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Mobile Phone Base Stations and its Health Hazards

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Abstract

A cross-sectional study was conducted from Oct 2014- Dec 2014, of three hundred ninety four randomly selected inhabitants in Sanctoria at Kulti block of Burdwan district who are having there for more than three years near two selected mobile phone base stations was undertaken using a questionnaire. Nineteen different symptoms (Non Specific Health Symptoms-NSHS), described as radiofrequency sickness, were studied by means of the chi-square test studies made in relation to the sex, age and distance from mobile phone base stations show significant ($p < 0.05$) increase as compared to people living >300m or not exposed to base stations. Women respondents complained the feeling of nausea, sleep disturbances, irritability and the men complained the feeling of Back pain. Relation to age the respondents older than 19 years, this study shows, the existence of a greater sensibility of some NSHS symptoms such as headaches, fatigue, sleep disturbances, depressive tendencies ,irritability, feeling of discomfort, hearing problem, back pain when comparisons are made between subjects living up to 300m vs. subjects of the reference group. In relation to distance, the complaints were received in a significantly higher ($p < 0.05$) proportions in the distance zones of 20m to 300m than the <20m from base stations. Up to 20m the symptoms are headaches, fatigue, sleep disturbance, feeling of discomfort, irritability, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, and back pain. Significant differences ($P < 0.05$) are observed up to 100 m from base stations for symptoms such as complained headaches, fatigue, felling of discomfort, irritability, depressive tendencies, difficulty in concentration, hearing problem, back pain. Beyond 200 m only the symptom of headaches, fatigue, sleep disturbances, irritability, movement difficulties, back pain is reported at a significantly high frequency ($P < 0.05$).

Key words:- Mobile phone base station, Electromagnetic field (EMF), Radio frequency (RF), Non specific health symptoms (NSHS).

Introduction

Use of mobile or cellular phones has increased significantly in the last decade. One cannot imagine a world without mobile communication anymore. Cellular or mobile phone technology is based on widespread network of base stations that connect through Radio Frequency (RF) signals. With the increasing presence of mobile phones towers, concern about possible health hazard caused by human exposure to RF in general and radiations emitted from base stations in particular are increasing.

Radio waves are basically electromagnetic waves which are transverse in nature. In the electromagnetic spectrum radio waves have frequencies ranges from 3 KHz to 300 GHz. Electromagnetic radiation is a form of energy consists of electric and magnetic energy perpendicular to each other and can propagate through space with the speed of light. Electromagnetic fields have both natural and artificial sources. Natural source of electromagnetic fields include sunlight, lightning and earth's magnetic field. Even the human body

has its own natural EM fields, which can carry messages along the nervous system. Artificial sources of electromagnetic fields are TV, Computers, mobile, base station, Microwave oven etc. Radio frequency (RF) fields spread out from base station antenna, like a beam of light from a lighthouse. Very close to the base station the strength of RF field is low. The region where the field strength is low is known as shadow region. The strength of RF field initially increases to small peak at 50 m to150 m depending on the tilt of the antenna and then reduces as distance increases. This is known as selective fading.

In accordance with the frequency and power level electromagnetic radiations are of two types' viz. ionizing radiation and non-ionizing radiation. X-rays, γ-rays and UV rays are the examples of ionizing radiations which negatively affect DNA structure of living organism (Khurana, et al. 2009)[1]. On the other hand, cellular phone base stations mainly produce and spread out non-ionizing radiations. Nobody would deny that the use of cellular wireless mobile phone in our country has been increased extensively during last decade. Cellular mobile phones were launched in India in 1995 and it is one of the top growing mobile telephony industries in the globe. According to the Telecom Regulatory authority of India (TRAI, 2012)[2] wireless user in urban area is 63.27% and rural area is 33.20%.In 2013, more than one billion people used cell phone connection in India. Nowadays, we find the mobile phone base stations frequently near or on shops, residential apartments, close to hospitals, educational institutions and densely populated urban residential areas. The increased use of mobile phone has been great concern for human health due to chronic exposure to RF signal and RF radiation from mobile towers. The exposition of RF radiation from mobile base station is of low power but it is a continuous process. Thus, it is expected that the exposure of non-ionizing radiations may have some adverse impact on health of the people residing close to the base station. The present study has attempted to explore the health impact on the exposure of non-ionizing radiation from two mobile base stations for the people living close to the stations.

We can separate probable health effects into two points of view – short run effects and long run effects. The common short run health effects are sleeping disorder, heart rate, high blood pressure, malfunction of brain. On the other side, headache, dizziness, fatigue, sensation of warmth, visual symptoms, memory loss, sleep disturbance, muscle pain, tumors and cancer are the examples of long run health effect of radiation spread from mobile phone base stations. A branch of studies have already assessed the impact of mobile phone base stations on health concern of the people living nearby the stations. We have reviewed some of them. Pachuau, et al. (2014) [3] have measured the power density in close proximity to mobile base station at the selected zones in Aizawl in Mizoram. They have found that the measured values of power densities at all the sites are higher than that of the safety recommendation of Bioinititative, 2012 but well below the safety limit prescribed by ICNIRP. They have reported that compared to males, females in the survey area are suffering more from health hazards. People residing close to the towers suffer more from health hazards than those residing far away from the towers. Conducting a primary survey in France, Santini et al. (2003)[4] have reported that closeness of residential house to the tower and duration of living significantly affects the frequency of symptoms reported. Apart from that, there is a significant association of frequency of symptoms reported with age and sex. Therefore, it is evident that mobile phone base stations have some negative health effect.

Objectives of the study:

The particular objectives of this study are as follows.

First we have investigated the sex wise variations of the selected health hazard symptoms in the sample zone.

Second objective of this study is to explore the associations between distance of residential house from the towers and exposition of the health hazards.

Third, the study examines some selected symptoms according to different age groups.

Materials and Methods

In literature we find different health concern symptoms as a consequence of the establishment of mobile phone base stations. In this study we have considered headaches, fatigue, nausea, sleep disturbances, difficulty in concentration, memory loss, visual disturbances, dizziness, movement difficulties, skin problems, throat cancer, leukemia, cardiovascular problems, breast cancer, hearing problem and back pain as probable indicators of health hazards due to establishment of the towers. In order to examine the impact of the existing tower on human health we have conducted a primary survey during Oct-Nov-Dec 2014 at Kulti block of Burdwan district. The survey was conducted at Sanctoria village which has been purposively selected for this study. There are total four mobile phone base stations in this village. Of them we have selected two towers which are situated at the densely populated area of the village. These mobile base stations have been erected five years back from our study year. In this study 90 households residing surrounding these two towers ranges from one to five hundred meters have been selected randomly. We have interviewed 394 persons with a structured questionnaire.

Then we have tested the variability of the selected symptoms in between male and female persons. In order to measure the impact of distance the study has compared the exposed person of different sub-groups within 300m with non-exposed person residing at greater than 300m from the base stations. Finally we have tried to capture the age group and distance wise experience of the symptoms of the people of our sample area. For all this purpose we have applied Chi-square test as an analytical tool.

Results

Table-1 shows the distribution of diseases among sample male and female. When the male and female comparison is made from all frequency of symptoms exposed at a distance up to 300m, sample males complained mostly headache, fatigue, feeling of discomfort, depressive tendencies, movement difficulties, back pain and women complained of nausea, irritability, which are significant at 5% level. On the contrary, for the other symptoms frequency of sufferings for male and female are not statistically significant in the area under study.

Table-1: Percentage Influence of sex comparison of inhabitants living near base station within 300 m (M=191, F141)

Symptoms	Male	FEMALE	P- Value
Headaches	57*	38.2	0.007
Fatigue	57.5*	47.5	0.001
Nausea	41.8	76.5*	0.041

Sleep disturbance	34	63.8*	0.04
Feeling of discomfort	57*	53.9	0.015
Irritability	41.8	78*	0.029
Depressive tendencies	50.2*	49.6	0.03
Difficulty in concentration	43.4	49.6	0.293
Memory loss	4.7	0.007	0.011
Visual disturbances	25	26.2	0.195
Dizziness	20.9	24.8	0.563
Movement difficulties	51.3*	48.2	0.019
Skin problems	40.3	47.5	0.404
Throat cancer	0.01	0	0.157
Leukaemia	0	0	0
Cardio vascular	5.7	9.2	0.683
Brest cancer	0	12	0
Hearing problem	51.3	54.6	0.112
Back pain	58.1*	46.8	0.0007

* ($P < 0.05$) significance difference in comparison between male and female

Distance

Table -2 shows that male persons residing up to 20 m and not beyond that are more likely to feel the certain symptoms like headaches , fatigue, sleep disturbance, feeling of discomfort, irritability, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, back pain compare to male residing more than 300m away from the mobile phone base stations. On the other hand, in contrast to female residing more than 300m away from the mobile base stations female persons up to 20m and not beyond that are complained headaches, fatigue, nausea, , sleep disturbance, irritability, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, back pain. Among the people residing in the range 20m – 50m away from the base station male persons are experienced the symptom like headaches, fatigue, feeling of discomfort, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, back pain compare to male person residing greater than 300 m from the base stations. However, in this range female persons relative to females living 300m away from mobile residing up to 20-50m are more likely to feel headaches, fatigue, nausea, sleep disturbance, feeling of discomfort, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, compare to female person residing greater than 300m from the mobile Phone base stations. Significant differences ($\rho<0.05$) are observed in the zone 50m – 100m from the base stations where male persons have complained of headaches , fatigue, feeling of discomfort, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, back pain compared to male persons residing greater than 300m from the base stations. On the other hand female person are more likely to feel headaches, fatigue, sleep disturbance, feeling of discomfort, irritability depressive tendencies, difficulty in concentration back pain compared to female persons residing greater than 300m from the base stations.

In the zone 100m – 200m from the base stations male persons are more likely to complain headaches , fatigue, feeling of discomfort, irritability, depressive tendencies, difficulty in concentration, movement difficulties, hearing problem, back pain compare to male persons residing greater than 300m from the base stations. Female persons have complained of fatigue, sleep disturbance, irritability, depressive tendencies, difficulty in concentration, back pain compared to female persons residing greater than 300m from the base stations. Now in the zone 200m – 300m male persons are more likely to feel discomfort, irritability, movement difficulties, skin problem, back pain compared to male persons residing greater than 300m from the base stations. On the other hand female persons are more prone to, sleep disturbance, irritability, depressive tendencies, difficulty in concentration compared to female persons residing greater than 300m from the base stations.

Table-2: Percentage Frequency of symptoms according to distance from base stations

Symptoms	Exposed										Non - Exposed	
	≤20m		20-50m		50-100m		100-200m		200-300m		>300m	
	M	F	M	F	M	F	M	F	M	F	M	F
Headache	67.5*	51.4*	56.6*	61.9*	56.4*	50*	59.2*	50	43.7	35	22	22.2
Fatigue	70*	54.2*	52.8*	50*	64.1*	46.4*	55.5*	50*	43.7	30	22	18.5
Nausea	60	80*	37.7	76.1*	38.4	78.5	29.6	50	25	40	31.4	37
Sleep disturbance	45*	68.5*	30.1	61.9*	30.7	53.5*	37	62.5*	28.1	70*	25.7	22.2
Feeling of discomfort	62.5*	45.7	67.9*	59.5*	46.1*	67.8*	59.2*	50	43.7*	40	17.1	25.9
Irritability	85.7*	82.5*	24.5	71.4	35.8	85.5*	44.4	87.5*	50*	50*	20	18.5
Depressive tendencies	65*	51.4*	45.2*	47.6*	48.7*	50*	59.2*	56.2	40.6	45*	22.8	18.5
Difficulty in concentration	60*	51.4*	35.8*	47.6*	46*	46.4*	44.4	37.5*	31.2	40*	14.2	11.1
Memory loss	2.5	0	3.7	0	0	0	1	0	15.6	5	0	7.4
Visual Disturbances	25	17.1	22.6	26.1	23	21.4*	37	37.5	25	40	17.1	18.5
Dizziness	20	22.8	16.9	21.4	15.3	21.4	29.6	31.2	21.8	35	17.1	18.5
Movement difficulties	60*	51.4*	47*	50*	51.2*	42.8	55.5*	50	40.6*	45	14.2	22.2
Skin problem	40	40	39.6	52.3	38.4	42.8	44.4	75	34.3	35	22.8	37
Throat cancer	0	0	0	0	0	0	3.7	0	0	0	0	0
Leukaemia	0	0	0	0	0	0	0	0	0	0	0	0
Cardio vascular problems	12.5	11.4	3.7	11.9	10.2	10.7	0	0	0	5	0	11.1
breast cancer	0	3	0	11.9	0	25*	0	12.5	0	0	0	0
Hearing problem	67.5*	54.2*	52.8*	64.2*	53.8*	46.4	51.8*	43.7	37.5	30	17.1	25.9
Back pain	72.5*	51.4*	49*	40.4	64*	50*	55.5*	56.2*	50*	40	17.1	18.5

* ($P < 0.05$) significance difference in comparison between exposed and non-exposed subjects for Non Specific Health Symptoms

Age-

Significant differences are observed from the Table-3 in relation to the Age group (from ≤16Y to > 60Y) for symptoms like headaches , fatigue, sleep disturbance, feeling of discomfort, depressive tendencies, hearing problem, back pain when the comparisons are made between persons residing up to 300m VS > 300m from the base stations. From this table we find that there is no significant difference for younger age group (≤16Y) in the frequency of symptoms between up to 300m VS > 300m from the base stations. But in the age group (16-30) there are significant differences of such symptoms like headaches, fatigue, sleep disturbance and back pain. Fatigue, sleep disturbance, feeling of discomfort, irritability, depressive tendencies, movement difficulties, hearing problem, back pain are significant in the age group (31-60). But no significant differences for greater than 60y from the above comparison was observed.

Table-3: Percentage Frequency of symptoms according to age

Symptoms	Exposed	Non-Exposed	Exposed	Non-Exposed	Exposed	Non-Exposed	Exposed	Non-Exposed
	≤16y		(16-30)y		(31-60)y		>60y	
	300m	>300m	300m	>300m	300m	>300m	300m	>300m
Headaches	41.6	42.8	61.3*	25	53.8	16	52.1	20
Fatigue	50	28.5	56.8*	25	53.2*	20	43.4	10
Nausea	25	11.1	18.1	25	54.3	40	17.3	30
Sleep disturbance	583	28.5	51.1*	25	45.1*	24	26	20
Feeling of discomfort	58.3	0	61.3	15	54.8*	32	36	20
Irritability	33.3	0	59	0	60.9*	28	43.4	50
Depressive tendencies	33.3	0	38.6	15	57.8*	24	34.7	20
Difficulty in concentration	75	42.8	36.3	20	48.2	4	34.7	0
Memory loss	12.5	14.2	2.2	5	2	0	4	0
Visual disturbances	33.3	0	31.8	15	21.3	16	34.7	20
Dizziness	25	0	26.1	15	27.9	16	26	20
Movement difficulties	25	0	54.5	5	51.2*	32	43.4	20
Skin problems	29.1	28.5	51.1	0	42.6	24	34.7	10
Throat cancer	0	0	0	0	1	0	0	0
Leukaemia	0	0	0	0	0	0	0	0
Cardio vascular problems	0	0	2.2	4	7.6	4	30.4	10
Brest cancer	0	0	13.6	0	25.3	0	0	0
Hearing problem	33.3	0	51.1	10	58.3*	24	30.4	50
Back pain	33.3	0	54.5*	25	58.8*	20	26	10

*** (P < 0.05) Age wise significance difference in comparison between exposed and non-exposed subjects for Non Specific Health Symptoms**

Discussion

From this study we observed that health symptoms are more significant at distance up to 200m-300m from mobile base stations. The significant increase in the frequency of symptoms in relation to the reference group goes in the direction of the observation found in an Australian government report , which have signaled that at 200m from the base station , some people exposed in their homes are complaining of fatigue and sleep disturbances[5,6].

Our results tally with those of a Spanish preliminary study on people living in the vicinity of mobile phone base stations, where symptoms such as headaches, nausea, irritability and sleep disturbances are experienced significantly higher way by the subjects located at distance up to 150m vs. subjects at a distance >250m[7,8,9]. The numbers of reported symptoms are higher in the area nearest to base stations, and that number decreases with increased distance from the base stations. Symptoms like headaches, sleep disturbances, feeling of discomfort, irritability, depressive tendencies, difficulty in concentration, back pain, which are experienced significantly at considerable distances from mobile phone base stations, reveal no notable decrease in the percentage of complaints experienced with the increased distance. But the measurements of electromagnetic field in the vicinity of mobile phone base stations show a decrease in strength over distance [10, 11,12]. The measurements of electromagnetic fields found in the region of mobile phone base stations may not be the true representation of population's exposure. In fact, different parameters are likely to interfere to modify the measurements and in particular fluctuations in emission strengths relating to the number of calls handled by mobile phone base stations, the reflection of electromagnetic waves etc [13].

This study observes that there is no significant decrease in the frequency of symptoms in relation to the length of time living in the vicinity of mobile phone base stations(from<1 year to 4 years). This results shows that there is no acclimation of subjects to microwave bioeffects with duration of exposure.

This study gives the greater sensitivity of women for three studied of nineteen non specific health symptoms. One earlier study related to mobile phone users established an increase in women's sensitivity for the symptoms of sleep disturbances [14]. This study also shows the existence of a greater sensibility for some non specific health symptoms, in relation to age, in subjects older than 20 years. This result agrees with the greater sensibility of the elderly to radiofrequencies [15].

Conclusion

This study shows that people living in close proximity to mobile phone base stations are at risk for developing non specific health symptoms, the facing position appears to be the worst one for distances from cellular phone base stations < 100 m, so more research concerning the effects of radiofrequency radiation from base stations is indicated. As a precautionary measure, sitting of base stations should be such as to minimize exposure of neighbours. From these results and in applying the precautionary principle, it is concluded and suggested that mobile phone base stations should not be located within 200m distance from the residential houses because exposed people can have different sensitivities related particularly to their sex and their age.

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