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Human and Environmental Impact Assessment of Common Cell Phone- A review

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Abstract : *In this study, the effect of common cell phones on humans and on the environment is investigated using open literature survey approach. Many definite risks are posed by radiation from wireless connection, cellular telephones and electronic devices. These risks appear to be minimal but are quite inimical in the long run. Also the unsustainable approach towards management of the discarded phone waste in developing nations is also highlighted. In this paper, radiations from' common phones are studied and the health effects of such radiations are also discussed. Possible recommendations to prevent the effect of these radiations - related health problems were also highlighted.*

Keywords – *Near-field radiations Cellular, specific absorption rate, radio frequency, unsustainable waste management*

I. INTRODUCTION

Currently, there are some significant attention on the public concern over the potential adverse health effects of mobile phones on its user and/or at the base stations. It is a common knowledge that mobile phone wastes have the potential to generate significant environmental impact since these mobile phones contain toxic and rare substances in its constituent materials. Virtually no home is without a cell phone. Calls are made at will and these all home products are used from second to second without any recourse to the many potential dangers they can pose. The human tissue is sensitive to radiations of all kind. They affect the human cells and organ in one-way or the other. Some of the effects are always of the long run type and may not be noticed immediately. In the literature, it has been reported that these phone waste and cause serious harm to human and environment if not properly managed [1]. The toxic substance accruing from mobile phones can pollute into the air, soil, water and on the environment. It has been established that the main component of the charger is print wiring board (PWB) which are mostly composed of hazardous substances including arsenic (As), lead (Pb), mercury (Au), cadmium (Cd), and dioxins [2-3]. Most of these toxic substance can be retained in the environment either directly or indirectly, thereby posing serious threat to man and the environment. Some of the major challenges associated to mobile phone wastes management especially in third world countries include; recycling, redesign of mobile phones and their accessories to facilitate reuse, and proper and sustainable waste disposal methods. The negative consequences of unsustainable waste management to man and to the environment has been widely reported in the literature [4-13].

In a related development, the producers of cell phone assert that every phone it sells meets radiation safety limits set by the government. However, recent tests conducted by ABC's news program and National Radiological Protection Board [14-15], indicate that most of the popular phones can far exceed the government radiation standards depending upon, how they are held. The signals transmitted and received by your cell phone are the same type of wave that is used in your microwave oven or by a doctors x-ray machine and, although these waves are not as strong, the waves received/transmitted by your phone is strong enough to travel over 50 miles [12, 15-16]. Depending on how close the cell phone antenna is, as much as 60% of the microwave radiation is absorbed by and actually penetrates the area around the head [17-18]. In most cases the bone of an adult skill can block most of the radiation that is created from other devices. The problem with cell phone is that it is normally held directly to one of the areas of the head which have the least amount of-protection, the ear canal/drum/ near the chest (when cell phone are placed in pockets of shirts), near the gonads (when cell phone are placed in pockets of trousers) etc. This makes it possible for majority of the

radiations to pass through these soft tissues, some part of the radiation reaching an inch to an inch-and- a half into the nearby organ.

This paper will therefore attempt to discuss available cell phone in the market, the amount of radiations they emit, the consequences of those radiation and possible ways to prevent oneself from these radiations. It will investigate the environmental hazards posed by these phone waste especially in the developing nations where recycling is either not existing or absolutely inefficient. Possible recmmendations and solutions are also presented.

II. MATERIALS AND METHOD

The authors used open survey of the literature, thus this research work was carried out using a literature based conceptual approach. In this regard, the authors comprehensively reviewed the literature of common cell phones with emphasis on the effect of the radiation emanating from the phones to the users, and on the environmental hazards associated to unsustainable waste management of discarded mobile phone wastes.

III. RESULTS AND DISCUSSION

Antenna and Radiation Hazards

A cellular telephone(s) main source of RF energy is its antenna. Therefore, the closer the antenna is to the head, the greater a person(s) is/are exposed to the radio frequency (RF) radiation. The amount of RF radiation .absorbed decreases rapidly with increasing distance between the antenna and the user [19-21]. The antenna of hand held cellular telephones is in the handset, which is typically held against the side of the head while the phone is in use. For transportable cellular telephones or "bag phones" the antenna is housed in a portable unit separate from the handset. Most of the studies conducted on cellular telephone use and cancer risk have focused on handheld models, since they deliver the most RF radiation to the user, RF radiation can be harmful at high levels because it produces heat. Many people have speculated that the heat produced by RF radiation from hand held cellular telephones might be associated with brain tumors, because the antenna is held close to the users head [18, 22]. Cell phones are becoming increasingly popular, yet most of us are unaware of the damage they are doing to our body tissues and organs. Today, there is more and more compelling evidence showing that low intensity, pulsed radiation can exert subtle influences that have serious health problems. Our body is an electrochemical instrument-of high sensitivity. Oscillatory electrical processes of various kinds determine its orderly functioning and control, each characterized by a specific frequency. Some of which happen to be close to those used in Global System for Mobile Telecommunications (GSM). The implication is that some of our biological electrical activities can be interfered with via oscillatory aspects of 'the incoming radiation, in much the same way as can the reception on a radio set [23]. Some of the- biological electrical activities that are vulnerable are highly organized electrical activities at a cellular level, whose frequency happens to lie in the microwave region, cell division leading to gene mutation, brain functions including the neuro-endocrine system. Cell phones have also been associated with 200-300% increase in neuro-epithelial tumors that occur on the same side of the brain that the cell phone is being used [24-29]. Increased risk of cancer with cellular telephone use is related to the radiation that cell phone produces. Just like the computer, and all other electrical devices, cellular telephones emit electromagnetic radiation.

Health Hazards

The beautiful things we carry about as cell phones that are as common as oxygen have made themselves as essential as foods. We cannot seem to live without it , yet the dangerous effect to human cells is not considered. According to the literature [15-36], the health hazards associated to the use of cell phones include; (i) It can lead to the brain cancer (ii) Leakage of the blood brain barrier, (iii) Cell phone radiation has been shown to damage, or cause breaking of DNA inside the cell, (iv) Men who regularly carry cell phones on a- belt clip can experience a reduction in sperm count of up to 30%, (v) Some diseases like Alzheimer's Parkinson's Psychological and behavioral problems like learning disabilities, attention deficit disorders, autism have all been linked to radiations from cell

phones, and (vi) Cell phone radiations have also been linked to the alteration of both estrogen and testosterone levels in the body. His study showed that estrogen increases and testosterone decreases when exposed to electromagnetic radiations. An increase in EMR increases the production of estrogen dominance in females and increased amounts of estrogen are a risk factor for breast cancer and prostate cancers in men.

In a study of teens under 16 years of age, scientists in Europe reported short term memory loss after using a cell phone [19, 25]. Reports also showed that young/growing tissues/cells are more vulnerable to radiation effects. In the developing nations, phones waste are littered randomly without concern on its implications on the environment. These constitutes serious hazards since they contain poisonous elements including lead.

Specific Absorption Rate (SAR)

This is the unit used in measurement .of amount of radiation that the human body absorbs from any source including cellular phones. The federal communication commission (FCC) sets limits as to what they deemed were safe levels of radiation from cell phones. In the beginning when "analog phones" were 800-900MHz of power, most of the cell phones manufactured met those safe guidelines. However as manufacturers raised the power of their phone up to 1800-200MHz and analog was replaced by digital majority of the cell phone exceeds the safe level set by the FCC. In fact the manufacturer continue to lobby to have the levels raised so that they may keep increasing the power of the phones. The highest SAR in the body is the ear, thus the concern about excessive cell phone use and the strength of the signal. The highest incidence of SAR occurs in the ear where the phone is placed when receiving or transmitting a call. For a-phone to pass FCC certification, the phone SAR level must be less than l.6W/Kg. In Europe, the level of 2W/Kg is recommended while in Canada, a maximum of 1.6w/kg is allowed. Table gives the SAR values for different phone models.

Near Field Radiation (RFR)

Near- Field refers to that portion of the radiation coming off the antenna that goes directly into the inner ear when the cell phone is placed against our ear to make or receive call. This portion of radiation is considered the most dangerous to the user of cell phones. Reports shows that tumors have been reported just behind the ear, thus any product that could effectively block that portion of radiation from entering the inner ear would be a valuable health tool.

Table 1 Some common phone models and their radiation level in SAR,

Phone model	**SAR (w/kg)**	**Phone model**	**SAR (w/kg)**
Motorola star Tac 130	0.06	Nokia 3210	1.12 ,
Nokia 8810 '	0.20	Sanyo scp 400	1.13
Hagenuk global	0.29	Trium Galaxy (fixed antenna)	1.15
Motorola star tac	0.32	Motorola 3 110	.1.16 ,
Motorola i100 plus	0.35	Ascom Axento	1.19
Mitsubishi trum galaxy 130	0.40	Motorola Stated (TDMA)	1.19
Motorola star Tac 130 (fixed Antenna)	0.46	Motorola 1500.	1.21
Sony cm-Dx 1000	0.48	Philip Genie 1800	1.23
Ericsson SH8	0.51	Nokia 6161	1.26
Sony CMD-C1	0.55	Samsung SCH 6100	1.27
Eriksson 1888 world	0.62	.LG info &Com	1.28

Nokia 6150	0.66	Mitsubishi T250	1.28
Motorola CD 930	0.67	Andiovox9000,	1.29
Siemens C25	0.71	Bosch M.Com 906	1.30
Nokia 8110i	0.74	Ericusson Dh 668	1,30
Audiovox Hap200E	0.77	Dense Tp 2200	1.31
Ericsson Alol83	0.87	Simen C25	1.31
SonyCMD-2i	0.90	Nokia7160	1.32
Ericsson SH888	0.90	Qua! comm. Qcp-2760	1.33
Ericsson GF 788	0.91	Ericsson AI229D	1,35
Triurn Galaxy	0.92	Motorola startec (dual mode)	1.34
Motorola cc! 930	0.94	Denso Toudi point	1.36
Panasonic EB -9520	0.95	Sanyo Scp-310	1.39
Ericsson G.t 688	0.97	NevvjDoint Np-1000	1.40
Audiorox CDm -1000x1.	0.97	Samsung Sch 3500	1.42
Motoroia GSM 1900	0.98	Nokia Lumia 925	1.40
ShargJQG 700	0.98	Motorola Droid Maxx	1.54
Phillip Genie	0.99	Motorola Droid Ultra	1.54
Nokia 1611	0.99	Alcatel One Touch Evolve	1.49
Philips Diga	0.99	Huawei Vitria	1.49
Philips savy	1.00	Kyocera Hydro Edge	1.48
Bosch GSM 909	1.10	Kyocera Kona	1.45
Kyocera Hydro XTRM	1.44	BlackBerry Z10	1.42
ZTE Source	1.41	BlackBerry Z30	1.41
ZTE Warp 4G	1.41	Nokia Lumia 928	1.40

Source: (37-38)

Recommendations:

In other to reduce the effect of radiation from cellular phones, the following are recommended;

- The use of phone kits,
- The use of phone with a long Ariel pointed away from the head,
- If you must use a phone in the car, use a speakerphone so that there is no contact between you and the phone.
- Cut out non-essential calls so as to reduce time spent on the phone.
- Make use of available shielding devices in the market so that you can block some radiation.
- Check the SAR before buying a cell phone.

- Desist from putting your cell phone inside your pockets especially around the pelvic region and the chest.
- Spending much time in making phone calls with cell phone should be discouraged because the more the phone cell is held near the body the greater the chances of exposing the body to these unfriendly radiations.
- Recycling should be given a speedy attention in all developing nations.

IV. CONCLUSION

The long-term effects of cell phone use is still under study. However, in the meantime, governments worldwide and health organizations like the WHO has continued to allocate funds towards ongoing research to determine the effects of cell phone usage. More reports of brain tumors are recorded. Many, users report 'symptoms like hot phones, headaches, fatigue, tingling sensations and even loss of memory have been associated with phone cell-especially for long durations of call. However, we observe a growing use of cell phones worldwide among young teens. A phone made with high value of SAR may have a better reception but its adverse effect to human health is more dangerous than one with a low value of SAR. Though one would like to go for models with, higher reception, the answer is that you are increasing the danger associated with RF radiations, the radiation maps of the phone indicate that high levels of radiations are emitted at the earpiece region of the phone. In some phones, operating the phone with the antenna down (retracted) will dramatically increases the level of radiation into the head through the ear piece. By placing the phone/shield on the cell phone, the radiation levels are reduced dramatically. The actual amount of radiation varies from phone to phone and how phone is used. Sustainable approach to waste management should be adopted by all countries in order to make the environment safe for everyone.

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