

Prevalence of Musculoskeletal Disorder among Smartphone Users in a Nigerian University's Undergraduates

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Abstract

Musculoskeletal disorders (MSK) are the commonest causes of severe long-term pain and physical disability affecting people around the world. This study assessed the prevalence of musculoskeletal disorders among undergraduate smartphone users' of the University of Medical Sciences Ondo.

Two hundred and seventy-nine (170 females, 109 males) respondents were administered Standardized Nordic Questionnaire and Smartphone Usage Questionnaire to be completed. The questionnaires were retrieved as soon as possible. Data was analyzed using descriptive and inferential statistics. Alpha level was set at 0.05.

The result shows that point prevalence of MSK was 84(30.1%), seven days was 112 (40.2%) and 12 months was 135(48.5%). The most prevalent site in seven days was lower back (62;22.3%) and 12 months was the neck (140; 50.1%). There was significant association between the type of smartphone and each of the point prevalence ($X^2 = 173.88, p = 0.000$), 7 days ($X^2 = 191.67, p = 0.000$) and 12 months' prevalence ($X^2 = 314.99, p = 0.000$)

It can be concluded that there was a high prevalence of musculoskeletal disorder among undergraduate smartphone users. Neck was the commonest site with 12 months prevalence and there was significant association between types of smartphone and 12 months prevalence.

Introduction

Musculoskeletal (MSK) disorders are the commonest causes of severe long-term pain and physical disability affecting hundreds of millions of people around the world [1]. The importance of musculoskeletal disorder is often underappreciated as they are rarely fatal and assumed to be irreversible and associated with age [2]. Musculoskeletal disorders are defined as muscular pain or injuries to the human support system that can occur after a single event or cumulative trauma, negatively impacting daily activities [3]. Musculoskeletal disorder is extremely common and affects people of all ages, gender, and socio-demographic background in society including young adults [4]. There has been an increase in the occurrence of musculoskeletal disorder especially neck pain, shoulder pain, and low back pain in the young adults' population [5]. Ayanniyi and Udofia reported a lifetime and point prevalence of musculoskeletal injury of 54.50% and 51.7% respectively from a recent study conducted among undergraduates in Nigeria [6]. Ayanniyi *et al.*, reported the prevalence of self-reported musculoskeletal symptoms to be significantly higher in the computer users than the non-computer users [7]. In developed countries there is an association between time of computer use and painful symptoms in the lower limbs and cervical spinal column of adolescents [8].

The latest generation of smartphones are increasingly viewed as handheld computers rather than as phones, due to their powerful on-board computing capability, capacious memories, large screens and open operating systems that encourage application development [9]. The use of smartphone as exponentially increase and has become integral part of our daily lives [10]. Significant concern has been made about smartphone addiction among the university undergraduates [10]. Smartphone embedded with powerful technology that allow continuous interaction with online services which allow users to consume a wide range of content which is not related to their present time and condition [11]. Based on the attractive functions or applications and easy access, smartphone users have become so dependent on such devices or develop the habit of excessively checking their phones without conscious self-control [12].

The current electronic device in use are smartphones, videogames, computers, laptops, and tablets of which smartphones have become the most common means of communication [13]. Smartphone users in Nigeria are growing rapidly to the extent that Nigeria has become one of the fifth growing smartphone markets in the world [14]. Different age groups make use of smartphones with young adults having the greatest proportions of smartphone use compared to all other age groups [15]. A great number of young adults are found in universities and these undergraduates have an unregulated usage and over-dependent attitude on smartphones [16]. Different injury has been attributed to the use of electronic devices and these injuries are termed technological disease [17]. These injuries such as carpal tunnel syndrome are common with people that uses computer mouse that are associated with long term usage in awkward position [17] of which smartphone is not excluded from the trend of technological disease as it indulges usage in any position [17]. Recently, University of Medical Sciences Ondo (UNIMED) has moved to online classes, this has

increased the use of smartphone among students. Therefore, this study aims at determining the prevalence of musculoskeletal disorder among smartphone users across different levels of University of Medical Sciences undergraduates.

Materials and Methods

Respondent

Respondents were undergraduates across all level at UNIMED that were involved in the usage of smartphone

Inclusion Criteria

- i. Respondents who have been using smartphones for not less than one year
- ii. Undergraduates with no history of trauma/injury for the last twelve months.

Exclusion Criteria

- i. Undergraduates that have been rusticated or on leave of absence
- ii. Undergraduates who are involved in rigorous sporting activities that might lead to unnoticed musculoskeletal injury

Site of Study

University of Medical Sciences Ondo Town, Ondo State Nigeria.

Instruments

The following instruments were used for this study;

The Standardized Nordic Questionnaire. Nordic musculoskeletal questionnaire developed by Kuorinka et al [18]. The Nordic musculoskeletal list of questions examined the difference in disorder of musculature in nine different body part: cervical region, pectoral girdle, posterior part of thorax, cubital region and lumbar. Other includes hands, thighs, knees joint and ankles joint. The questions were in three dimensions: First Section: This was designed to examine biodata of respondents. Second Section: This was designed to obtain information on work related musculoskeletal pain. It asked questions like, how did the pain start, duration of pain, effect of the pain on activities in the office, activity that brought the pain and site where the pain is felt and pain intensity using the present pain. The respondent will answer Yes or No to each question.

Smartphone usage questionnaire is a tool developed to ask questions relating to the pattern of smartphone usage. The questionnaire is a two part, 5 item tool. Section A consists of demographic information and section B consists of information relating to the duration of smartphone usage, activities commonly carried out on smartphones [19]. The smartphone is a Likert questionnaire.

Method

Research Design

This research is a cross sectional survey

Sampling Technique

The sampling technique used for this study was convenient sampling technique.

Determination of Sampling Size

The sample size for this study was based on the formula - Yamane formula [20]

$$n = N/1+(Ne^2)$$

N = Population size

e = precision level will be 50% = 0.05

$$n = 922/1+(922 \times 0.05^2)$$

$$n = 922/3.305$$

$$n = 279$$

Procedure

Ethical approval was obtained from the Ethic and Health Research Committee of University of Medical Sciences Ondo Town, Ondo State Nigeria. Permission to carry out the study was obtained from the Registrar and Dean of Students Affairs of the institution. Respondents having met the inclusion criteria gave their informed consent after the purpose and protocol for the study was explained to them. Socio-demographic data and types of phone were documented, smart phone usage and standardized Nordic questionnaire were completed by the respondents. The questionnaires were retrieved as soon as completed.

Data Analysis

Descriptive statistics was used to access the frequency and percentage of respondent. Chi square test of association was used to evaluate the association between prevalence of musculoskeletal pain and smartphone usage, smartphone type and gender. Alpha level was set at < 0.01. Statistical Package for Social Sciences, IBM 23 was used to analyze the data

Results

Socio-demographic Characteristics of Respondents

Table 1 showed sociodemographic characteristics of respondents. The result showed that more than two-third were female (60.9%) and the mean age of respondents was 21.26±2.38 years. The point, seven days and 12 months prevalence were 30.1%, 40.2% and 48.5% respectively

Table 1: Sex Distribution and prevalence of MSK among respondents N=279

Variables	Frequencies	Percentage
Sex		
Male	100	30.1
Female	170	60.9
Prevalence	Yes (n %)	No (n %)
Pain as at the time of survey	84 (30.1)	195(70%)
Pain in any part of the body 7 days ago	112 (40.2)	167 (59.8%)
Pain in any part of the body 12 months ago	135 (48.5%)	144(51.6%)

Types of Smartphones of the Respondents

Considering the types of smart phone by the respondents, infinix was mostly used and LG 1(0.4%), Vivo 1(0.4%) and Xiaomi 1(0.4%) were the least as presented in table 2

Table 2: Types of smartphone of the respondents N=279

Types of Phone	Frequency	%
Andriod	12	4.3
Apple	2	0.7
Hawai	5	1.8
Infinix	72	25.9
Iphone	62	22.2
Itel	16	5.7

LG	1	0.4
Nokia	10	3.6
Oppo	7	2.5
Redmi	7	2.5
Samsung	28	10.0
Tecno	55	19.7
Vivo	1	0.4
Xiaomi	1	0.4

12 Months Ago and 7 Days Prevalence of Musculoskeletal Disorder According to Body Parts

As regards the 12 months and seven days prevalence, neck (50.1%) was the most painful body part followed by both hips (37.7%), whereas for seven days, low back 22.3 % was most prevalent followed by the right shoulder (20.1%) as presented in Table 3.

Table 3: 12 months and 7 days prevalence of musculoskeletal disorder according to body parts N=279

Variable	12 Months Frequency(%)		7days Frequency(%)	
	Yes (%)	No(%)	Yes(%)	No(%)
Neck	140 (50.1)	139(49.8)	45(16.1)	234(83.9)
Right shoulder	50 (17.9)	229(82.1)	56 (20.1)	223(80.0)
Left shoulder	18 (6.5)	261(93.6)	30 (10.8)	249(89.2)
Both shoulder	31 (11.1)	248(88.9)	11 (3.9)	268(96.0)
Right elbow	15 (5.4)	264(94.6)	10(3.6)	269(96.5)
Left elbow	6 (2.2)	273(97.8)	12 (4.3)	267(95.7)
Both elbows	12 (4.3)	267(95.7)	5 (1.8)	274(98.2)
Right wrist/hand	45 (16.1)	234(83.9)	2(0.7)	277(99.3)
Left wrist/hand	15 (5.4)	264(94.6)	30(10.7)	249(89.3)
Both wrist/hand	18 (6.5)	261(93.6)	14(5.0)	265(95.0)
Upper back	18 (6.5)	261(93.6)	41(14.7)	238(85.3)
Lower back	78 (28.0)	201(72.1)	62(22.3)	217(77.8)
One/both hips/thigh/buttocks	105(37.7)	174(62.4)	40(14.4)	239(85.7)
One or both knees	52(18.6)	227(81.4)	24(8.6)	255(91.4)
One or both ankles/feet	39 (14.0)	240(86.1)	26(9.3)	253(90.7)

The prevention of activities due to pain was presented in Table 4. From the result lower back 34(12.2%) mostly restricted respondents from carrying out activities followed by the wrist 27(9.7 %).

Table 4: Pain characteristics of respondents N=279

Variable	Frequency	
	Yes(%)	No(%)
Prevented from carrying out activities due to pain		
Neck	27(9.6)	252(90.3)
Shoulders (both/either)	23(8.2)	256(91.7)
Elbow (both/either)	9 (3.2)	270(96.8)
wrist/hand (both/either)	27(9.7)	252(90.3)
Upper back	21(7.5)	258(92.5)
Lower back	34(12.2)	245(87.8)
hips/thigh/buttocks	19(6.8)	260(93.2)
Knees	22(7.9)	257(92.1)
ankles/feet	23(8.3)	256(91.8)

Association Between Type of Smartphone Usage and Pain at any Part of the Body 12 Months Ago

From the result, there was a significant association between type of smartphone and 12 months prevalent (X2 =314.984, P<0.01) with infinix reporting the highest

Table 5: Association between type of smartphone usage among respondents and pain in the body 12 months ago

Variable	12 months Prevalent		X2	p-value
	Yes	No		
Variable	Yes	No		
Andriod	6	6		
Apple	1	1		
Huawai	4	1		
Infinix	31	41		
Iphone	24	38		
Itel	9	7		
LG	1	0		
Nokia	6	4	314.984	0.000*
Oppo	4	3		
Redmi	1	6		
Samsung	20	8		
Tecno	27	28		
Vivo	0	1		
Xiaomi	1	0		

Types of smartphone of the respondents N=279

Association Between Causes of Pain and Pain at any Part of the Body 12 Months Ago

From the result, there was significant association between perceived causes of pain and 12 months prevalent $X^2 = 503.185$, $P < 0.01$).

Table 6: Association between causes of pain and pain at any part of the body of the respondents 12 months prevalent

Variable	12 months Prevalent		X 2	p-value
	Yes	No		
Abnormal walking	1	0		
Akward posture	16	18		
House working	1	0		
Nil	38	64		
Overstress	1	0		
Prolonged standing	3	4	503.185	0.000*
Stress	39	44		
Trauma	18	12		
Ulcer	3	0		
Wrong sleeping posture	0	2		

KEY * = Significant at $P < 0.01$

Discussion

The study investigated the point, 7 days and 12 month prevalence of musculoskeletal pain among undergraduate smartphone users and investigated the association between prevalence and type of smartphone. The age range of respondents of this study was below 30 years which was in agreement with the previous study carried out among undergraduates by Kim and Kim, [21,22]. This could be the fact that the minimum age of entry into university is 16 years due to the fact that majority of people now starts their academy journey especially the kindergartens on time [23]. From this study, it was observed that the number of infinix users were more than other smartphone users. This could be because infinix is affordable and accessible compare to other smartphones, again infinix may possess space and capacity which makes it youth friendly more than some other phones. Amidst the respondents, the point prevalence was more than one third which indicated that one out of three undergraduates has musculoskeletal pain resulting from the smart phone usage as at the time of the study, It could be amazing that one of every two undergraduates had a complaint of body pain resulting over a period of one year from smart phone usage at the University of Medical Sciences, Ondo as at the time of this study. Studies reported that the frequent use of smartphone has forces the users to adopt an awkward posture leading to an increased risk of musculoskeletal disorders and pain [24]. The rates of postural abnormalities while using smartphones affecting head, shoulders, knees, and feet alignments were

17.5%, 29%, 18.5%, and 34.2% respectively [19]. In a study by Odole et al, it was documented that 73.5% respondents used their smartphones between 0 to 10 hours on a typical day for reading/studying, 100% used phone for calls, 100% for texting/chatting, and 99.8%, for accessing the internet [19].

Within the last 12 months, the respondents reported that the body part most affected by musculoskeletal disorder was the neck followed one or both hips/thigh/buttocks and lower back.

Meanwhile the last 7 days most musculoskeletal pain was reported to be experienced at the lower back. This is similar to the study carried out by Odole et al., where the female respondents reported the body part affected over a period of 12 month was the neck followed by the lower back [19]. One of the causes of musculoskeletal pain is related to sedentary and repetitive movements which are considered as the major risk factors for musculoskeletal disorder [25-28]. It is confirmed that continually working on smartphones for performing and accomplishing a task in sitting and sedentary position is considered as one of the risk factors for the incidence of musculoskeletal disorder [29]. Musculoskeletal disorder outcome range from symptoms to substantial impairment losses [30], including decreased quality of life [31], decreased productivity and increased medical expenses owing to disability [32]. When smartphones are constantly used at home without any rest and a poor posture is maintained over a long period of time musculoskeletal pain can occur. According to studies by Bendix *et al.*[1,33] the longer that display terminals are used, the more the bending angles of the neck bone and waist bone are increased.

Considering the posture when using smartphone, an individuals will hold phone with one hand and use the other hand to manipulate the phone below the eye level which necessitated looking down and using the finger to touch the screen [9]. This position will enforce adoption of an awkward posture of continuous forward flexion by the user [33-35] The prolonged and frequent use of smartphones, as well as the repeated movement of the upper extremities in an awkward posture, have been shown to be the main contributing factors to the incidence of musculoskeletal symptoms [33-35].

In this study there was significant association between the prevalence of musculoskeletal pain and type of smartphone. What this implies is that the rate of experience of musculoskeletal disorder is informed by the type of smartphone. The determinants of smartphones could be factor of predisposing one to musculoskeletal pain, these includes; brand name, performance, aesthetic value, product design, product price, perceived brand value. Smartphone with high performance tends to accumulate more applications on the smartphone causing one to be doing lot of activities on the smartphone for a prolonged time predisposing them to musculoskeletal pain. Also the brand name of the smartphone is a factor in the sense that a smartphone with a good brand name causes one to purchase the smartphone and making them obsess with the usage of smartphone which eventually predispose them to musculoskeletal pain.

Conclusion

This study has shown that there was a high prevalence of musculoskeletal disorder among undergraduate smartphone users. Neck was the commonest site with 12 months prevalence and there was significant association between types of smartphone and 12 months prevalence.

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