Users Knowledge on Awareness of Health Implications of Energy Emitted from ICT Devices

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ABSTRACT
Humans are generally exposed to various sources of radiation in the course of our day-to-day activities irrespective of our work environment. Though these non-ionizing emissions from common sources like phones, computers, electronic devices, power lines and wireless devices are not known to present serious health risks, control remains the watchword. This study investigates the level of awareness of the health challenges posed by radiation from mobile phones, computers and other ICT devices among users and to suggest ways of reducing these free radicals from the body. A total of 500 students were used for the study with the aid of “Impact Awareness Questionnaire” developed and tested for face and content validity and a reliability test by internal consistency and stability assessments. The data captured in the study was tested using simple percentages, frequencies and Chi-Square. The result from this study establishes that there is no significant relationship between knowing that ICT devices radiate EMF and taking proactive measures to reduce the negative health effects. Though a vast majority of the respondents believe that radiation from their devices affects them health-wise, only a few are making efforts to reduce the effects.

Keywords
Ecosystem, ICT devices, Ionization, Radiation, Wi-Fi

1. INTRODUCTION
Technological advances in the development and use of cell phones and other smart devices have tremendously led to increased demand for these high-tech gadgets especially among the youths and the business community in quest for information. These devices not only aid in the dissemination of information, but also facilitate speedy communication and timely decision making at all levels.

Schools and residences continue to be erected in immediate proximity to power lines emitting immense EMR, pregnant women continue unawares to be exposed to EMR in various occupations, teens spend inordinate amounts of time attached to cellular phones, and mobile phone masts continue to be placed in communities close to residences, schools, preschools, hospitals and workplaces [1].

The use of postal services and other methods of information communication are almost considered as outdated and obsolete since the discovery of the internet and the micro and nano technology. This has not only positively affected the way we communicate, learn, research and do business, but have generally influenced our daily life schedules.

From entertainment to teaching, medical science, communication, research and development all centers around the use of ICT devices with all the associated social and health implications posed by these smart and intelligent devices. Household equipment like electric stoves, microwave ovens, radio and television sets and even toys are presently considered as necessity items except where they are not affordable.

Though these devices and equipment dissipates electromagnetic waves in various quantities and degrees, they have seemingly become unavoidable and inseparable to our daily living. Efforts can only be geared towards control and management of their health challenges associated with them.

The fear of not having or dispossession of a mobile phone called “nomophobia” is common trend especially among youths in this information age driven by ICT and the internet world. According to the report by Ofcom, (A communications industry regulator in the UK) in 2015, the average amount spent online has more than doubled from 9.9 hours a week 10 years ago to 20.5 hours [2]. Today, the environment, specially the urban regions, is characterized by exposure levels to electromagnetic field which are beyond the usual thresholds existing in nature [3]. The increasing use of the electromagnetic waves for cheaper communication have drastically reduced the cost of information communication and management but have also brought about its own environmental challenges which if not well and adequately managed, may be causing more harm than good.

Radiation is energy that travels in the form of waves or high speed particles (photons) and makes up the electromagnetic spectrum. These are waves of electric and magnetic energies that travel together, at the speed of light. These particles easily diffuse into the environment causing all sorts of pollution and leaving unquantifiable measures of toxins into our bodies which eventually leads to numerous kinds of diseases and bodily defects.

2. TYPES AND SOURCES OF RADIATION
Radiation within the electromagnetic spectrum is divided into two major categories: ionizing radiation and non-ionizing radiation. While the ionizing radiation consists mostly of ultraviolet rays, x-rays and gamma rays, the non-ionizing radiation comprises of low frequency sources including microwaves, radio frequency and infrared.

The sun remains a major source of radiation experienced in most parts of sub-Saharan Africa. However, over the past decades an increasing number of studies warned against the
risks of excessive sunlight exposure. Unfortunately, the harmful effects can go beyond unpleasant feelings of sunburn. Long-term exposure can contribute significantly to more serious damage such as pre-mature skin aging and skin cancer [4].

The increasing use of computers, telecommunication equipment, phones and other ICT devices which constitutes a major sources of non-ionizing radiations have called for a great attention among researchers and health personnel considering the fact that the number of these smart devices will continue to be on the rise.

Younger users are mostly engrossed in the use of smart devices for either social networking, watching video, and/or listening to music or podcasts. Fully 91% of smartphone owners ages 18-29 used social networking on their phone at least once over the course of the study period, compared with 55% of those 50 and older [5]. According to the research, 64% of American adults own one kind of smartphone or the other. There is therefore the need to accelerate efforts both in terms of awareness, control and management of the effects of these free radicals as they continue to pollute our natural environment and physical wellbeing.

3. OBJECTIVES OF THE STUDY

This major aim of this paper is to explore the level of awareness of non-ionizing radiation and its health effects among the youths who constitutes a vast majority of users of ICT devices.

Among the objectives are:

1. To examine the level of usage of smart devices and computers along with handling styles among diverse users
2. To examine the level of knowledge of the negative effects of radiation from smart devices
3. To find out if users are taking any precaution against the radiation from long-term use of these devices
4. The research attempts also to examine if the knowledge of the effects of radiation from smart devices have any significant relationship with the level of precaution taken to forestall health breakdown.

4. CONTRIBUTION

Tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body. At the frequencies used by mobile phones, most of the energy is absorbed by the skin and other superficial tissues, resulting in negligible temperature rise in the brain or any other organs of the body [6].

According to a poll conducted for Common Sense Media, a nonprofit focused on helping children, parents, teachers and policymakers negotiate media and technology, 50% of teens and 27% of parents feel they’re addicted to their mobile devices while nearly 80% of teens check their phones hourly and 72% feel the need to respond immediately [7]. With about 150 million active lines in Nigeria [8], we are not left out in this EMF invasion.

Based on available data, the International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans and placed in Group 2B category. This category is used when a causal association is considered credible, but when chance, bias or confounding cannot be ruled out with reasonable confidence.

The major contribution of this research is evaluate the psychology of mobile phone users in Nigeria and their preparedness towards overcoming the health effects of EMF radiation especially in this part of the world where there is already over-exposure to sun rays.

5. RELATED WORK

There have been an increasing number of researches into this growing trend of radiation and environmental pollution posed by the use of mobile phones, telecommunication equipment, computers and ICT associated devices. This has been a major area of concern both to the academia and the industry with the growing awareness of green ecosystem, the ozone layer depletion and their effects on humans.

Various researches have indicated that between 20% to 60% of the energy emitted from a mobile phone is absorbed by the user’s head. The percentage absorbed depends on the design of the phone, type of aerial or antenna and how far it is to the nearest base-station (the weaker the base station signal, the more the phone will power up to maintain contact with the network) [9].

The National Toxicology Program (NTP) of the National Institutes of Health while reporting partial findings from the study of the cancer risk from cellphone radiofrequency radiation (RFR), found low incidences of tumors in the brains and hearts of male rats. These studies in mice are still ongoing but complete results from all the rats and mice is expected by the end of 2017 [10]. In another research [11] acknowledged the occurrences of two tumor types in male rats exposed to RFR, malignant gliomas in the brain and schwannomas of the heart. According to the report, about thirty of 540 (5.5%), or one in 18 male rats exposed to cell phone radiation developed cancer while 16 pre-cancerous hyperplasias were diagnosed. Thus, 46 of 540, or one in 12 male rats exposed to cell phone radiation developed cancer or pre-cancerous cells.

In a related research [12], concluded that radiofrequency exposure from mobile phones is concentrated to the tissue closest to the handset, which includes the auditory nerve. Though the findings do not indicate an increased risk of acoustic neuroma related to short-term mobile phone use after a short latency period. However, the investigation conducted suggests an increased risk of acoustic neuroma associated with mobile phone use of at least 10 years duration.

[13] in a similar study also on the effects of mobile phone usage, observed functional and volumetric changes in the parotid glands associated with mobile phone use. In this study, the unstimulated parotid saliva flow rate was measured bilaterally in 142 individuals divided into 2 groups of heavy users and control subjects using a modified Schirmer test. Bilateral parotid ultrasonography was performed to evaluate gland volume. The result from this research shows a significant increase in salivary flow rate along with increased blood flow rate and volume of the parotid glands of the side where mobile phones are frequently placed especially in the heavy user group. In addition to the effects of mobile phone radiation on saliva, [14] conducted a research on the effects of radiation on dental health and came to the conclusion that though there have been no clear effects of mobile radiations on teeth and buccal mucosa but changes in the saliva and parotid gland have taken place. The outcome of this experiment has substantiated the precarious works by [13].
Several other studies have come to the conclusion that these invisible radiation from cell phones, microwave ovens, computers, cordless phones, electrical wiring in homes, other buildings and offices are all contributors to health problems such as neck and shoulders pain, headaches, brain tumors (especially for children who are less resistant to radiation), hypertension, cancer, brain and eye tumors, Alzheimer's disease, memory loss and many others [15]. The researcher established that the question is no longer whether these electromagnetic waves emitted by these devices are dangerous to health, but how to protect humans to proactively manage their health and wellbeing by providing free, clear and reliable precautions about cell phone radiation risks. To this effect, public awareness and health campaign is an essential part of any comprehensive control programme that will aim at putting an end to the cell phone radiation risk. Even among students of medical sciences and radiography where it is expected that there should be generally high level of health effects of radiation, [16] found that there is insufficient knowledge of non-ionizing radiation among final year students of college of medical science, University of Maiduguri. The research went further to discover that there is also poor knowledge of systems that emits non-ionizing radiation, with only radiography students having good knowledge about them; however, participants were seen to generally have good knowledge of potential hazards of non-ionizing radiation. While this study centered on medical students, a similar study among a set of doctors on the knowledge of radiation and it effects among doctors in Makurdi, Nigeria found that there was appreciable level of awareness of radiation hazard among doctors, but there is limited radiation knowledge and lack of use of referral guidelines [17]. The researcher advocated that radiation protection courses and education of practical issues including radiation safety should be made mandatory both at undergraduate levels and also post qualification.

6. METHODOLOGY
A questionnaire for the knowledge of health related effects of non-ionizing radiation was designed, validated and administered to a total number of 450 students of various departments in the University of Abuja. A total of 420 respondents successfully completed their questionnaire while 25 questionnaires were considered invalid and 395 respondents representing about 88% of the number distributed. The questionnaire contains three (3) sections; section A centered on usage of ICT devices, phones, wifi-devices and computer systems; section B was aimed at finding out the respondent’s level of knowledge of the effects of radiation and how the use of these devices can contribute to doses of radiation in the body system. The last section examines if the users are taking any measures to counter or reduce the effects of radiation from these devices.

Data collected in the survey was subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) version 16.0 generating various descriptive statistics such as Chi-square, frequencies and percentages.

To test whether there is a significant relationship between those that believe radiation from their devices affects them negatively and those that are making any effort towards reducing the effects, a hypothesis was formulated.

\[ H_0: \text{We acknowledge that radiation from ICT devices affects our health negatively but are not making any effort towards reducing those effects} \]

\[ H_1: \text{We acknowledge that radiation from ICT devices affects our health negatively are making efforts towards reducing those effects} \]

7. RESULTS
Figure 1 shows the distribution of the students according to the smart device(s) they use along with the length of time they have been using these devices. The result obtained shows that a greater number of the students have been using these devices for a period of between 6-10 years. While greater numbers of student are smart phone users.

![Figure 1: Distribution of respondents according to duration of usage of devices](image)

Figure 2 examines the percentage of respondents that make use of hands free sets especially among those using smart phones. It is revealed from this response that 203 respondents of those using smart phones do not use hands-free sets. Since these sets play a role towards reducing the negative health effects of radiation, it can be considered to be on the high side.

![Figure 2: Respondents and the use of hands free set](image)
Table 3: Distribution of respondents according to how they hold their devices during calls

Figure 4 considers the number of respondents who experience rise in temperature of their devices during the cause of usage, and are also aware of the health effects of radiation. It is shown that majority of the total number of respondents who are aware of the effects of radiation to their health experience heat on their devices. 44 respondents who are not aware of the health effects of radiation seem to experience the heating of devices. 39 respondents who are aware of the health effects of radiation but do not experiences heating may include those who do not engage in lengthy calls or those who use shields.

Table 1: Respondent’s radiation awareness level

<table>
<thead>
<tr>
<th>AWARE*KNOWLEDGELEVEL CROSSTABULATION</th>
<th>HOW DO RATE YOUR KNOWLEDGE ABOUT RADIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aware</td>
<td>Excellent</td>
</tr>
<tr>
<td>Yes</td>
<td>87(25.44%)</td>
</tr>
<tr>
<td>No</td>
<td>14(26.42%)</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Table 2 further examines the percentage of those respondents who knows that radiation have negative health implications especially among those that are aware their devices radiate energy. The result reveals that a high percentage of the respondents who are aware of the radiation of EMF from their devices acknowledge the fact that radiation has negative health implications, while the remaining 23.68% feels there are no adverse effects. This level of ignorance is alarming and deserves more awareness and sensitization.

Table 2: Respondent’s knowledge of negative health implication of radiation

<table>
<thead>
<tr>
<th>AWARE*HEALTHIMPLICATION CROSSTABULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEALTH IMPLICATIONS</td>
</tr>
<tr>
<td>Aware</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Table 3 showcases the belief and mentality of the respondents on whether they believe that the negative health effects of radiation can be reduced especially among those that are of the opinion that radiation from these smart devices affects them. Of the 302 respondents that are of the opinion that radiation of their devices have negative effects to their health, only about 175 representing 57.90% believe that these effects can be reduced, while about 42.10% are of the opinion that though radiation from their devices affects them, they do not have any way of reducing it as long as they keep using the devices.

Table 3: Ratio of people that are of the opinion that radiations form their devices can be reduced

<p>| AFFECTS YOU*CAN BE REDUCED CROSSTABULATION |</p>
<table>
<thead>
<tr>
<th>CAN BE REDUCED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affect You</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Figure 4: Respondents who are aware of radiation and gadget heating

Table 1 shows how the respondents rate their level of knowledge of radiation generally especially among those that are aware that their smart devices radiate energy in the course of usage. This level of knowledge is however as perceived by the respondents and not subjected to any further scientific or empirical study.

It is clear that only a negligible percentage (7.60%) of the respondents showed insufficient level of knowledge while 45.61% have a good understanding of its negative effects to health. This shows that most of the respondents have adequate knowledge of radiation be it ionizing or non-ionizing.
Although 76.46% of the sample have accepted the fact that radiation from their devices affects their health, it is important to find out how many of these respondents are of the opinion that they can play a role towards its reduction. Table 4 examines the percentage of respondents that are of the opinion that they can play a role or do something towards reducing the effects of radiation to their health.

Table 4: Respondent’s belief that they can play a role towards reducing the effects of radiation in there system

<table>
<thead>
<tr>
<th>AFFECTS YOU*YOU CAN DO CROSSTABULATION</th>
<th>YOU CAN DO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>240(79.50%)</td>
</tr>
<tr>
<td>No</td>
<td>56(20.50%)</td>
</tr>
<tr>
<td>Total</td>
<td>296(74.90%)</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Since 79.50% of the 302 respondents have accepted the fact that there is something they can do to caution the effects of radiation, the research goes on to capture the level of effort being made towards this reduction. From the data presented in Table 5, it is surprising to find out that only about 40 respondents making about 13.20% makes conscious effort to detoxify their system.

Table 5: Distribution of respondents who make conscious efforts to reduce the effects of radiation from their system.

<table>
<thead>
<tr>
<th>AFFECTS YOU</th>
<th>No</th>
<th>Yes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>84(90.30%)</td>
<td>9(9.70%)</td>
<td>93</td>
</tr>
<tr>
<td>Yes</td>
<td>262(86.80%)</td>
<td>40(13.20%)</td>
<td>302</td>
</tr>
<tr>
<td>Total</td>
<td>346(87.60%)</td>
<td>49(12.40%)</td>
<td>395</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

The Chi-Square table below shows the test to determine if the respondents that feel radiation from their devices affects them negatively have any relationship with those that are making any effort towards reducing the effects. It can see from the Pearson Chi-Square that $\chi^2 = 0.833$, $p = 0.361$. This implies that there is no statistically significant association between those respondents who are of the opinion that radiation affects them and those that are making effort to consciously reduce its effects on their health testing for 5% level of significance.

8. DISCUSSION

The results from this study are quite revealing. It is established that almost all the respondents use one type of smart device or the other ranging from smart phones, palmtops, desktops to laptops. These devices accordi to them, not only aid them in effective communication but also for research and news. About 33.42% of the respondents have been using their devices between 6-10 years which puts them in a better position to respond out of long period of experience. However, majority of about 81.20% of the users do not make use of hands-free sets which can even reduce the negative effects of radiation form these devices. This may either be due to lack of knowledge or out of the inconveniences the sets may be causing the user. Since most of the respondents do not use hands-free sets, it becomes imperative to examine how close these devices are place to the body during the course of usage. It is further revealed that about 60% of the users of smart phones place them on their ears while making or receiving calls thereby absorbing all the EMF radiated from the devices without their knowledge with only about 12.30% using speak-outs. This may either be attributed to factors ranging from poor signal reception in most areas, low quality phones to habit and need for privacy.

The research went further to investigate the level of knowledge of the negative health effects of radiation from smart devices among users. It is revealed that more than 80% of both those who are aware the devices radiate energy and those who are not aware experience temperature rise in their body system during the cause of usage. The 11.40% who are aware of the health effects of radiation but do not experience heating may include those who do not engage in lengthy calls or those who use one kind of radiation shield or the other. It is interesting to discover however that of the over 80% who experience rise in body temperature after long duration of usage, only 58.60% believe that radiation from these devices can be reduced even when 79.49% of the sample have accepted the fact that radiation from their devices affects their health and about 34.19% believing that they can play a role towards reducing these negative effects.

There seem not to be much difference between the respondents that are of the opinion that radiation from their devices can be reduced (57.90%) and those who feel otherwise (42.10%). Though 240 respondents representing 79.50% are of the opinion that they can play a role towards reducing their body EMF absorption, only 40 (13.20%) accepted that they are making some level of effort towards its reduction.

9. CONCLUSION

The results obtained from the study reveal that there remains insufficient knowledge of the negative health effects of radiation caused by use of smart phones and mobile devices especially among youths. Even among the few respondents that have knowledge of this life threatening sources of EMF, only quite a few are aware that they can play a role towards its reduction and subsequentl make efforts towards cleansing their system for the toxins absorbed.

Chi-Square test was used to determine if there exists a significant relationship between those that believe radiation
from their devices affects them negatively and those that are making any effort towards reducing the effects. The result establishes that there is no significant relationship between the two variables, implying that even though a vast majority of the respondents believe that radiation from their devices affects them health-wise, only a few are making efforts to reduce the effects.

It is therefore recommended that frantic efforts should be made by health professionals and other concerned groups to educate the populace and sensitize them on the health implications of non-ionizing radiation from devices and the need to make efforts towards limiting the effects and the need to detoxify their system as often as they can.

The arrival of 5G networks will also witness the proliferation of ICT and telecom-based devices which automatically means erecting more antennae and sites. This will further increase the level of radiation pollution in our environment.

Service providers should also be encouraged and advised to always boost the signals from their base stations since the weaker the signal from the base station, the more the phone will power up to maintain contact with the network.

10. REFERENCES


