



**Keywords**

Electromagnetic Wave,  
Mobile Phone,  
Possible Hazards,  
Human Health

Received: March 19, 2017

Accepted: August 30, 2017

Published: October 17, 2017

# Awareness of the Possible Hazards of Electromagnetic Waves Radiation among Mobile Phone Users in Bosso, Niger State, Nigeria

Owodunni Ayanda Samuel<sup>\*</sup>, Raymond Emmanuel,  
Ekele Ojonugwa Abraham

Department of Industrial and Technology Education, Federal University of Technology Minna,  
Nigeria

**Email address**

owoscosam@yahoo.com (O. A. Samuel), s.owodunni@futminna.edu.ng (O. A. Samuel)

<sup>\*</sup>Corresponding author

**Citation**

Owodunni Ayanda Samuel, Raymond Emmanuel, Ekele Ojonugwa Abraham. Awareness of the Possible Hazards of Electromagnetic Waves Radiation among Mobile Phone Users in Bosso, Niger State, Nigeria. *Engineering and Technology*. Vol. 4, No. 5, 2017, pp. 65-69.

**Abstract**

The dramatic increase in the number of mobile phones users raise significant concerns due to its possible negative effects on people exposed to radio waves radiating from the cell phones. Since mobile phones are used in positions very close to the human body and require a large number of base station antennas, the public and the scientists have raised a lot of questions on the possible health hazards these phones. This study therefore investigated the awareness of health hazards of using mobile phones in Bosso Metropolis, Niger State. The study was descriptive in nature. The sample size was 355. A structured questionnaire containing 24 items was used for data collection. Data collected were analyzed using mean and Standard Deviation. The findings of the study revealed that mobile phone users in Bosso metropolis are not aware of most possible health hazard of electromagnetic waves radiated from mobile phones. In addition, the findings also revealed that the participants were not aware of ways of reducing these possible effects of the electromagnetic waves radiated from mobile phones. Conclusion was drawn and recommendations made among which are that efforts should be made by government, stakeholders in communication and health to improve and standardize the varying level of knowledge in Bosso Metropolis on the possible health risk of mobile phones and to ensure that users are informed accurately.

## 1. Introduction

Mobile phones are common communication medium in the world today. About 31% of the global population uses mobile phones and the diffusion of the mobile phone was among the fastest of any technology in history [1, 2]. In 2005, Gartner pointed out that mobile phone sales will exceed one billion in 2009 [3]. Such a rapidly evolving and wide spread communication technology and medium has important social contexts and implications. Mobile phones use electromagnetic radiation in the microwave range of 450–2100 MHz and the effect of this radiation on human health is a subject of interest and study worldwide, as a result of the enormous increase in mobile phone usage throughout the world. The increasing number of telecommunication devices available and length of time spent using mobile telephones has also aroused interest of possible interactions between human and radiofrequency radiations [4]. The study of Schörnborn

*et al.* showed that the adult human head absorbs 80% of the radiation emitted by a cellular telephone [5].

Several other studies have indicated that EMF emitted from mobile phone could affect human health [6; 7; 8; 9; 10; 11; 12; 13]. However, some studies have reported contradictory results regarding potential effects of electromagnetic fields (EMF) of digital mobile phone on the human health [14; 15]. In 2011, International Agency for Research on Cancer (IARC) classified mobile phone radiation as Group 2B – possibly carcinogenic (not Group 2A – probably carcinogenic – nor the dangerous Group 1). That means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted. The WHO pointed out in June 1998 that "to date, no adverse health effects have been established as being caused by mobile phone use", a point was reiterated in October 2001 [16; 17; 18].

Epidemiological studies carried out by Harvard center for cancer prevention in 2006 as well as International Commission on Radiological Protection in 2009 have mixed results as some have shown no statistically significant association between exposure to Electromagnetic Field (EMF) and health effects, and some have shown a weak association. More recently, laboratory studies have failed to show such an association, or to establish a biological mechanism for how magnetic fields may cause cancer. A number of scientific panels convened by national and international health agencies and the U.S. Congress have reviewed the research carried out to date. Most concluded that there is insufficient evidence to prove an association between EMF and health effects; however, many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe.

With the advent of internet access through mobile phones, and with the several other options of communication that mobile phones offer, users who enter in a more extrovert period of their lives might prioritize these communication opportunities more than their health [19]. Therefore it is crucial to be aware of health hazard involved in the usage. The W.H.O EMF Project believe that there is no direct evidence of hazardous effects on human health incurred by low level radiofrequency but there is much public concern about the issues surrounding the effects of electromagnetic fields on health, in particular, the possible health effects of mobile telephones. It is in this regard that this study sought to found out the awareness level of mobile phone users on the possible health hazards of electromagnetic waves radiated from mobile phones in Bosso Metropolis of Niger State, Nigeria.

#### a. Significance of the Study

Full implementation of this study will be of enormous benefits to telecommunication companies, the government, prospective researchers and mobile phone users. The study will enable stakeholders in telecommunication industries to be aware of the perceptions of mobile phone users on the possible negative effects of electromagnetic waves on human health and take appropriate steps to educate them on how to

prevent it or reduce it to the barest minimum

It is hope that the study will be of great benefit to the government in offering model legislation to protect mobile phone users against electromagnetic exposure and also to the ministry of health in providing unique data base of electromagnetic wave exposure standard as well as promoting high level of health protection to the public. The mobile phone users will be adequately informed on the likely or possible health hazard of electromagnetic waves radiated from mobile phones.

#### b. Research Questions

The following research questions were answered by this study.

What is the level of awareness of mobile phone users on the potential negative effects of electromagnetic waves on human health?

What is the level of awareness of mobile phone users on the ways of reducing the potential negative effects of electromagnetic waves on human health as perceived by mobile phone users?

## 2. Methodology

This study was a descriptive survey research design which involves the use of questionnaire in determining the opinion of respondents. The population for this study was all mobile phone users in Bosso Metropolis, Niger State. The researchers used convenience and purposive sampling methods to draw a sample size of 355 (181 males and 174 females) from the population. Purposive and Convenient sampling methods were used to select respondents who are convenient to the researchers. Respondents who are conveniently accessible geographically were selected. This enabled the researchers to easily, quickly and economically obtain data from the potential respondents. This method was used in distributing questionnaire to the targeted population. Purposive sampling is a theoretical method of getting information from a sample of the population that one thinks knows most about the subject matter [20]. The instrument used for collection of data was structured questionnaire titled 'Awareness of mobile phone users on the negative effects of electromagnetic waves on human health'. The questionnaire consist of two parts. Parts 1 of the questionnaire contain personal data of the respondent and a guide on how to respond to the questionnaires. While part 2 is divided into two subsections A and B, Section A contains 11 items which deals with the awareness of mobile phone users on the negative effects of electromagnetic waves on human health and section B contains 13 items which deals with ways of reducing the negative effects of electromagnetic waves on human health. All the items were responded to using the following rating scales; Highly Aware (HA) = 4 points, Aware (A) =3 points, Slightly Aware (SA) = 2 points, Unaware (UA) =1 point. The researchers administered the instrument to the respondents personally by visiting all the major areas in Bosso. The data

collected for this study were analyzed by using mean and Standard Deviation. In order to determine the acceptance level of the items of the research questions, the mean ratings of respondents were interpreted using real limits of numbers. The detail is as follows.

Highly Aware (4)	3.50-4.49
Aware (3)	2.50-3.49
Slightly Aware (2)	1.50-2.49
Unaware (1)	0.50-1.49

### 3. Results

**Table 1.** Mean responses of mobile phones users on the level of awareness of mobile phone users on the possible adverse effects of electromagnetic waves radiated from mobile phones on human health.

N = 355

S/N	Item statement	Mean	Standard Deviation	Remarks
1	Long Exposure to electromagnetic radiation from mobile phone usage causes Cancer.	3.71	0.44	Highly Aware
2	Fatigue/ weakness are possible effects of exposure to electromagnetic radiation from mobile phone.	1.04	0.67	Unaware
3	Electromagnetic radiation from mobile phone can lead to Diarrhoea.	1.28	0.85	Unaware
4	Heart Problems (pain/pressure, palpitations) are caused exposure to electromagnetic waves from mobile phone.	2.42	0.72	Slightly Aware
5	Memory Problems associated with electromagnetic radiation from mobile phone.	1.30	0.69	Unaware
6	Mobile phone electromagnetic radiation can lead to Headache.	1.36	0.86	Unaware
7	Loss of mental attention can result from exposure to electromagnetic waves from mobile phone.	1.74	0.56	Slightly Aware
8	Exposure to mobile phone electromagnetic radiation can result to Dizziness.	1.40	0.78	Unaware
9	Sleep disturbance is associated with exposure to mobile phone electromagnetic radiation.	1.68	0.69	Slightly Aware
10	Mood Issues (depression, anxiety, and irritability) can occur due to exposure to electromagnetic wave from mobile phone radiation.	1.47	0.67	Unaware
11	Exposure to electromagnetic waves from mobile phone radiation can result to infertility problem	2.71	0.75	Aware

Key: N = Number of the respondents.

The result in table 1 shows that the respondents are highly aware of item 1 which the mean value falls between 3.50 and 4.49, aware of item 11 which their mean values fall between 2.50 and 3.49, slightly aware of items 4, 7 and 9 which their mean values fall within 1.50 and 2.49. In addition, the respondents are unaware of items 2, 3, 5, 6, 8 and 10 which their mean values fall within 0.5 and 1.49 as possible negative effect of electromagnetic waves radiated from mobile phones on human health. Lastly, the standard deviation of the respondents ranges from 0.44 to 0.86, indicating that their responses are not far from the mean and from each other.

**Table 2.** Mean responses mobile phones users on ways of reducing the negative effects of electromagnetic waves radiated from mobile phones on human health.

N = 355

S/N	Item statement	Mean	Standard Deviation	Remarks
1.	Use Air Tube earpiece/Bluetooth earpiece or the speaker function, When using the mobile phone	3.01	0.51	Aware
2.	Turn off WIFI and 3G/4G Data connection on your smartphone when not in use	2.32	0.56	Slightly Aware
3.	Unplug the mobile phone from the power, when not in use	3.57	0.65	Highly Aware
4.	Don not stay long in place in which there is a lot of EMR.	3.08	0.57	Aware
5.	Put hand phone away from body	2.65	0.45	Aware
6.	Use a belt holster designed to shield the body from radiation.	3.04	0.36	Aware
7.	Avoid using a mobile phone in a moving car, train, bus, or in rural areas at some distance from a cell tower	1.30	0.34	Unaware
8.	Do not sleep with a cellphone beneath their pillow or keep it bedside.	3.97	0.66	Highly Aware
9.	Switch off mobile phone when not in use	3.26	0.42	Aware
10.	Stay away from people who use mobile phones, when they use them	2.72	0.60	Aware
11.	Do not carry mobile phones in pockets or in shirts or bras	2.94	0.69	Aware
12	Always use public phone	1.48	0.55	Unaware
13	Don't use mobile phone frequently	2.35	0.77	Slightly Aware

Key: N = Number of the respondents

The result in table 2 shows that the respondents are highly aware of items 2 and 8 which their mean values fall between 3.50 and 4.49, aware of items 1, 4, 5, 6, 9, 10 and 11 which their mean values fall between 2.50 and 3.49, slightly aware

of items 2 and 13 which their mean values fall within 1.50 and 2.49. Lastly, the respondents are unaware of items 7 and 12 which their mean values fall within 0.5 and 1.49 as ways of reducing the possible negative effects of electromagnetic

waves radiated from mobile phones on human health. The standard deviation of the respondents ranges from 0.34 to 0.77, indicating that their responses are not far from the mean and from each other.

#### 4. Discussion of Findings

Awareness was high on long exposure to electromagnetic radiation from mobile phone usage can possibly causes Cancer and infertility problem. The mobile phone users in Bosso are slightly aware that health problems, loss of mental attention and sleep disturbance can result from exposure to electromagnetic waves from mobile phone. However, the mobile phone users are unaware that fatigue/weakness, diarrhea, headache, memory problems and dizziness are associated with expose to electromagnetic waves radiated from mobile phones. This finding is in line with the findings of [21] who conducted a study on awareness of mobile phone hazards among university students in a Malaysian medical school and discovered that fatigue, sleep disturbance, dizziness, loss of mental attention, memory loss, headache, tachycardia, diarrhea and constipation are hazardous effects associated with mobile phones. [22] pointed out that there is concern that microwaves might induce or promote cancer, and the symptoms associated with their use include sleep disturbance, memory problems, headaches, nausea, and dizziness. In a similar vein, [23] noted that changes in the permeability of the blood-brain barrier, electroencephalographic activity, and blood pressure have also been reported. However, the study conducted by International Agency for Research on Cancer (IARC) in 2011 classified mobile phone radiation as Group 2B – possibly carcinogenic (not Group 2A – probably carcinogenic – nor the dangerous Group 1). It means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted. In 2001 also, WHO reported that there is no direct evidence of hazardous effects on human health incurred by low-frequency radiofrequency [18]. Another preliminary study published in 2011 by The Journal of the American Medical Association conducted using fluorodeoxyglucose injections and positron emission tomography concluded that exposure to radiofrequency signal waves within parts of the brain closest to the cell phone antenna resulted in increased levels of glucose metabolism, but the clinical significance of this finding is unknown. [24] also conducted an epidemiological study that suggested that regular use of a mobile phone over a decade or more was associated with an increased risk of acoustic neuroma, a type of benign brain tumor. The increase was not noted in those who had used phones for fewer than 10 years.

In research question two, awareness was at the highest with unplug the phone when not in use, and do not sleep with a cellphone beneath their pillow or keep it at the bedside. The mobile phone users in Bosso are aware that use of earpiece or the speaker function, putting mobile phone away from body, using belt holster designed to shield the body from radiation,

switch off mobile phone when not in use, stay away from people who use mobile phones, when they use them and not carrying mobile phones in pockets or in shirts or bras can reduce the potential negative effects of the electromagnetic waves from the mobile phones. At the same time the mobile phone users are not aware that avoid using a mobile phone in a moving car, train, bus, or in rural areas at some distance from a cell tower and constant use of public phone can reduced the risk associated using mobile phones. This finding agrees with the suggestion made by [21] that use of infrared, putting hand phone away from body, use loud speaker mode, switch off when not use, use of earphones and constant use of public phones can reduce the hazard associated with using mobile phone. [11] also asserted that electromagnetic waves have adverse effect, but the effect can be reduced to the barest minimum when necessary precautions are taken in to consideration when using the devices that radiate or use the waves.

#### 5. Conclusion

The Awareness of mobile phone hazards among Bosso was found to be too low as most of users were not aware of the health hazard of electromagnetic waves radiated by the phones. An understanding of the awareness of mobile phone users might aid in developing more effective risk communication to groups in Bosso and Nigeria in general. While debates on the health consequences of RFR continue, it would be cautious to approach this issue with a preventive perspective. However, these likely effects can be reduced to the barest minimum by observing the rules and regulations guiding the use of mobile phones.

#### Recommendations

In line with the findings of the study, the following recommendations are made:

1. Efforts should be made by government, stakeholders in communication and health to improve and standardize the varying level of knowledge in Bosso on the possible health risk of mobile phones and to ensure that users are informed accurately.
2. Health education on the correct use of this technology should include appropriate messages.
3. Documents including standard recommendations on ways of reducing the health hazard of mobile phones could be prepared by experts assigned by the government and used for enlightenment campaign
4. Except for emergencies, children and pregnant women should reduce the frequency of using cell phone
5. Limit conversations on mobile phones as much as possible, as there is no protection that is adequate enough.
6. Limit cell phone use while driving, during driving the phone goes to maximum power to connect with base stations in order for the signals to pass through the car, especially if the signal must reach the antenna on your cell phone.

## References

- the NRPB.
- [1] Motorola (2006). Towards the next billion subscribers: Motorola delivers on seamless mobility vision.
- [2] Townsend, A. M. (2002). Mobile communications in the twenty - first century city. In B. Brown, N. Green and R. Harper (eds.), *Wireless World: Social and Interactional Aspects of the Mobile Age*, (2002), 62–77, Springer.
- [3] Gartner Press Release (2005). Gartner Says Mobile Phone Sales Will Exceed One Billion in 2009.
- [4] Hyland, G. J. (2000), Physics and biology of mobile telephony, *Lancet*, 356, 1833–1836.
- [5] Schömborn, F., Buckhardt, M. & Kuster, N. (1998), Differences in energy absorption heads of adults and children in the near of field sources, *Health Phys.*, 74, 160–16.
- [6] Hamblin, D. L., Wood, A. W. (2002). Effects of mobile phone emissions on human brain activity and sleep variables, *Int. J. Radiat. Biol.*, 78, 659–669.
- [7] Edelstyn, N., Oldershaw, A. (2002). The acute effects of exposure to the electromagnetic field emitted by mobile phones on human attention. *Neuroreport*, 13, 119–121.
- [8] Koivisto, M., Krause, C. M., Revonsuo, A. & Laine, M & Hämäläinen, H (2000). The effects of electromagnetic field emitted by GSM phones on working memory, *Neuroreport*, 11, 1641–1643.
- [9] Nittby, H., Grafström, G., Tian, D. P., Malmgren, L. Brun, A., Persson, B. R. Salford, L. & Eberhardt, G. J., (2008). Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation, *Bioelectromagnetics*, 29 (3), 219–232.
- [10] WHO Backgrounder (2000) "Electromagnetic Fields and Public Health: WHO Backgrounder on Cautionary Policies" WHO, Geneva.
- [11] SCENIHR (2010). Possible effects of Electromagnetic Fields (EMF) on Human Health. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR).
- [12] Wdowiak A, Wdowiak L, Wiktor H (2007). "Evaluation of the effect of using mobile phones on male fertility" *Ann Agric Environ Med.*, 14 (1): 169–72.
- [13] AGNIR (2001) Advisory Group on Non-Ionising Radiation, "ELF Electromagnetic Fields and the Risk of Cancer". National Radiological Protection Board (UK). Documents of
- [14] Haarala, C. F., Takio, F. Rintee, T. Laine, M., Koivisto, M., Revonsuo, A. Hämäläinen, H. (2007) Pulsed and continuous wave mobile phone exposure over left versus right hemisphere: effects on human cognitive function, *Bioelectromagnetics*, 2007, 28 (4), 289–295.
- [15] Kwon, M. S., Koivisto, M., Laine, M. & Hämäläinen, H. (2008). Perception of the electromagnetic field emitted by a mobile phone, *Bioelectromagnetics*, 29 (2), 154–159.
- [16] IARC (2011) classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans" (PDF). World Health Organization press release N° 208 (Press release). International Agency for Research on Cancer. 31 May 2011. Retrieved 2 August 2016.
- [17] WHO Fact Sheet (1998) "Electromagnetic Fields and Public Health: Extremely Low Frequency (ELF)". WHO Fact Sheet #205 Geneva.
- [18] WHO Fact Sheet (2001) "Electromagnetic Fields and Public Health: Are Extremely Low Frequency Fields Carcinogenic?" WHO Fact Sheet #263 WHO, Geneva.
- [19] Hassoy, H Durusoy, R and Karababa, O. A (2013). Adolescents' risk perceptions on mobile phones and their base stations, their trust to authorities and incivility in using mobile phones: a cross-sectional survey on 2240 high school students in Izmir, Turkey. *Environ Health.* (12): 10.
- [20] Walliman, N. (2005). *Your research project.* (2nd edition), London: Sage Publications.
- [21] Kumar, R. L., Chii, D. K. Way, C. L., Jetly, Y. and Rajendran, V. (2013) Awareness of mobile phone hazards among university students in a Malaysian Medical School. *Journal of health.* 3 (7), 406-415.
- [22] Maier, M. (2000). The health hazards of mobile phones. *British Medical Journal*, 320, 1288-1289.
- [23] Hermann, D. A. and Hossmann, K. A. (1997). Neurological effects of microwave exposure related to mobile communication. *Journal of the Neurological Sciences*, 152, 1-14.
- [24] Hardell, L; Carlberg, M.; Söderqvist, F; Mild, K. H.; Morgan, L. Lloyd (2007). "Longterm use of cellular phones and brain tumours: Increased risk associated with use for  $\geq 10$  years". *Occupational and Environmental Medicine.* 64 (9): 26– 32.