Imperial Journal of Interdisciplinary Research (IJIR)
Vol-3, Issue-11, 2017
ISSN: 2454-1362, http://www.onlinejournal.in

Mobile Phone Usage and Awareness of Health Hazards among the Adolescents in Sylhet City

Jannatul Ferdous
Senior Lecturer, Dept. of Business Administration, Metropolitan University, Sylhet, Bangladesh

Abstract*: Adolescents around the world are increasingly confident and passionate users of mobile phones (MPs). They are embracing the opportunities provided by it in ways that could not have been predicted a decade ago. Research has revealed that the MPs are the dominant sources of radio wave exposures and relevant sources of extremely low frequency magnetic fields, which can penetrate easily into the head of children and may show a significant effect on their cognitive function. A cross sectional study was conducted by distributing a perception questionnaire among 178 adolescents of school and college of Sylhet city to show the present phenomenon of MPs usage by them and to create awareness among them against the adverse effects associated with the usage of MPs. Percentage and logistic regression model are used to study the distributions, associations, and determinants of the entities. From the study, it has been revealed that in Sylhet nearly 70% of all adolescents surveyed use MPs, among which 46% of users are between ages of 12-16 years and 54% are between ages of 16-20 years. Furthermore, the analysis shows that nearly 70% of the teenagers who are using MPs are facing different types of health problems due to the long/short duration communication through the MPs. The findings of this study conclude that as long as the adverse health effects cannot be ruled out with some degree of certainty, it appears to be appropriate to emphasis on the prudent use of MPs by children.*

1. Introduction

Mobile phones (MPs) are becoming the most ubiquitous technology around the whole world, in particular among adolescents. The widespread and intensive use has created concern that it may cause behavioral or concentration problems, which belong to the most common health complaints of adolescents. Researchers in various disciplines have been extensively examining how adolescents use MPs and what influences MPs usage has on their lives for more than 20 years [1-3]. Typically, MPs transmit and receive Radio Frequency (RF) signals in order to communicate. The RF signals from MPs fall within the microwave part of the electromagnetic spectrum. This radiation is also referred to as microwave radiation or RF radiation or electromagnetic radiation. RF exposure from MPs is concentrated to the handset closest to the head tissue, which includes the auditory nerve and the exposure is relatively high only for the glial and meningeal tissue closest to the surface of the head, the parotid gland, and the vestibular portion of the eighth cranial nerve where acoustic neuromas arise [4-6]. To date, numerous research reports have been reported in the literature regarding the possibility of adverse health effects related to RF electromagnetic energy (EME) emissions from MPs and their associated base stations [4, 5, 7-10].

Safety standards have been established by Federal Communications Commission (FCC) to limit the microwave radiation exposure from mobile phones and base stations. The FCC settled a standard that defines the maximum RF energy allowed to be absorbed through the head when using a mobile phone, measured through a value called the Specific Absorption Rate (SAR). The SAR is a value that corresponds to the relative amount of RF energy absorbed in the head of a user of a wireless handset. The FCC limit for public exposure from cellular telephones is an SAR level of 1.6 watts per kilogram (1.6 W/kg) [11]. However, if the thermal effect does not cause a temperature increase in our head of more than one degree, the microwave exposure is deemed to be safe. But many research studies have shown that non-heating, or non-thermal, microwave radiation has a profoundly negative effect on the human body. A 2003 study by Prof. Salford et al for example, established for the first time evidence for neurological damage caused by non-thermal microwave exposure [12].

Children that grow up in our new mobile phone world are exposed to microwave radiation from the moment they are in the womb. The Stewart Report is a report commissioned by the British Parliament in

response to fears that mobile phone use could be linked to memory loss, and even Alzheimer's disease. It explains the effect of mobile phone radiation on children, mentioning that a one year old could absorb around double RF radiation and a five year old around 60%, more than an adult. A German study showed that the possibility of developing cancer is three times higher for people who lived within 400 meters of a cell phone tower for a period of five years [8]. A similar Spanish study found that people living in the close vicinity of a cell phone tower had the following health problems: 1) depression increased by up to 64-fold, 2) fatigue increased by up to 37-fold, and 3) appetite loss increased by up to 25-fold [13]. Moreover, it has been reported that adolescents may be more vulnerable to RF-EME due to the developing nervous system. Their brain tissue is more conductive than that of adults due to the higher water content and ion concentration. Besides, due to the smaller circumference of their head, RF-EME can penetrate into regions that are deeper in their brains and about two times higher fraction of RF energy is absorbed in the peripheral brain tissues of children aged 5-18 years as in adults [14, 15]. As a consequence, the widespread and intensive use of MPs has attracted immense concern that it may cause behavioral or concentration problems, which belong to the most common health complaints of adolescents [16-19].

In the current work, I tried to elucidate the usage pattern of MPs by adolescents in a specific region of Bangladesh (Sylhet) and its impact on their health in order to concern the parents and the guardians through a case study. The outcome of this research indicates that parents can overcome these hazards and give the country a future healthy generation by practicing some precautionary steps, carefulness, and maintenance of the Department of Health advice.

2. Methods

In this cross sectional survey, questionnaire was sent out to 200 currently enrolled students from 6 schools and 5 colleges in Sylhet city. The questionnaires were distributed and collected during school/college hours by the research staffs who had previously received survey training. The students were eligible to ask the research staffs if they had any problems with the questions. Among these, 178 questionnaires were selected for the analysis after excluding those with incomplete information.

2.1. Questionnaire

The questionnaire was composed of three parts as follows: demographic information, information on MP usage and self-reported physical symptoms.

2.2. Demographic Information

In this section demographic information such as name, sex (male/female), age, education level (school/college) were listed.

2.3. Information on MP Usage

To obtain information about time spent using a MP, students were asked to answer the following questions. "How much time do you spend making phone calls per day?". MP usage was assessed using these questions, "which ear you preferred for receiving/calling (right/left/both)?", "where do you put your MP during the day (pocket/bag/others)?", "what is the mode of your MP at night (powered on and nearby the head or keep away from the head)?". They are also asked "is there any mobile base station around your home?"

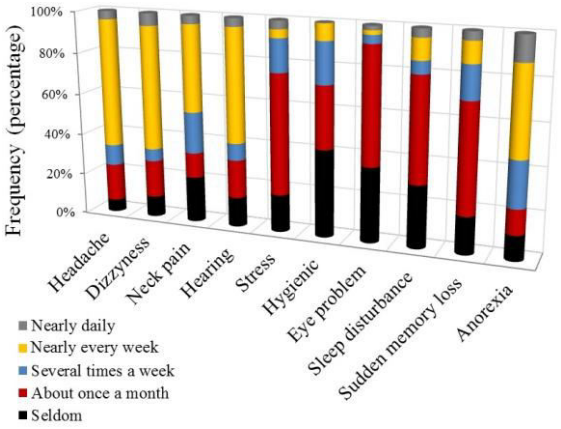

Figure 1. Overall conditions of the symptoms among the respondents

2.4. Self-reported Physical Symptoms

Health related 10 variables were included in the questionnaire. These were: headache, dizziness, neck pain, hearing problems, eye problem, sleep disturbance, sudden memory loss, and anorexia and hygienic. These symptoms were assessed on a 5 point Likert scale (nearly daily, several times a week, nearly every week, about once a month, seldom or never). The Cronbach's α coefficient of the well-being items was 0.83. The overall conditions of the symptoms among the respondents were presented in the Figure 1.

2.5. Statistical Analysis

Chi-square tests ($\chi 2$) were used to compare the prevalence of physical hazard symptoms between different classifications of MP usage. Odd ratios and 95% CIs were obtained using logistic regression

models to assess the potential associations between the gender, years of MP usage, the daily duration of MP calls, habit of answering phones by ear, position of MP during the day, mode of MP at night, whether close to mobile phone stations or not and the prevalence of well-being symptoms in children. All the self-reported symptoms for each student were taken into account and a total score of severity (TSS) was calculated. The TSS was calculated by the following equation:

$$TSS \text{ for each individual} = \Sigma (\text{Self-reported symptom} \times \text{Severity factor of that symptom}) \quad \ldots\ldots\ldots\ldots (1)$$

To determine the severity of a factor in the above equation, nearly daily reported symptoms were scored one, while those reported several times a week two, nearly every week by three, about once a month by four, and seldom by five respectively. In the next step, according to their total score of severity, all participants were classified into two groups, namely yes or to suffer from different hazards. Thus hazard following conditions is treated as dependent variable that is classified in the following way:

$$Y = Hazard\ condition = \begin{cases} 1, yes\ (if\ he\ or\ she\ follows\ hazard) \\ 0, otherwise \end{cases}$$

Assessment of the fit between the model and data was gauged by the goodness of fit test. From the explanatory variables which were found statistically significant i.e., $p < 0.05$ wer e included in the logistic regression model. Statistical analysis was conducted using SPSS 22.0.

3. Results and Discussion

3.1. Descriptive Information

Out of 200 students from 6 schools and 5 colleges, 22 questionnaires were incomplete. In total, 178 (89%) questionnaires were completed in all sections (including demographic information, information on MP usage and different self-reported physical symptoms) and were used in the analysis. Among the participants, 51.12% are male and 48.87% are female. The mean age was 15.26 ± 1.77 years. A total of 92 (51.68%) of the adolescents from college level and the rest 86 (48.31%) from the school level.

Overall, 70.10% students use mobile phones at the time of survey and had been using a MP for a mean of 3.59 ± 2.41 years. Participants spent 9.44 ± 14.98 minutes on making calls daily. The details of the socio-demographic characteristics and MP usages are given in Table 1.

Table 1. Descriptive data of socio demographic characteristics and the use of MP (N = 178)

Characteristics	N (%)
Sex	
Male	91 (51.12)
Female	87 (48.87)
Age	
12	7 (3.29)
13	25 (13.63)
14	34 (18.87)
15	37 (19.08)
16	29 (15.76)
17	22 (12.76)
18	18 (9.52)
19	5 (2.73)
20	1 (0.56)
Education level	
School	86 (48.31)
College	92 (51.68)
Location to mobile base stations	
Close to mobile base stations	131 (73.59)
Far away from base stations	47 (26.40)
Characteristics	**Mean ± SD**
Age	15.26 ± 1.77
Duration of using MP	3.59 ± 2.41
Duration on call (min/day)	9.44 ± 14.98

3.2. Association Between MP Usage and Hazard Conditions

The overall prevalence of health prevalence of the hazard condition was 49.79% out of 178 valid questionnaires in the study. The prevalence of the hazard condition was significantly associated with gender, duration of using MP, duration on call per day, habit of answering phone by ear, position of MP during the day, mode of MP at night, location to mobile base stations but the using status during travelling, education level, age, number of SMS received or sent per day and number of calls are insignificant with hazard following conditions.

To identify the determinants of health hazard followed by the adolescents of Sylhet city of Bangladesh, a logistic regression model has been fitted. The significant outcomes are summarized in the Table 2. In this model, health hazard following conditions are considered as response variable and the gender, duration of using MP, duration on call

per day, habit of answering phone by ear, position of MP during the day, mode of MP at night, location to mobile base stations were considered as explanatory variables.

Sex of the students was not a significant factor for having health hazard as the p value for gender (0.832) is less than 0.05. This result indicates that gender does not play a vital role in having any health hazards.

The regression co-efficient for the adolescents who were using MPs 2-4 years is 0.062 and the corresponding odd ratio was 0.451 (95% C.I. (0.102, 0.315)), which is not significant. However, the participants using more than 4 years had a regression co-efficient of 1.720 with an odd ratio of 1.064 (95% C.I. (0.601, 1.884)) is significant, which indicates that the adolescents using MP more than 4 years are 1.064 times more hazard follower than whose were using MP for 0-2 years.

Habit of answering phone by the respondents contributes significantly on the model. It refers that students who received phone calls by left ear are 0.23 times less hazard follower than those who received by right ear and the significance value is 0.04 with a confidence interval (0.090, 0.591).

Table 2. Association between the use of MPs and the conditions for health hazard

Explanatory Variables	B	S.E.	Sig.	Relative risk or odds ratio Exp(B)	95% C.I. for Exp(B)	
					Lower	Upper
Gender						
Male (r)				1.000		
Female	-1.469	0.481	0.830	0.230	0.090	0.591
Duration of using MP						
0 - 2 years (r)				1.000		
2 - 4 years	0.062	0.289	0.251	0.451	0.102	0.315
> 4 years	1.220	0.291	0.000	1.064	0.601	1.884
Duration on call						
0 - 10 min/day (r)				1.000		
10 - 20 min/day	0.452	0.238	0.175	1.572	0.987	2.505
> 20 min/day	0.347	0.291	0.057	1.415	0.856	1.884
Habits of answering phone						
Right ear (r)				1.000		
Left ear	-1.469	0.481	0.042	1.230	0.090	0.591
Both	0.035	0.221	0.873	1.036	0.672	1.598
Position of MP during the day						
Pocket (r)						
Bag	-0.402	0.348	0.05	0.266	0.338	1.324
Other	-0.103	0.554	0.853	0.902	0.302	2.691
Mode of MP at night (power on)						
Nearby their heads (r)				1.000		
Away from their heads	-0.349	0.190	0.049	0.705	0.486	1.024
Location to mobile base stations						
Close to mobile base stations (r)				1.000		
Far away from base stations	0.632	0.213	0.03	1.882	1.240	2.556
-2log likelihood = 790.762	Cox & Snell R square = 0.246			Nagelkerke R square = 0.381		

Position of MP during the day is less significant factor in the model. It is seen from the Table 2 that the adolescents who were used to keep their MP in bag 0.26% less sufferer than the others who kept in pocket.

Participant's practice to keep the mode of MP at night, which is categorized as "powered on and nearby their heads or keep away from their heads" are significantly associated with the dependent variable. Table 2 magnifies that the adolescents

whose mode of MP at night is power on and keep away from their heads are 0.7.5 times less hazard follower compared to their counterpart. This variable determines the hazard condition with aloe degree of significance level (0.049) and confidence interval of (0.486, 1.024).

Now-a-days, almost all the adolescents are within the coverage of different types of mobile base stations. But from our study it is revealed that those who are close to the mobile base stations (1 km or less than 1 km) are significantly (0.03) 1.88 times more sufferer than the others who are far away from the mobile base stations with a confidence interval (1.240, 2.856).

4. Recommendations

From the extensive literature reviews (related works) and the findings from this work, it is obvious that excessive/frequent use of MPs is related to health problems or concentration capacity in adolescents. As the safety of adolescents is of paramount importance, the current findings suggest some undeniable steps to get rescued from it:

1. New standards should be developed in order to protect adolescents from the possible health consequences of exposure to microwave radiation.
2. The widespread use of MPs by adolescents for non-essential calls should be discouraged.
3. Using a handset to places more distant between users' head and the antenna (the main source of radiation).
4. The mobile phone industry should refrain from promoting the use of MPs by adolescents.
5. Use of MP only when a conventional phone is not available.
6. Keeping the phone off of users' lap as well.
7. Avoid long conversations and frequent use.
8. Planning guidance on base station locations.

5. Conclusions

In summary, the outcome of the current work reveals that the increasing trend of using MPs among adolescents in Sylhet city, Bangladesh are depending on their educational status, region and financial condition. It also shows that the frequency of use of MPs exponentially increases with increasing age of the adolescents. RF radiation is a proven health risk and children are affected more by it as children are more sensitive due to their developing nervous system. It is found that the radiation caused by MPs and MP masts has a negative effect on the health of adolescents and they are facing different types of health problems. Most studies have only looked into the (relatively) short term effects. The long term effects of continuous exposure to microwave radiation, starting from the earliest beginning are unknown. More research is always needed to understand the full extent of the health implications that come with microwave radiation. In conclusion, this research recommends that we should listen to the Department of Health advice and do not allow the adolescents to affect their future health and potential by misusing or excessive using a MP.

6. References

[1] Soderqvist, F., Carlberg, M., and Hardell, L., "Use of wireless telephones and self-reported health symptoms: a population-based study among Swedish adolescents aged years", *Environmental Health*, 7, 18, May 2008, pp. 15-19.

[2] Yan, Z., Chen, Q., and Yu, C., "The science of cell phone use: Its past, present, and future", *International Journal of Cyber Behavior, Psychology and Learning*, 3, 1, January 2013, pp. 7-18.

[3] Zheng, F., Gao, P., He, M., Li, M., Wang, C., Zeng, Q., Zhou, Z., Yu, Z., and Zhang, L., "Association between mobile phone use and inattention in 7102 Chinese adolescents: a population-based cross-sectional study", *BMC Public Health*, 14, 1, October 2014, pp. 1022.

[4] Galeev, A. L., "The effects of microwave radiation from mobile telephones on humans and animals", *Neuroscience and Behavioral Physiology*, 30, 2, March 2000, pp. 187-94.

[5] Kim, K. H., Kabir, E., and Jahan, S. A., "The use of cell phone and insight into its potential human health impacts", *Environmental Monitoring and Assessment*, 188, 4, April 2016, pp. 1-11.

[6] Klaps, A., Ponocny, I., Winker, R., Kundi, M., Auersperg, F., and Barth, A., "Mobile phone base stations and well-being – A meta-analysis", *Science of the Total Environment*, 544, February 2016, pp. 24-30.

[7] Bandara, P., "Mobile phone use and the brain cancer incidence rate in Australia", *Cancer Epidemiology*, 44, January 2016, pp. 110

[8] Eger, H., Hagen, K. U., Lucas, B., Vogel, P., and Voit, H., "The influence of being physically near to a cell phone transmission mast on the incidence of cancer", *Occupational and Environmental Medicine*, 63, 5, May 2006, pp. 307-313.

[9] Kucer, N., and Pamukcu, T., "Self-reported symptoms associated with exposure to electromagnetic fields: a questionnaire study", *Electromagnetic Biology and Medicine*, 33, 1, March 2014, pp. 15-17.

[10] Lonn, S., Ahlbom, A., Hall, P., and Feychting, M., "Long-term mobile phone use and brain tumor risk", *American Journal of Epidemiology*, 161, 6, March 2005, pp. 526-535.

[11] *Radio Frequency Safety - Cellular Telephone Specific Absorption Rate (SAR)*, United States, Office of Engineering and Technology, Federal Communications Commission (FCC). Retrieved from https://www.fcc.gov

[12] Salford, L.G., Brun, A.E., Eberhardt, J.L., Malmgren, L. and Persson, B.R., "Nerve cell damage in mammalian

brain after exposure to microwaves from GSM mobile phones", *Environmental Health Perspectives*, 111, 7, June 2003, pp. 881-883.

[13] Oberfeld, G., Navarro, E., Portoles, M., Maestu, C., and Gomez-Perretta, C., "The microwave syndrome-further aspects of a Spanish study", *Biological Effects of EMFs, Kos Greece*, October 2004.

[14] Kheifets, L., Repacholi, M., Saunders, R., and Deventer, E. V., "The sensitivity of children to electromagnetic fields", *Pediatrics*, 116, 2, August 2005, pp. 303-313.

[15] Heinrich, S., Thomas, S., Heumann, C., Von Kries, R., and Radon, K., "Association between exposure to radiofrequency electromagnetic fields assessed by dosimetry and acute symptoms in children and adolescents: a population based cross-sectional study", *Environmental Health*, 9, 1, November 2010, pp. 75.

[16] Byun, Y.H., Ha, M., Kwon, H.J., Hong, Y.C., Leem, J.H., Sakong, J., Kim, S.Y., Lee, C.G., Kang, D., Choi, H.D., and Kim, N., " Mobile phone use, blood lead levels, and attention deficit hyperactivity symptoms in children: a longitudinal study", *PLoS One*, 8, 3, March 2013, pp. 59742.

[17] In-Albon, T., Zumsteg, U., Muller, D., and Schneider, S., "Mental disorders in the pediatric setting–results of a Swiss survey", *Swiss Med Wkly*, 140, January 2010, pp. 13092.

[18] Roser, K., Schoeni, A., and Roosli, M., "Mobile phone use, behavioral problems and concentration capacity in adolescents: A prospective study", *International Journal of Hygiene and Environmental Health*, 219, 8, November 2016, pp. 759-769.

[19] Thomas, S., Heinrich, S., Von Kries, R., and Radon, K., "Exposure to radio-frequency electromagnetic fields and behavioral problems in Bavarian children and adolescents", *European Journal of Epidemiology*, 25, 2, February 2010, pp. 135-141.