International Journal of Business Marketing and Management (IJBMM)
Volume 5 Issue 7 July 2020, P.P. 09-17
ISSN: 2456-4559
www.ijbmm.com

The Awareness of Health Danger with the Usage of Smartphone among the Young Generation

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Abstract: *The growth ofsmartphones usage, the unlimited possibilities of the latest mobile phones and the growing accessibility of this device to every single person in the world have made them indispensable. At the same time, an increasing number of studies are raising the public awareness on the danger of radiations emanating from both Antennas and Phone devices. The marketing of shields and other protection devices is a booming market. Our focus is here to understand whether the public is conscious of this health risk, especially among young and educated people, and whether they have taken steps to protect themselves.*
The results of our findings are encouraging and need deeper research on existing and affordable solutions based on Ion negative products.
Keywords: *health marketing, smartphone dangers, negative ions*.

I. Introduction

Since the past 10 years, the number of mobile telecommunication devices have grown to such a point that more than 2/3 of the world's population uses now mobile phones. At the end of the year 2019, more than 5.1 Billion personsin more than 200 countries were using a smartphone, a multimedia phone or a simple mobile phone (Global digital report, 2019)

The growth of mobile communications has been very fast. In the 1980s, the first generation of phones, deemed mobile, were using an analogue technology. It was only a sound transmission, through quite heavy devices that were the size of a small suitcase. The Digital Technology, namely GSM or Global System for Mobile communication, was deployed first inFinland in December 1991. It included new features and developments such as data and image transmission. This protocol was named 2G (Actually most smartphones are using an evolution of this technology, with the 4G+ transmission protocol). Analogue and digital mobile phones are all using signals transmitted and received in the form of waves. It is called radio frequency (RF).For analogue phones, the RF wavelength ranges from3 kHz to 300 MHz. Regarding digital phones, RF are in microwaves range, from 300 MHz to 300 GHz, as microwave are parts of the electromagnetic spectrum, and we are talking about electro magnetic field or EMF.

People are surrounded by waves from both mobile phones and their antennas. Indeed, GSM Antennas relay and amplify waves to allow a good reception for the user, which wants to send and receive calls.

People have embraced very fast the GSM technology, and everywhere around the world there is a widespread use of mobile phones. Some have no other choices, in remote areas of Africa, Asia or South America, the GSM technology is usually the only one available, as there is no available copper landline.

There have been from the very beginning of the development of mobile phone some concerns about a potential health hazard and possible consequences on health of a long exposure to EMF and RF. So even if some people do not have a choice, between exposure and non-exposure, concern and worries exist.

There are 2 effects of Microwave radiation: thermal and non-thermal. The thermal effect relates to the heat generated by absorption of microwave radiation, exactly like in a microwave oven. One can therefore imagine that being exposed to theses waves as a person has direct effects on the body and consequences on health.

The non-thermal effects of radiationare still not completely understood, (some researches associate it with cell membrane permeability issues). "Sadly the current exposure safety standards are purely based on the thermal effect while ignoring the non-thermal effects of radiation".(Morgan, 2009)

Reports and studies have tried as early as2000 to summarize researches on possible links between mobile phones and health, and particularly any effect of Microwave energy and RF on the increase of cancer cells in the body (WHO, 2006).

Since a long period of latency is often the case, to find the link between tumours and mobile phone usage is usually difficult and complex. Therefore, most of the published researches are not able to reveal the risks of a long exposure to waves, and consequently the long-term effects of the usage of these devices.A better risk analysis through continued research still needs to be done. (Kumar, 2009)

Therefore, a preventive approach should be preconized for the use of any communication device until a better knowledge on the effects on health is made available.The European Union for instance has already released some guidelines on the use of such devices, (European Union Directive) and is providing the public with a detailed information.

II. Problem Statement

It is a proven fact that smartphone and telecommunication devices can be harmful for human bodies, and that most government and world organizations do regularly inform the public about the dangers of mobile phone usage.
If the health effects can only be seen on the long term, it is true that the old generation which has only known the mobile phone in their 40s and 50s is not necessary concerned nor worried (wrongly or not) about the health hazards. But how about the young generation, and the persons who were born when the mobile phones were already in use?

That is why we are focusing here on the young generation (30 years old and younger), if they are aware of these health risks and whether they protect themselves from this risk.

Our research therefore aims to find whether smartphone users are changing their consumer habits when they are getting informed of the dangers of EMF for their health?

Based on the previously mentioned factors on the behaviour of the young generation towards the dangers of the usage of mobile phones, the following research the primary objective of this research is to find out to which extent the perception of the dangers of radiations through the delay use ofsmartphones and electronic pads have an influence on the behaviour ofinformed customers.

The specific objectives of the study are

a) To find out whether people are aware of the danger of EMF when using electronic devices.

b) To determine the change in their usage behavior when they know about the health risks?

c) To investigate the change in their purchase behavior when they are aware of the risks of mobile phone?

d) To identify if people are aware of the new trends in Green business such as EMF and RF shields

III. Significance of study

The findings will give better insight on;

1. The marketing strategies used by protection devices manufacturers towards smartphones and ipad users.
2. The awareness of electronic devices users on the harmfulness of Electric Magnetic Fields.
3. The influence of health warnings policies regarding usage of electronic devices on the consumer habits.

Scope and Limitation

This study will be covering the scope of International Students studying in Malaysia, aged between 17 and 27 years old, which represents students from diploma to post-graduate degree.

For practical reasons, this study will be done among the International students fromMUST (Malaysia University of Sciences and Technology)

IV. Health hazard

The effect of microwave radiation and its thermal effect has been medically studied and refers to the heat generated due to absorption of microwave radiation. Exposure to this Microwave generated heat causes tiredness, cataracts and reduced mental focus.
The evidences found raises concerns about cell phones and exposure to microwaves (WHO, 2006)

Health Consequences of Mobile Phone Usage are quite important, according to WHO reports : "If the risk of developing a brain tumor exists, the wider use of mobile phones and the expected number of people who will develop a brain tumor will suffice to detect a potential 1.5-fold increase in risk from 5 to 10 years from the start of mobile phone use".

There are millions of websites on the risk of microwave radiation, some of which are reported here:

According to The Telegraph (2008), Study carried out by the International Agency for Research on Cancer, found that the chances of developing a malignant tumor are "considerably increased" for people who use mobile phones for a duration of ten yearsor above. They also found that a type of brain tumor called glioma is more likely in long-term mobile users.

There is also a five fold risk of brain tumors for children and adolescents, who are more sensible to health hazard. (the Independent 2008).

A study by Jonas Hardell, a professor of oncology in Sweden, suggests that the risk of developing brain tumors increases dramatically for people who use the phone more intensely and for more years. In addition, a significantly increased risk of brain cancer was observed on the same side as the one wearing the phone but not on the other side.
In addition, the risk has been increased by 30% to develop Acoustic Neuroma, a benign tumor in the brain on a nerve related to hearing that can cause permanent deafness if not removed on time. (Hardell L 2009)

In 1995, Professor Henry Lai and NP Singh published a research on DNA damage in rat brain cells exposed to radiation similar to that emitted by cell phones (Lai H et al 1995). The study was ignored by the mobile phone industry stating that its results had not been confirmed.
The results of the research of a group of 12 researchers in seven European countries, revealed that radiation at certain levels damaged DNA (Reflex,2004).

A study in Saudi Arabia revealed a relationship between headaches, fatigue, dizziness, tension and sleep disorders in people exposed to mobile phone emissions (Thamir Al-Khlaiwi et al 2004). The use of mobile phones has been considered a risk factor for health hazard, which suggests avoiding the excessive use of mobile phones.

Radio-Wave can also have consequences on cell phone users, especially organs such as lungs, nervous system, heart, eyes, testicles and thyroid gland, that all have proved particularly sensitive to radio waves.(The Guardian, 2004)

In summary, the higher the use the higher the exposure to a mobile phone. The higher the exposure to radio and micro-waves, the higher the risk of health hazard.

V. Detail of SAR

What is SAR? The SAR rate is the rate at which radiation is absorbed by the human body. It is measured by a specific absorption rate (SAR), in units of watts per kg (W / kg) of human tissue. Each mobile phone is equipped with a SAR note (although some manufacturers try to hide it). It should always be less than 1.6 W / kg (EU Recommendations).

In order to ensure a "safe" operation, many mobile phone user manuals indicate that the phone must be kept at a certain distance from the user's body for "safe" operation. For example, the Apple iPhone warns the user, "Tested for use at the ear and for worn-out operation of the body (with the iPhone positioned 15 mm (5/8 inches) from the body)." This means that even the existing exposure limits on a false premise) will be violated if the mobile phone is within 15 mm of the body (eg, held in the ear, in a shirt pocket, in a Trouser / trouser pocket, etc.).

Other manufacturers have the same warnings on their user manual.

Since these manuals are rarely read, the devices will probably be placed against the body.

The regulators have set their maximum levels for handsets. Radiation depends on its design antenna, the way it is used and handled. The Institute of Electrical and Electronics Engineers (IEEE) Committee on Man and Radiation, national and international organizations have established safety guidelines for exposure to RF energy.

The SAR values are based on the directives of the Federal Communications Community of the United States. Since the European criteria are higher, the SAR value would be lower than the US equivalent.

The increase in thermal effects occurs when the entire body's energy absorption exceeds a SAR of 4 W / kg. Taking this value as a threshold for adverse effects, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) applies a safety factor of 50 to derive safety limits for exposure to the general public.

However, studies have shown that human exposure to cell phone radiation can change brainwave activity, affect memory and learning at SAR levels as low as 0.1 watt per kilogram (W / Kg) Relative to the permissible level of the United States of 1.6 W / Kg and the ICNIRP permissible level of 2.0 W / Kg.

VI. Products on the market

Since radiowaves and electromagnetic fields are considered as positively charged ions. One of the solutions to reduce radiation is to induce negative ions which minimizes the positive ions and therefore the effects of radiation.(Aniolczyk, 2004)

Negative ionic charge buffer, on which you put your phone when chargingwill absorb negative ions and it is stated that the user is protected for a few days against Radiowaves and EMF.

Negative ions are naturally absorbed by metal, glass and ceramic material (J. Ishikawa). As a result, the cell phone will retain negative ions in its body over time, thereby reducing radio-wave and EMC emissions and protecting the user.

It has been proven that up to 67% of the radiation comes out of the back of a cellular phone, that is why lots of shields on the market are placed on the back of the phone, such as negative ion stickers or protection casings.

How to measure the efficiency of these shields?
The tricky part of measuring the radiation of a cell phone is that the transmission follows a wave frequency. An average measure has to be calculated, through more than 8 different tests, be it SAR, EMF or RF frequency.

The SAR is measured in a laboratory with a specific instrument in order to simulate the texture of the body tissue and the human body and the action of radiation in a depth of 2 cm of tissue.
A Gaussmeter measures the EMF and a RF counter measures Radiowaves.

A good shield for mobile phone with good radiation absorption and a negligible effect on the performance of the mobile phone antenna exists. (Prabir Kumar Duttaand al. 2016).
Are people aware of that?

VII. People reactions

Are people following the recommendations of WHO, European Union and other bodies? It seems that there is a growing interest in shields and other EMF protection that can be found on the market (Ragha, 2010).

This EMF protection devices are manufactured by companies that have sized the opportunity of a so-called "green business". Green business or Green marketing refers to manufacturers which produce environmental friendly products that can benefit the environment and by extension is positive for the health of the consumers. (Ward, 2017)
Are the consumers aware of these products and do they believe they can be a solution to protect them from the mobile phone health hazards?

Few people can say they are not aware of the dangers of cell phone use. Almost every day, either on TV, social networks, radio and on the magazines, the dangers of the phone radiation are displayed.

The scientific community is quite prolific on the consequences of the usage of a smart phone or any other telecommunication device, from the infertility danger (Agarwal, A, 2011) to Glioma, cancer, tumors (L. Lloyd Morgan, 2009).

Our study aims to find out whether people know and whether they adapt their phone use consequently.

Very few information is available on the latest "green marketing" trends, new habits of cell phone users and the new protection devices efficiency. We aim to fill part of this gap in our survey.

Research methodology

This research is going to be solely based on data obtained from a quantitative form of survey. These statistics will then be used to provide a measure of the behaviour of the participants in the study from a numerical and statistical point of view.
Secondary data that is included in this study was mostly found on internet statistics websites such as IWS.
The primary data used was obtained from the 16-questions survey that was posed to 88 of the students in Malaysia University of Science and Technology.
We adopted a deductive approach, with the hypothesis that the smartphone users are aware of the dangers of the radiations. We decided to go for a quantitative method, on a convenience sample.

Collecting data

The method of collecting data in this study was by way of a Questionnaire.
The data available is based on the average number of student in Malaysia University of Science and Technology, which is an international university with 20% of its students being foreigners and a Registered number of students in the university at the end of December 2017 of 1,000, (Registrar office data).
The sample size, with a 10% an acceptable margin of error has been calculated at 88 with a level of confidence of 95%

Most of the data required for the study was collected by Using online monkey survey tool. Links to the questionnaire were sent by Email to a group of 200 bachelor students, and got 90 replies.

VIII. Questionnaire

The questionnaire consists of 16 questions, 8 questions to reply by yes or no, 1 questionabout gender, 1 numerical question and 6 multiple choices questions. The question 3 will stop the questionnaire for the persons not in the target sample.

The questions 7 and 8 depend on a positive answer to the question 6.

Question 14 is to validate the negative answer to question 13.
The questionnaire is found in Appendix A

IX. Analyse of data finding

The survey was answered by a majority of young male students aged 22 years old and above.

The questions 1 to 5 were qualifying questions, to make sure that the respondents are in our target population. In our survey, 88 persons out of 90 do have a smartphone. Most of them keep the phone in their bedroom at night (convenience reason?) and 1/3 have their phone near their bed.

It would be interesting as a further research to learn more about the reasons why people leave their phone outside their bedroom (26% of the respondents) at night, whether for practical reasons or because of an awareness to the dangers of the phone radiations.

Also 41% of our respondents already experienced problems with their phone (overheating….) which might have influenced their decision of having the phone out of the bedroom at night and might also influence their awareness of the phone dangers.

Our first objective is answered through the questions 6to 11. According to our survey, 78.6% of people are aware of the EMF emissions from the phone, even if the SAR level which is used to measure the EMF emissions is unknown to more than 87% of them.

Almost 19% of respondents had a health problem linked to their phone usage which is also a proof of awareness of the dangers of the phone radiations, even if for half of them, they don't identify the common sickness link to phone radiations, like migraine, Eye pain and lack of sleep as the sickness they experienced.

Our second objective, to determine whether people change their behaviour when they are aware of the dangers is replied in the question 8 and the question 15. It is interesting to learn that 41% of the respondents still do nothing about it, unless it is for their kids, where 76% would take action to protect them. But if 41% of the respondents do nothing about it is it linked to the fact that 55% do not know what to do about it? (question 10). It might be interesting to learn more on this specific information, through a deeper research.

Our third and fourth objectives were to identify the purchase behaviour of informed people through their awareness of the existing protection devices.Phone radiation shields are not known from 41% of the respondents, which is a high proportion. But if we look at the respondents who know what are the protection devices, 83% of them (44 persons out of the 53) already purchased a protecting device (question 13). An interesting 63.4% of the people who did not purchased a protection device (question 14) say that it is because they are not convinced of the efficiency of this devices or because they have not found the right protection. Is it a lack of available information on the market? A lack of communication on a sensitive issue from the smartphone manufacturers?

We can see that unless it is for their children, people, even when they are aware of the new EMF protection industry, are still not completely ready to change their behaviour. 2/3 of the respondents are not convinced of the efficiency of the protection devices for themselves, but still would be willing to purchase such a device for their children.

It seems that since the awareness of this industry is still low, the price is not something relevant yet, as we can learn from the answers of the question 16, where no real tendency emerges from the psychological price tag of EMF devices.

The market of Green business and especially EMF devices is still unknown to lots of people.

X. Recommendations

The following recommendations are for the marketing departments of companies manufacturing EMF devices, after the findings of this survey on the awareness of protection devices against smartphones radiations among the young generation

- More communication should be done on how to protect the user from the danger of phone radiation

- Companies should take an educative stance to inform the population on the available solutions to protect themselves from Smartphone EMF emissions.
- More demonstration of the efficiency of these devices need to be done, to convince buyers of the utility of such devices.

The students fall in the age group which is a very important target for companies. Once they build trust with this group, through information and educative communication, they can thenslowly build brand and product awareness.

A study to differentiate the effects of the Antennas compared to the effects of the phone itself should also be conducted, especially as the latest 5G technology is about to be implemented worldwide for communication.

XI. Conclusion

The market of devices to protect people from the smartphones radiation is still in the early stages, for many reasons. The communication on the danger of smartphones goes against the general communication of the giant companies who manufacture phones, such as Apple, Samsung, Huawei….and therefore is difficult to initiate.

People are aware of the dangers of smartphones EMF emissions, but due to lack of communication and because of the actual size of the EMF devices market, and a small offer on this market, phone users are not all ready to buy these devices.

It would be interesting to follow up the evolution of the purchase behaviour of phone users these next 5 years, in order to observe changes in their habits/

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Appendix A

Questionnaire on the sensitivity of consumer to the danger of phone radiation

1. **How old are you?**

□ between 16 and 18 □ between 19 and 21 □ between 22 and 24 □ above 24

2. **Are you?**

□ Male□Female

3. **Do you have a cellphone or a smartphone ?**

□Yes□No

4. Where do you generally charge your smartphone at night?

□ Near my bed □ On a table in my bedroom □ Outside my bedroom

5. Have you experienced any problem with your phone before such as ?

□Battery stops because of over-heating□Battery explosion / fire □Other physical problem □No

6. **Have you experienced any health problem linked to heavy phone usage?**

□Yes□No

7. If yes were they ?

□Headache / migraine□Eye pain □Lack of sleep □Nauseas □Others

8. If yes, what action do you take to protect you?

□use hands free kit□use loudspeaker □use less the phone □do nothing much

9. Do you know that phones emit wave radiations and electromagnetic fields?

□Yes□No

10. Do you know how to reduce your exposure to these radiations?

□Yes□No

11. Do you know the SAR level of your own phone?

□Yes□No

12. Have you heard of phone radiation shields?

□Yes□No

13. Have you ever bought a phone radiation shield such as phone cover, sticker or negative ions card ?

□Yes□No

14. If no what is the reason?

□I don't think it is efficient□I know how to protect myself from phone radiations □I have not found the proper protection □Protections are too expensive

15. Knowing the kids are more fragile and receptive to this harmful radiations, even if you do not buy for you, would you still buy for your kids?

□Yes□No

16. How much would you be ready to spend for a proper device that protects you and your family from phone radiation for the next 10 years?

□Below 100 RM□Between 101 and 250 RM □Between 251 and 400 RM
□Above 400 RM