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Survey of Potential Adverse health Effects of Mobile Phones, And wireless Base Stations in Nigeria

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ABSTRACT: Survey was conducted to gather information on potential adverse health effects of Mobile Phones, and Telecommunication Tower Base Stations in Nigeria. Data was sourced from two sampled populations. Firstly from the people living in close proximity to base stations, and secondly from cell phone users.Questionnaire was used to gathered information from 574 people on thirteen nonspecific health symptoms. Data obtained was presented and analyzed. The analysis shows that people living close to the based stations over a long period of time with or without cell phone, and also the heavy phone users with close proximity to the base stations are liable to have some potential health hazards, such as fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty in concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness.
Keywords: *Nigeria, Mobile phones, health hazards, Telecommunication Tower Base Stations, wireless base stations, phone users.*

I. INTRODUCTION

In this era of mobile and ICT economy, there is pervasive public disquiet about the probable adverse health effects of mobile phones, and especially their associated base-stations. There are hundreds of, apparently conflicting, reports in the media about the health effects of mobile phones & base-stations. The scientific literature is large and confusing, also apparently showing very inconsistent effects across studies [1]. As at the May 2016, the total number of active phone users is one hundred and fourth eight millions, eight hundred and forty eight thousand and one hundred and fifty eight (148,848,158) [2].Cell phone technology has revolutionized the telecommunication scenario in Nigeria. Due to its several advantages, cell phone technology has grown exponentially in the last decade. Currently, there are more than 148,848,158 cell phone users and several base stations towers to meet the communication demand. The numbers of cell phones and cell towers are increasing without giving due respect to its disadvantages.

The people who lived closest to the cellular antennas had the highest incidences of the following disorders: fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty in concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness [3].

All over the world, people have been debating about associated health risk due to radiation from cell phone and cell tower.In an article titled unknown health hazards associated with use of mobile phones identified the following hazards: hearth problems, infertility, hearing impairments, eyes problems, skin allergies, infections, and stress [4. From table 1, it is cleared that majority of active phone users in Nigeria uses mobile line. Nigeria communication commission statistics for active mobile phone users as at June 2016 gives population to one hundred and forty eighty million plus which is over fifty percent of the nation population see detail in table 1. This implied that more than half of Nigeria population may be suffering from aforementioned hazards. In this study we will look at possible negative effects of using mobile phone to the users. Also we will x-ray the effect of living close to mobile base station on human beings. The questionnaire will be used to gather information on potential adverse effect of living near the mobile base station and use of mobile phones. In section two of this technical report we presents health effects of mobile phones, and wireless base stations, we present the analysis of data obtained from questionnaire, recommendation to avoid ameliorate the potential hazards was given in section four, while conclusion was presented in section five.

Table 1: Statistic of active phone users [2]

Operator	Number	Percentage
Mobile GSM	148,189,043	99.55718968
Mobile CDMA	487,141	0.327273785
Fixed wireless	171,974	0.115536532
Total	148,848,158	

Significance of Study

The significance of this study is to identify the adverse health of effects of using mobile phones/staying near mobile phone station in Nigeria.

Problem Statement

As at June ending of year 2016, the number of active mobile phone users in Nigeria is one hundred and forty eighty million plus. This is over fifty percent of the population of the country. Some of the users are not aware of potential health hazards of using mobile or living near mobile phone stations. Hence there is need for this research to carry out survey on potential health hazards and provide antidote for safety use of mobile phone in Nigeria.

Objectives of the Study

The main objective of this research work is to examine the potential health hazards associated with mobile phone use, and living near mobile phone stations.

II. HEALTH EFFECTS OF MOBILE PHONES, AND WIRELESS BASE STATIONS

Radiation effects

Several adverse effects of using mobile phone, and living near mobile phone towers are associated with RF radiation. As people use cell phones to make calls, signals are transmitted back and forth to the base station. The RF waves produced at the base station are given off into the environment, where people can be exposed to them. The energy from a cellular phone tower antenna, like that of other telecommunication antennas, is directed toward the horizon (parallel to the ground), with some downward scatter [5; 6; 7]. Base station antennas use higher power levels than other types of land-mobile antennas, but much lower levels than those from radio and television broadcast stations. The amount of energy decreases rapidly as the distance from the antenna increases. As a result, the level of exposure to radio waves at ground level is very low compared to the level close to the antenna. Radiation effects are divided into thermal and non-thermal effects. Thermal effects are similar to that of cooking in the microwave oven. Non-thermal effects are not well defined but it has been reported that non-thermal effects are 3 to 4 times more harmful than thermal effects. A GSM900 base station antenna transmits in the frequency range of 935-960MHz. This frequency band of 25 MHz is divided into twenty sub-bands of 1.2 MHz, which are allocated to various operators. There may be several carrier frequencies (1 to 5) allotted to one operator with upper limit of 6.2 MHz bandwidth. Radiated power density from the cell tower is given by the formula.

$$P_d = \frac{P_t . G_t}{4\Pi R^2} Watt \quad / m^2 \quad ----------(i)$$

Where P_t = transmitter power in watts, G_t= gain of transmitting antennae, and R = Distance from the antenna in meters.

The implication of the formula is that, the closet is one to the antennae the possibility of effect with hazards associated with radiation. Some possible adverse effects of using mobile phones as follows:

Blood Brain Barrier, the brain is protected by tight junctions between adjacent cells of capillary walls by the bloodbrain barrier (BBB), which selectively lets nutrients pass through from the blood to the brain, but keeps toxic substances out. Experiments conducted on young laboratory rats found that RF from mobile phones can significantly open the BBB in animals and cause leakage of albumin from blood vessels in inappropriate locations (neurons and glial cells surrounding the capillaries) in the brain;

Risk to Children, children are more vulnerable to cell phone radiation because they absorb more energy than adults from the same phone owing to their smaller head and brain size, thinner cranial bones and skin, thinner, more elastic ears, lower blood cell volume, as well as greater conductivity of nerve cells and the energy penetrates more deeply;

Irreversible infertility, recent studies confirm that cell phone radiation can drastically affect male fertility. American Society for Reproductive Medicine reported that use of cell phones by men is associated with decrease in semen quality, sperm count, motility, viability and normal morphology and is related to the duration of cell phone use. Studies have found 30% sperm decrease in intensive mobile phone users, in addition to damage of sperms;

DNA damage, cellular telephone frequencies can lead to damageof DNA. Studies show that microwave exposure at levels below the exposure standard, produces single and double strand breaks in DNA;

Effect on Skin, radiation from cell towers and mobile phones affects human skin. People who talk often on cell phones have a higher concentration of the *transthyretin*protein than those who do not. *Transtyretin*is formed in the liver; it helps transport vitamin A in the body and plays an important role in nervous diseases such as Alzheimers;

Tinnitus and Ear Damage; tinnitus, popularly known as "Ringxiety" is the psychological disease of hearing phantom sound and sensation of cell phone ring and it has been reported among millions of cell phone users in the world. People with severe tinnitus may have trouble hearing, working or even sleeping. The radiation emitted by mobile phones may damage the delicate workings of the inner ear**,** and long term and intensive mobile phone use for more than four years and for longer periods than 30 minutes in a day are at a higher risk of developing hearing loss, which cannot be reversed;

Effect on Eye/ Uveal Melanoma, frequent use of mobile phones can also damage the visual system in many ways and cause uveal melanoma i.e. tumor of the eye. Tumors involve the choroid (98%), iris (1%) and unknown parts of the uveal tract (1%). Computational modeling and experiments with several laboratory animals show that microwave radiation similar to mobile phone frequencies (900, 1800 MHz and 2450 MHz) can induce chromosomal breaks in the corneal epithelial cells and increase the intraocular temperature of the eye with prolonged exposure;

weakness of bones, researchers have measured bone density at the upper rims of the pelvis (iliac wings) in men who were mobile users and carried their phones on their belts. The iliac wings are widely used source of bone for bone grafting, so any reduction in bone density may be of special importance to reconstructive surgery. The results showed reduction in iliac wing bone density on the side where men carried their phones;

Salivary gland tumor, increased risk of salivary gland cancer among residents in Israel from 1970 to 2006 has been reported, which is believed to be linked to the use of mobile phones. Among salivary gland cancer cases, researchers found a worrying rise in the number of cases of malignant growth in parotid glands - the salivary gland located under the ear, near the location where cell phones are held during conversations. Users below the age of 20 were found to be more susceptible.

Another epidemiology study found that people who held a mobile handset against one side of their head for several hours a day have 50% more risk for tumor formation in the parotid gland - the largest salivary gland after 5-10 years;

Melatonin Reduction, melatonin, a vital natural neuro-hormone is a powerful antioxidant, antidepressant and immune system enhancer that regulates our circadian rhythm. Every night as we go to sleep, our melatonin levels rise. Melatonin goes through our blood and clears our cells up, that is to say, scavenges free radicals in the cell to protect the DNA and reduce the possibility of cells becoming carcinogenic. The daily sleep/wake cycle, blood pressure and heart rate cycle, metabolic rate and thermal regulation, hormone production and immune system activity all have a daily cycle regulated by melatonin directly or indirectly through the autonomic system;

Sleep Disorders, electromagnetic fields have been shown to affect the brain physiology. Use of mobile phones disturbs Stage 4 sleep, the stage important for full recuperation of brain and body. Use of the handsets before bed, delays and reduces sleep, and causes headaches, confusion and depression.The findings are especially alarming for children and teenagers as they use cell phones at night and also keep the phone next to their head; which may lead to mood and personality changes, depression, lack of concentration and poor academic performance;

Increase in Cancer risk, heavy use of mobile phones can cause cancer. Use of mobile phones for >10 years give a consistent pattern of increased risk for brain cancer [8].

III. RESEARCH METHODS AND DATA ANALYSIS

Questionnaire was used to collect data from sampled population of 574 people living near mobile phone base station around Sango-ota Ogun State Nigeria. Data obtained was tabulated and present in table 2. The data obtained was analyzed based on the following: Distances from base stations in meters (m); How often individual uses his/her mobile phone to receive or make calls per day; How long individual have been living near the base station; and question was asked to ascertain whether the respondent have experienced any of the potential hazard associated with mobile phones, and wireless base stations. With reference to thirteen difference

potential hazards associated with mobile phone usage and it base station. It was discovered that it was only in Visual Disruptions and Cardiovascular Disorders that the number of respondent with the symptom is below average with the 29.7% and 2.97% respectively. It was revealed that the frequency of the occurrence of the symptoms is associated with following factors.

i. Proximity with the mobile base stations.
ii. Length of period individuals have stayed or live near the base station.
iii. Length of time individual spent on receiving or making calls with his/her mobile phone.

Critical review of Girish Kumar 2010 report on cell tower radiation support the assumptions i-iii. As regards the frequency of occurrences of the symptoms mentioned in this paper. The breakdown of the data in table II is also a clear evidence as the percentage of YES to NO to the thirteen sampled nonspecific hazards in this paper higher in the people living close to mobile phone stations, and those that received or make calls frequentlyvice versa. See table 3, 4, and 5. The following results obtain from simple arithmetic equations derive by authors of this paper from the table also authenticate the factors associated with the frequency of the symptoms.

Let us have the following
No of Sample nonspecific hazards NS = 13
No of people sampled NP = 574
Total no of respondents = TNR

From the table 2,
Tnr People Within 300meters To Mobile Base Stationtnrx = 5298
Tnr Living For Over A Yr Near Mobile Base Station Tnry = 4911
Tnr People Call/Receiving Time Above 10mins/Day Tnrz = 4924

Using the equations

$$TNR = NS * NP \quad ----------(ii)$$

$$= 13 * 574 = 7462$$

$$\%TNR_x = \frac{TNR_x}{TNR} ----------(iii)$$

$$= \frac{5298}{7462} = 71\%$$

$$\%TNR_y = \frac{TNR_y}{TNR} ----------(iv)$$

$$\%TNR_y = \frac{TNR_y}{TNR} ----------(iv)$$

$$= \frac{4911}{7462} = 65.81\%$$

$$\%TNR_z = \frac{TNRz}{TNR} ----------(v)$$

$$= \frac{4924}{7462} = 65.9\%$$

Taking into considerations, the TNR_x**(5298)**, TNR_y**(4911)**, and TNR_z**(4924)**. The total numbers of the YES response to the non-specific hazards symptoms is 3974 which is equivalent to **75%** TNR_x, **80.9%** TNR_y, and **80.7%** TNR_z responses.

Table 2: Data Obtained from sampled population

Symptoms	Distances from base stations in meters (m)							How often Do you use your mobile phone to receive or make calls per day			How long have you been living near this base station			Hazard Symptoms
	< 20	20 to 50	50 to 100	100 to 200	200 to 300	300 to 400	> 400	Between 0 and 10 minutes	Between 10 & 30 minutes	30 mins and above	Less than 1year	Btw 1 & 3yrs	> 3yrs	
Fatigue	113	49	57	101	78	105	71	188	203	183	193	197	184	YES=389 NO = 185
Sleep Disturbances	73	99	95	97	48	87	75	202	187	185	202	187	185	YES=493 NO = 81
Headaches	89	103	103	92	79	54	54	203	200	171	203	200	171	YES=385 NO =189
Feeling Discomfort	74	87	101	49	99	83	81	196	199	179	196	199	179	YES=371 NO =203
Difficulty In Concentrating	93	104	73	31	101	83	89	188	203	183	188	203	183	YES=391 NO =183
Depression	113	79	37	103	44	95	103	193	197	184	193	197	184	YES=379 NO =195
Memory Loss	103	40	97	47	111	103	73	189	202	183	202	187	185	YES = 7 NO = 567
Visual Disruptions	91	81	105	97	56	47	97	203	183	188	203	200	171	YES=171 NO =403
Irritability	82	95	111	39	77	77	93	195	197	182	196	199	179	YES=343 NO =231
Hearing Disruptions	109	72	93	81	53	71	95	203	183	188	188	203	183	YES=341 NO =233
Skin Problems	97	47	103	95	53	76	103	191	201	182	189	202	183	YES=313 NO = 261
Cardiovascular Disorders	79	97	55	103	81	81	78	188	203	183	203	183	188	YES = 17 NO = 557
Dizziness	82	59	97	47	99	93	97	199	194	181	195	197	182	YES=374 NO =200

Table 3: Response with respect to distance from base station versus sampled hazards

Symptoms	Distances from base stations in meters (m)							Hazard Symptoms	
	< 20	20 to 50	50 to 100	100 to 200	200 to 300	300 to 400	> 400	YES	NO
Fatigue	113	49	57	101	78	105	71	389	185
Sleep Disturbances	73	99	95	97	48	87	75	493	81
Headaches	89	103	103	92	79	54	54	385	81
Feeling Discomfort	74	87	101	49	99	83	81	371	203
Difficulty In Concentrating	93	104	73	31	101	83	89	391	183
Depression	113	79	37	103	44	95	103	379	195
Memory Loss	103	40	97	47	111	103	73	7	567
Visual Disruptions	91	81	105	97	56	47	97	171	403
Irritability	82	95	111	39	77	77	93	343	231
Hearing Disruptions	109	72	93	81	53	71	95	341	233
Skin Problems	97	47	103	95	53	76	103	313	261
Cardiovascular Disorders	79	97	55	103	81	81	78	17	557
Dizziness	82	59	97	47	99	93	97	374	200

Table 4: Response with respect to time of mobile phone usages versus sampled hazards

Symptoms	How often Do you use your mobile phone to receive or make calls per day			Hazard Symptoms	
	0 to 10mins	10 to 30mins	30mins & above	YES	NO
Fatigue	188	203	183	389	185
Sleep Disturbances	202	187	185	493	81
Headaches	203	200	171	385	81
Feeling Discomfort	196	199	179	371	203
Difficulty In Concentrating	188	203	183	391	183
Depression	193	197	184	379	195
Memory Loss	189	202	183	7	567
Visual Disruptions	203	183	188	171	403
Irritability	195	197	182	343	231
Hearing Disruptions	203	183	188	341	233
Skin Problems	191	201	182	313	261
Cardiovascular Disorders	188	203	183	17	557
Dizziness	199	194	181	374	200

Table 5: Response with respect to length of staying near base station versus sampled hazards

Symptoms	How long have you been living near this base station			Hazards Symptoms	
	< 1year	Btw 1 & 3yrs	>3yrs	YES	NO
Fatigue	193	197	184	389	185
Sleep Disturbances	202	187	185	493	81
Headaches	203	200	171	385	81
Feeling Discomfort	196	199	179	371	203
Difficulty In Concentrating	188	203	183	391	183
Depression	193	197	184	379	195
Memory Loss	202	187	185	7	567
Visual Disruptions	203	200	171	171	403
Irritability	196	199	179	343	231
Hearing Disruptions	188	203	183	341	233
Skin Problems	189	202	183	313	261
Cardiovascular Disorders	203	183	188	17	557
Dizziness	195	197	182	374	200

1. Further Research

Many reports and reviews have been published, most concluding that there is little evidence for any adverse health effects that can be attributed to mobile phone base-stations. But the result of this research prove otherwise. Consequently we recommended a further research to be carried out on base stations in Nigeria to determine the level of compliance with NRPB and ICNIRP guideline.

2. Recommendation and Conclusion

In our view, Proximity with the mobile base stations may result to adverse health effects such as fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty in concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness. The level of the symptom is depends on: Length of period individuals have stayed or live near the base station; Length of time individual spent on receiving or making calls with his/her mobile phone. Consequently we recommended that people living or stay over a long time near mobile based station to ascertain level radiation and make effort to screen the radiation if perceived danger, Also individual should reduce their level of making or receiving call with their mobile to avoid some of the potential hazard mentioned conversation with text messages could be a better option. In general, it is better to keep mobile phones as far as possible from our body during our daily lives.

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