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Assessment of awareness of possible health effects of radiation emitted by mobile phones among University of Nigeria Enugu campus students

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ABSTRACT

Objective. To assess the awareness of University of Nigeria Enugu Campus (UNEC) students on the radiation emitted by mobile phones and the possible health effects of the emitted radiation.

Methods. A cross-sectional study of UNEC students was conducted from April to July 2017. Participants were recruited through a convenient sampling technique. A quantitative questionnaire comprising three sections was used to collect data from participants in the following five faculties of UNEC: Health Sciences and Technology; Medical Sciences; Environmental Sciences; Business Administration; and Law.

Results. Three hundred and sixty (n=360 students) participated in the study: males (n=172/47.8%) and females (n=188/52.2%). Three hundred and thirty-eight (94%) were aware that mobile phones emit some form of radiation. Furthermore, 320 students (88.9%) were aware that the emitted radiation from mobile phones may have some harmful effects. All (n=212/100%) participants in the first three faculties stated that they were aware of the negative effects of using mobile phones. Sixty-three of the 75 participants (84%) from the Business Administration faculty, and sixty of 73 participants (82.24%) from the Law faculty, stated that they were aware of the negative effects of using mobile phones.

Conclusion. The awareness level of mobile phone radiation,, and its possible health effects among UNEC students, is high. Students from science-oriented faculties were better informed on the subject matter than those from arts and business-oriented faculties.

Keywords radiation, microwave, radiofrequency

LAY ABSTRACT

Students' knowledge on the possible harmful effects of mobile phones was investigated. Most were aware of some harmful effects.

INTRODUCTION

A mobile phone (cellphone) is a long-range, electronic device used for mobile voice or data communication over a network of specialised base stations known as cell sites.[1] Mobile phones have a standard voice function. The more modern ones support services like text messaging, gaming, Bluetooth, infra-red, e-mail, packet switching, camera, video recording, general packet radio service (GPRS), multimedia messaging service (MMS), moving picture experts group layer-3 (MP3) player and radio. There are two types of mobile phones: analog (analogue) and digital. Their basic differences are their ability in translating audio or video signals, and their sound quality. Analog phones use technology that translates audio or video signals into electronic pulses. Digital phones use technology that translates audio or video signals into binary code. The former have a substantially higher sound quality and the latter have a slightly clearer sound.[2] In a cross-sectional study by Sandstrom et al[3] in both types of phones, low-risk warmth was observed behind and around the ear.

Mobile phones give off a form of energy known as radiofrequency (RF) waves. They function by sending signals to nearby base stations or cell towers using radiofrequency waves. At very high levels, RF waves heat up body tissues. The levels of energy given off by mobile phones are much lower and are not enough to raise temperatures in the body.[1] Radiofrequency waves from mobile phones come from the antenna of the phones. These waves are strongest at the antenna and lose energy quickly as they travel away from the phone. Usually a phone is held against the side of the head when in use. The closer the antenna is to the head, the greater a person's exposure to RF energy. Symptoms like headaches, dizziness, memory problems, sleep problems, irregular heartbeats, ringing in the ears are mostly experienced by people that make extensive use of mobile phones.[4]

The world has experienced a very rapid increase in mobile phones use over the past few decades. Similarly, the use of mobile phones in Nigeria has increased over the past few years with the total number of mobile phone subscribers reaching 149 million as at April 2017.[5]

With the growth in mobile phones use, there has been an inevitable increase in the possible health effects associated with exposure to radiation emanating from mobile phones.[6] The argument regarding electromagnetic radiation and health started in the 1930s and has been ongoing till now. Scientists postulated that high frequency electromagnetic fields are likely to cause health problems. Frey[7] in 1975 carried out the first recorded study showing the relationship between wireless technology, electromagnetic radiation and health problems. Since then, the impact of radiation emitted by mobile phones is still being researched. Hermann[8] reported that the radiation emitted by mobile phones could cause changes in the blood-brain barrier, electroencephalographic activity and blood pressure. Maier[4] carried out a study on the health hazards associated with the use of mobile phones and reported that the radiation emitted by mobile phones might induce cancer. The symptoms associated with their use include sleep disturbance, memory problems, headache, nausea and dizziness.

The International Commission on Non-Ionising Radiation Protection[9] state that high frequency field emitted by mobile phones has the ability to penetrate into the body and to cause a temperature rise in the body tissue; this temperature rise can provoke serious health effects such as heatstroke and tissue damage. The World Health Organisation[10] published a report on the effects of mobile phones on people's health. According to their report mobile phones emit non-ionising radiation in the form of RF and microwave parts of the electromagnetic spectrum. However, in terms of their report, the evidence available does not provide a clear pattern to support an association between exposure to radio frequency and microwave radiation from mobile phones and direct effects on health.[10]

Most studies carried out on the health effects of mobile phones showed weak impacts of mobile phones use on the health. Mobile phones are a relatively new technology therefore their long-term effects have not been evaluated. In view of this there is a need for the government to implement standard policies and strategic planning so as to reduce people's concerns and provide suitable solutions for high-risk people.[11] The objectives of this study were to assess the awareness of University of Nigeria Enugu Campus (UNEC) students on the radiation emitted by mobile phones and the associated health effects, to ascertain whether any correlation exists between the students' faculty and awareness, to determine if there is a correlation between the students' year of study and awareness; and to find out the safety measures practiced to minimise the unwanted effects of mobile phones.

MATERIALS AND METHODS

Participation in this cross-sectional study was voluntary and all were informed that their right to confidentiality and privacy would be adhered to. Ethics approval to carry out the study was obtained from University of Nigeria Enugu Campus (UNEC). Postgraduate students and students with visual impairments were excluded. Four hundred (n=400) undergraduate students in five faculties, namely, Health Sciences, Medical Sciences, Environmental Sciences, Business Administration and Law, were invited to participate. A questionnaire, which was based on the one by Kumar et al[1] was adapted for the study.

Closed questions were used to obtain the following demographic data: gender, age, level of study, faculty and department. The measuring tool tested the awareness level of the possible health effects of radiation emitted by mobile phones. This required the participants to rate their level of awareness on a 5-point Likert scale: 1 = strongly disagree (SD) to 5 = strongly agree (SA).

Statistical analysis was done using Statistical Package for Social Sciences (Windows Version 23; SPSS Inc., Chicago, USA). Descriptive statistics of mean, frequency and percentages were used in the analysis of data. Pearson's correlation was used to ascertain the correlation of faculty and year of study with level of awareness. Statistical significance was considered at $p < 0.05$.

RESULTS

A total of 400 questionnaires were distributed and 360 were returned giving a response rate of 90% (n=400/n=360). Table 1 summarises the demographic characteristics of the 360 participants. There were 172 males (47.8%) and 188 females (52.2%). There were 73 from the faculty of Health Sciences, 69 from the faculty of Medical Sciences, 70 from the faculty of Environmental Sciences, 75 from the

Table 1. Demographic distribution of respondents (n = 360)

GENDER	FREQUENCY	%
Male	172	47.8
Female	188	52.2
AGE		
16-20 years	181	51
21-25 years	131	36
26-30 years	29	8
31-35 years	19	5
35 years and above	--	--
YEAR OF STUDY		
1st year	71	19.7
2nd year	72	20
3rd year	74	20.6
4th year	75	20.8
5th year	56	15.6
6th year	12	3.3
FACULTY		
Health Sciences	73	20.3
Medical Sciences	69	19.2
Environmental Sciences	70	19.4
Business Administration	75	20.8
Law	73	20.3

Table 2. Distribution of the respondents based on awareness of emission of radiation from mobile phones

Faculty	Awareness of Emission of Radiation from Mobile phones				Total
	Yes		No		
	Frequency	%	Frequency	%	
Health Sciences	73	100	-	-	73
Medical Sciences	69	100	-	-	69
Environmental Sciences	70	100	-	-	70
Business Administration	66	88	9	12	75
Law	60	82	13	18	73
TOTAL	**338**	**94**	**22**	**6**	**360**

Table 3. List of health effects that could be experienced as result of using mobile phones and the responses

Possible Health Effects of Using a Mobile phone	Strongly Agree (5)	Agree (4)	Undecided (3)	Disagree (2)	Strongly Disagree (1)	MEAN
Cancer	98	154	37	12	59	3.6
Over-heating of organs	68	144	42	30	76	3.3
Dizziness	51	164	88	27	30	3.5
Headaches	161	96	60	20	23	4.0
Mutation of genes	62	102	79	44	73	3.1
Slight heat	100	173	49	-	38	3.8
Infertility	26	146	75	26	87	3.0
Pimples	63	50	93	100	54	2.9
Ear ache	52	157	21	104	26	3.3
Reactive waves	123	115	66	31	25	3.8
Vasodilatation of blood vessels near the ear	66	174	36	40	44	3.5
Mental retardation	62	88	102	48	60	3.1
Nausea	46	106	81	53	74	2.9
Impotence in men	57	120	100	41	42	3.3
Prostrate carcinoma	56	115	79	51	59	3.2
GRAND MEAN	**1091**	**1904**	**1008**	**627**	**770**	**3.4**

faculty of Business Administration, and 73 from the Law faculty.

Table 2 shows the distribution of the participants based on their awareness of radiation emission from mobile phones. All (n=212) from the faculties of Health Sciences, Medical Sciences, and Environmental Sciences stated that they were aware of radiation emission from mobile phones. Sixty-six out of 75 (88%) in the faculty of Business Administration, and 60 out of 73 (82%) in the Law faculty stated that they were aware of the emission of radiation from mobile phones.

Table 3 shows a list of effects that could be experienced while using mobile phones and the various responses. The list of effects was adapted mainly from the works of Kumar et al[1] and Maier.[4] The most predominant effect experienced was headache followed by slight heat and reactive waves.

Table 4 provides Pearson's correlation of awareness with faculty and year of study of the participants. There was a significant correlation between awareness with faculty and year of study.

Table 5 shows a list of safety measures that could be adopted to reduce the health effects of mobile phone radiation. The list of safety measures was adopted from the work by Kumar et al.[1] Of the 360 participants only 86 (23.9%) practiced some safety measures. The rest (n=274/76.1%) did not practice any safety measures.

DISCUSSION

The majority (n=338/94%) of participants were aware that mobile phones emit some form of radiation; 22 (6%) were not aware. The level of awareness of the possible health effects of phone radiation was 3.4: this shows that the participants had significant knowledge of such possible health effects and were able to identify them. The majority indicated that they did experience headache, dizziness and heating up of the side in contact with the phone after extensive usage of mobile phones. This is in line with the findings of Chia et al[12] as a significant number of their respondents were aware of the health effects of mobile phone radiation with a good number of them experiencing headache, dizziness and heating.

In the present study, the majority of participants stated that cancer is one of the health effects of using mobile phones. This is not in keeping with the literature

Table 4. Pearson's correlation of awareness with faculty and year of study

Variable	p-value
Faculty	0.026 (significant)
Year of study	0.020 (significant)

$p < 0.05$ (Any p-value less than 0.05 was used as a criterion of statistical significance).
This means that there is a statistically significant correlation between faculty and awareness.
Also, there is a statistically significant correlation between year of study and awareness.

Table 5. List of safety measures that could be adopted to reduce the health effects of mobile phone radiation and the responses

Safety Measures	Response	
	Frequency	%
Use of ear piece	19	22.1
Headphone	10	11.6
Not pressing phone while charging	21	24.5
Reducing the number of minutes spent on calls	10	11.6
Keeping phones away from bed heads while sleeping	10	11.6
All of the above	16	18.6
TOTAL	**86**	**100**

as Poulsen et al[13] state that little evidence of skin cancer risk was observed among mobile phone users. Most of the participants in the current stated that slight heat on and around the ear, over-heating of organs and headache are health effects of mobile phone use. This is in line with a study by Sandstrom et al[14] which noted low-risk warmth behind and around the ear, headache and fatigue among mobile phone users. Oftedal et al[15] also noted sensations of warmth on/around the ear and burning sensations in the facial skin. Soderqvist et al[16] in their study noted the experience of burning sensation and skin rash as a result of mobile phone use.

In terms of this study it was deemed necessary to ascertain whether the level of awareness could be linked to the years spent in the course of training. In this study there was a correlation (p=0.020) between the awareness level and the year of study of the participants. This finding is in agreement with work done of Martha and Griffet.[17] They found that the level of academic study/education has an impact on awareness level. Level of education has a significant importance on the duration of calls and the way mobile phones are generally used.

There was also a need to find out whether there was a relationship between the students' faculty and their level of awareness. From this study, there was a correlation (p=0.026) between the students' faculty and their level of awareness of health effects of mobile phone radiation.

The unwanted effects of mobile phone radiation may be thermal or non-thermal.[18] These unwanted effects can be minimised by the application of some safety measures. In this study, 86 (23.9%) of the participants adopted some safety measures; 274 (76.1%) did not adopt any safety measure to reduce the effects of mobile phone radiation. This implies that the majority did not practice any safety measure. They were however aware of the possible health effects of radiation emitted by mobile phones. The measures adopted by the 23.9% were the use of an earpiece, headphones, abstaining from pressing of phones while charging, reduction of daily call duration and keeping the phone at a distance from the bed while sleeping. This finding is in keeping with the work of Abubakar et al.[19]

LIMITATIONS OF THE STUDY

In the course of data collection, some students declined participating in the study. Some that did agree to participate did not return their questionnaire or returned incomplete questionnaires. Such questionnaires were therefore not used in the study. Also, the benchmarking of lists of effects and preventative measures was a limitation in this study.

CONCLUSION

The level of awareness of the possible health effects of radiation emitted by mobile phones among UNEC students is high. The awareness of the participants in the science-oriented faculties was higher than their peers in the arts-oriented faculties. The most predominant reported health effect, after extensive use of mobile phones, was headache. The main safety measure adopted was abstaining from pressing phones while charging.

DECLARATION OF CONFLICT OF INTERESTS

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CONTRIBUTION BY THE AUTHORS

MBU (University of Nigeria Enugu Campus) was the main researcher and drafted the manuscript; AA (University of Nigeria Enugu Campus) assisted in drafting the manuscript. AEO (University of Nigeria Enugu Campus) provided critical comments and recommendations regarding the literature review; OS (University of Nigeria Enugu Campus) assisted with interpretation of the results. UCN (University of Nigeria Enugu Campus) was responsible for data capturing; UEC (University of Nigeria Enugu Campus) was responsible for presentation of results.

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