posture of the neck while using smartphones, while 111 (35.1%) participants agreed with this statement (Table 2).

Table 3 shows the comparison between perceived impact of knowledge, awareness, attitude, intention to change, help-seeking, and behavior change of abnormal

TABLE 2
Frequency distribution of the perceived impact of the app on the user's awareness, knowledge, attitude, intention to change, help-seeking, and behavior change

	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
Domains	n	%	n	%	n	%	n	%	n	%
Awareness	3	0.9	7	2.2	36	11.4	128	40.5	142	44.9
Knowledge	4	1.3	4	1.3	47	14.9	118	37.3	143	45.3
Attitude	5	1.6	6	1.9	49	15.5	132	41.8	124	39.2
Intention to change	5	1.6	6	1.9	53	16.8	135	42.7	117	37.0
Help seeking	3	0.9	14	4.4	72	22.8	118	37.3	109	34.5
Behavior change	4	1.3	13	4.1	58	18.4	130	41.1	111	35.1

TABLE 3
Comparison between perceived impact and level of smartphone addiction of male and female app users

	Male		Female			
Domains	Median	Q1-Q3	Median	Q1-Q3	U	*p**
Awareness	5.00	4.00-5.00	4.00	4.00-5.00	9398.00	0.06
Knowledge	4.00	4.00-5.00	4.00	4.00-5.00	10340.50	0.62
Attitude	4.00	4.00-5.00	4.00	4.00-5.00	9486.00	0.09
Intention to change	4.00	4.00-5.00	4.00	4.00-5.00	10062.00	0.38
Help seeking	4.00	3.00-5.00	4.00	3.00-5.00	10573.50	0.88
Behavior change	4.00	4.00-5.00	4.00	3.00-5.00	9392.00	0.07
Smartphone addiction scale	38.00	33.75-41.0	37.00	33.00-41.00	10522.000	0.83

Q1: First quartile; Q3: Third quartile; U: Mann-Whitney U; * Significant at p<0.05.

TABLE 4
Correlation between perceived impact of the app on the user's knowledge, awareness, attitude, intention to change, help-seeking, behavior change, and sociodemographic variables

	Age		Sex		Religion		Class level	
	r_s	*p*	r_s	*p*	r_s	*p*	r_s	*p*
Awareness	−0.057	0.316	−0.105	0.062	0.075	0.185	−0.133	0.018*
Knowledge	−0.090	0.109	−0.028	0.623	0.063	0.267	−0.107	0.057
Attitude	−0.092	0.103	−0.097	0.087	0.041	0.464	−0.185	0.001*
Intention to change	−0.191	0.001*	−0.050	0.376	0.098	0.083	−0.238	0.0001*
Help seeking	−0.199	0.0001*	0.009	0.879	0.099	0.078	−0.240	0.0001*
Behavior change	−0.108	0.055	−0.103	0.067	0.009	0.868	−0.167	0.003*

rs: Spearman correlation; * Significant at p<0.05.

posture of the neck while using smartphones. It was revealed that there was a significant difference (p>0.05) between male and female participants.

Table 4 shows that there were negative weak correlations between awareness (r=0.133, p=0.018), attitude (r=–0.185, p=0.001) intention to change (r=–0.238, p=0.0001), help-seeking (r=–0.240 p=0.0001), and behavior change (r=–0.167, p=0.003) and class level of the respondents but no significant correlation with knowledge of the respondents. The result also revealed that there were negative weak correlations between intention to treat (r=–0.191, p=0.001) and help-seeking (–0.199, p=0.0001) and age of the participants.

DISCUSSION

This study examined the perceived impact of a smartphone app on awareness, knowledge, attitudes, help-seeking, behavior change and, intention to change an abnormal posture of the neck while using smartphones among smartphone-addicted undergraduates. This study involved undergraduates that are addicted to smartphone use. This finding concurs with the outcome of the study by Akodu et al.,[7] and Alruzayhi et al.,[18] which revealed that addiction to smartphone use is very common among university undergraduates.

Most of the respondents strongly agreed that the CerviTech app increased awareness of the significance of addressing the abnormal posture of the neck while using smartphones, this may be due to some of the functions and features of the app that allow individuals to know how to position their neck appropriately while using smartphones.

Most of the respondents strongly agreed that the CerviTech app increased their knowledge and understanding of proper positioning of the neck while using smartphones, and almost half of the respondents claimed that the app could change their attitudes toward improving their habit of assuming proper neck posture while using smartphones. Most of the participants strongly agreed that the CerviTech app could help to raise their intention to change their habit of assuming an abnormal posture of the neck while using smartphones, as well as encourage further help-seeking and increase behavioral change of assuming proper posture of the neck while using smartphones. The fact that most of the participants strongly agreed to these statements evidences the usefulness of the CerviTech app in accomplishing all the characteristics of this perceived impact of the app on participants, proving that mobile phone apps can help influence health behavior.[19]

The outcomes of this research showed that there was no significant difference in the level of awareness, knowledge, attitude, intention to change, help-seeking, and behavioral change between male and female participants in this study. This might be due to the lack of difference in the level of addiction to smartphone use between male and female participants. This study showed a significant correlation between intention to change an abnormal health behavior, in addition to seeking proper health behavior concerning abnormal posture of the neck and age of the respondents. This outcome supported the finding of the study by Zhao et al.[19] stating that mobile phone apps help impact the health behavior of individuals. Behavioral addiction is one of the main problems caused by usage of smartphones. In behavioral addiction, the individuals are unable to stop doing the related behavior, and they may display tension and disturbance they face with prevention.[20] The fact that the participants have the intention to change their habits and try to seek further help in changing their bad habits while using smartphones helps the participants in achieving their goal of appropriately positioning their necks regardless of their age.

In this study, the class of the participants significantly correlated with awareness, attitude, and intention to change, help-seeking, and behavioral transformation of the participants' abnormal posture of the neck. The reason for this outcome might be due to the level of information and the activities the participants were able to do with the app, which made them appreciate the functionality and benefit they could get from using the app. This app has been proven to be interesting and interactive and has good graphic design, color scheme, high visual appeal, and high-quality information. All these characteristics are included in the questionnaire used in evaluating the quality of a mobile health app.[15] In the aspect of approach to behavioral changes, adolescents often lack self-monitoring and planning required for the implementation and sustenance of healthy behaviors.[21] Self-regulation was incorporated in the CerviTech app by giving users access to the screen for setting daily goals on how they will be able to abide with the maintenance of proper neck posture with the help of push notifications and motivational tips. The provision of feedback that is personally relevant is also a significant approach for changing adolescents' behaviors.[22]

Motivation from accomplishing a set goal and social influence can improve self-efficacy, and this has been acknowledged as a vital mechanism in attaining modifications in behavior.[23] The CerviTech app provides motivational statements through automated push notifications, which serve as a means for positive words of inspiration that would help adolescents to be optimistic about their habit of maintaining appropriate posture while using smartphones. The usage of graphic designs to boost behavior change was also considered while developing the CerviTech app using the concept of behavior-image model proposed by Werch.[24] The benefit of incorporating images in an app is that several and varying habits can be corrected using a relatively effective approach to ensure they are standard for developing short-term treatment.[24]

The limitation of this study was the nonavailability of the iOS version of the app, making it difficult to sample participants. However, the iOS version is undergoing beta testing and could be included in further studies.

In conclusion, participants' class had an influence on the perceived impact of the smartphone app on awareness, attitude, intention to change, help-seeking, and behavioral change of abnormal posture of the neck while using smartphones. Furthermore, participants' age had an influence on the intention to change and help-seeking health behavior. It was also revealed in this study that most of the participants agreed that the CerviTech app resulted in improvement in the same parameters. Therefore, we recommended that individuals that assume abnormal posture while using smartphones be encouraged to use the CerviTech app to lessen the musculoskeletal disorders of the spine.

Ethics Committee Approval: The study protocol was approved by the College of Medicine, University of Lagos Ethics Committee of (date: 04.03.2022, no: CMUL/HREC/01/22/1001. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Idea/concept, design, data collection and/or processing, analysis and/or interpretation, writing the article, references and fundings: A.A.; Control/supervision, critical review, other: A.A., O.I., A.O.; Literature review, materials: A.A., O.I.

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