

Technology and Health Effect of Mobile Base Station on Human Health

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Abstract - In last decade, by tremendous use of mobile phones, a growing concern about the possible health hazards has increased greatly among public health workers and scientists. The radiation exposure has been demonstrated to have many effects upon the immune functions, stimulating hormones, mammalian brain, sperm motility and morphology, and neurological pathologies syndrome. The aim of the study was to investigate different health related symptoms among persons living in vicinity of mobile base station and to compare them with those residing far from the base station. A total of 360 (180 near base stations and 180 far from base station) study subjects selected by cluster sampling were interviewed for health related symptoms. A standard questionnaire was used to explore the health complaints of participants including 15 questions. The results of the questionnaire survey explored that persons living near base stations exhibited various health complaints. Chi-square with Yates correction was used in relation to the sex, and distance and location from mobile base stations. Results showed significant ($p < 0.05$) increase among persons living near to base station as compared to people living >300 m or not exposed to base stations.

Key words - Mobile base stations (MBST), Health, Questionnaire, Persons.

I. INTRODUCTION

The wide spread use of mobile cellular phones have increased in the last decade in all over the World. It's no longer viewed as a luxury or costly service, but recognized as an important infrastructure service that should be available, to all at affordable prices.

A cellular phone is a portable telephone that does not require a wired connection. It connects to a wireless carrier network using radio waves. Cell phones communicate with nearby towers, called as base stations, which consist of electronic equipment and antennas that receive and transmit radiofrequency (RF) signals – various types of radiation. Due to the increasing numbers of providers, the number of base stations keeps growing very much. [1] A substantial increase in the number of mobile phone base stations (MPBS) has been observed all over the world. This development has raised public concerns and substantial controversy about the potential health effects of the radiofrequency electromagnetic field emissions of this technology. [2-4]

The RF energy absorbed by humans may be not very much because both the phones and the base stations are of low power, the RF energy emitted from them are generally very low. Although exposures are very low, but once the energy different ward members (elected and selected) and explained the purpose of the study.

Dausa city was divided in four parts as per geographic boundaries viz north, south, east and west. Information about the mobile base stations was obtained from telecom offices. Stations operating less than 5 years were excluded from the study. Subjects living near electrical transformers (at less than 10 m), High or very high tension electric power lines (at less than 100 m), radio and television transmitters were also excluded from the study. For the purpose to demonstrate effect of base station radiation among persons

is absorbed by the biological matter, due to persistent use or frequent exposure to source can cause severe and long lasting damage to human health. It might take years for the damage to produce noticeable symptoms.

Effects on a wide range of health parameters such as cognitive functions, well-being, sleep and even cancer have been discussed over the last decade. [5-6]. A growing concern about the possible health hazards have increased greatly among public, even on those who do not use such phones. [7]

However, the findings have been ambiguous and inconsistent as we gone through literature. There is a scarcity of data in this regard in our country and state as well. So we undertook this study to enlighten health aspects of mobile technology revolution.

II. MATERIAL AND METHODS

The aim of the study was to investigate different health related symptoms among persons living in vicinity of mobile base station and to compare them with those residing far from the base station. The study was conducted in Dausa city between June to September 2017.

Prior to conduct the study, permission was taken. Research protocol was approved. We met with living under base station we considered them located on high rise buildings. Persons with chronic serious diseases were also excluded. Finally four base stations were randomly selected and all the residents who were living, since last five years, in respective wards (clusters) were included in the study. One household from selected colony constituted our sample. A total of 205 households were contacted to be part of the study, among which 180 households agreed and gave consent to participate as study subjects. 180 subjects in the same wards residing far from

the base station matched for age and sex, served as reference group.

General demographic details as sex, age, estimated distance from base station and their location in relation to antenna was obtained through personal interview.

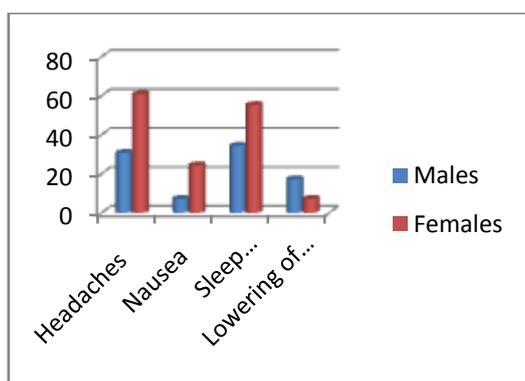
Study subjects were investigated and completed standardized questionnaires that focused on the relevant parameters (headaches, fatigue, sleep disturbances, irritability, depressive tendencies, feeling of discomfort, loss of appetite, nausea, difficulties in concentration, memory loss, visual disturbances, hearing disturbances, dizziness, cardiovascular problems, lowering of libido). The level of complaints for the studied symptoms was expressed by the study participants using a scale of: 0 = never, 1 = sometimes, 2 = often and 3 = very often.

III. STATISTICAL ANALYSIS

The data was collected and tabulated. Number and frequency of the complaints experienced in relation to responses with 0 = never, were analyzed by the Chi-square test with Yates correction as and when required. Results were compared with the frequency of complaints of the reference group (subject exposed at > 300 m) for incidences of distance, sex and others. The comparisons were done with the frequency of complaints expressed by subjects exposed up to 300 m), for location of subjects (comparison of locations among themselves) and for sex and age. A value of $P < 0.05$ was considered significant. Data were entered into a personal computer and analyzed using SPSS Version 17.0.

IV. RESULTS

In our study 180 individuals (110 women and 70 men) residing near mobile station and 180 far from station filled a questionnaire on 15 unspecific symptoms of ill health. Frequency of symptoms was cross tabled with estimated distance of the residence from a base station (<10 m, 10-50 m, 50-100 m, 100-200 m, 200-300 m, >300m). Frequency of the complaints experienced in relation to responses with 0 (=never), were analyzed by use of chi-square test with Yates correction taking the group of people living at least 300 m from the next base station as reference group. Yates correction was applied where numbers of persons were less than 5.



GRAPH 1 – Frequency of symptoms among males and females Participants

Tables 1 show frequency of inhabitant symptoms of people living near mobile phone BTS antenna according to their gender. The results among the 360 questionnaires showed that the symptoms, such as nausea, headache, among woman and lowering of libido among man, were statistically significant in the exposed group. ($p < 0.05$) (Table1) (Graph 1).

TABLE 1. FREQUENCY OF SYMPTOMS ACCORDING TO PARTICIPANTS GENDERS LIVING IN VICINITY OF MOBILE PHONE BTS ANTENNAE

S.No.	Symptoms	Men (N=70) N(%)	Women(N=110) N(%)
1	Memory loss	30(27.2)	22(20)
2	Visual disturbance	5(4.5)	8(7.2)
3	Headaches	34(30.9)	67(60.9)*
4	Feeling of discomfort	23(20.9)	31(28.1)
5	Nausea	8(7.3)	27(24.5) *
6	Hearing disturbance	14(12.7)	18(16.4)
7	Nervousness	17(15.4)	21(19.1)
8	Fatigue	32(29.1)	57(51.8)
9	Sleep disturbance	38(34.5)	61(55.45)
10	Irritability	14(12.7)	32(29.1)
11	Depressive tendencies	25(22.7)	37(33.6)
12	Loss of appetite	4(3.6)	9(8.1)
13	Dizziness	6(5.5)	11(10)
14	Cardiovascular problem	11(10)	16(14.5)
15	Lowering of libido	19(17.3) *	8(7.3)

* = statistically significant (p-value <0.05)

Frequency of symptoms according to distance from mobile phone BTS antenna is presented in Table 2. Significant differences ($P < 0.05$) are seen up to 100 m distance from base stations for symptoms like headache, sleep disturbances, irritability, depressive tendencies, feeling of discomfort, and difficulties in concentration, memory loss and lowering of libido.

Table 3 demonstrates the symptoms of inhabitants who are living under and opposite to the mobile phone BTS antennae. There was significant increase in the symptoms such as of sleep disturbance, fatigue, irritability among the inhabitants opposite to the station and the inhabitants under the station ($P < 0.05$) respectively.

TABLE 2.FREQUENCY OF SYMPTOMS ACCORDING TO PARTICIPANTS DISTANCES FROM MOBILE PHONE BTS ANTENNAE.

Symptoms	Exposed					Non exposed
	≤ 10 m	10-50 m	50-100 m	100-200 m	200-300 m	> 300 m
Memory loss	6(40)*	10(26.3) *	15(33.3) *	16(33.3) *	5(14.7)	5(2.8)
Visual disturbance	3(20)	4(10.5)	3(6.7)	2(4.2)	1(2.9)	7(3.9)
Headaches	10(66.7) *	25(65.8) *	24(53.3)	22(45.8)	20(58.8)	26(14.4)
Feeling of discomfort	9(60) *	13(34.2) *	17(37.8) *	9(18.8)	6(17.6)	5(2.8)
Nausea	2(13.3)	9(23.7)	9(20)	8(16.7)	7(20.7)	0(0)
Hearing disturbance	5(33.3) *	7(18.4)	9(20)	6(12.5)	5(14.7)	9(5.0)
Nervousness	6(40) *	10(26.3) *	12(26.7) *	8(16.7)	2(5.9)	4(2.2)
Fatigue	10(66.7) *	20(52.6) *	23(51.1) *	23(47.9) *	13(38.2) *	14(7.8)
Sleep disturbance	10(66.7) *	25(65.8) *	24(53.3) *	26(54.1) *	14(41.2) *	23(12.8)
Irritability	3(20) *	13(34.2) *	15(33.3) *	11(22.9)	4(11.8)	20(11.1)
Depressive tendencies	8(53.3) *	19(50) *	13(28.9)	14(29.2)	8(23.5)	3(1.7)
Loss of appetite	3(20)	4(10.5)	2(4.4)	3(6.3)	1(2.9)	0(0)
Dizziness	3(20)	6(15.8)	4(8.9)	3(6.3)	1(2.9)	0(0)
Cardiovascular problem	4(26.7*)	9(23.7) *	6(13.3)	4(8.3)	4(11.8)	1(0.6)
Lowering of libido	3(20) *	6(15.8) *	8(17.8) *	8(16.7) *	2(5.9)	2(1.1)

* = statistically significant (p-value <0.05)

TABLE 3.PARTICIPANTS SYMPTOMS WHO ARE LIVING UNDER AND OPPOSITE TO THE MOBILE BTS ANTENNAE.

Symptoms	Study subjects (N=80)		p-value (>0.05)
	Opposite the station (N=42) N(%)	Under the station (N=38) N(%)	
Headache	7(16.7)	4(10.5)	<0.05*
Fatigue	9(21.4)	3(7.9)	<0.05*
Sleep disturbance	12(28.6)	2(5.2)	<0.05*
irritability	13(30.9)	5(13.2)	>0.05
Depressive tendencies	7(16.7)	6(15.8)	>0.05
Feeling of discomfort	11(26.2)	4(10.5)	>0.05
Loss of appetite	6(14.7)	7(18.4)	>0.05
Nausea	7(16.7)	7(18.4)	>0.05
Difficulty in concentration	9(21.4)	4(10.5)	>0.05
Memory loss	10(23.8)	9(23.7)	>0.05
Visual disturbance	9(21.4)	4(10.5)	>0.05
Dizziness	7(16.7)	6(15.8)	>0.05

* = statistically significant (p-value <0.05)

V. DISCUSSION

In this study, we studied reactions of the people who are living near mobile phone BTS antenna. A number of studies have been conducted in different parts of the world relating ill health effect to mobile base station radiations. Due to the inconsistency regarding the study designs and different

geographical regions, exact comparisons could not possible, yet we tried to compare.

We cannot jeopardize health concern on the fact of improving and spreading of technology. We are living in a world of electromagnetic radiation (EMR) produced by electrical appliances, power lines, wiring in buildings, and other technologies that are involved in our modern life.

The findings showed the fact that health symptoms examined, were reported by people at distances up to 200m to 300m from mobile phone base stations antenna. It applies a significant increase in the frequency of complaints in relation to the reference group or control group (people exposed at >300 m or not exposed) was existed. Females were affected more than males in regard of symptoms and this can be justified by the fact that females were confined to home place more time than males as males leave the home for going to workplaces. The findings are in same with those studied by different authors who showed that at 200m from a base station some people exposed in their homes are complaining of chronic fatigue and sleep disturbances [8-9]. Moreover, the number of reported symptoms is higher as we go close and closer to base stations and decreases with increased distance from them. This is in agreement with a study, in which symptoms as irritability, headaches, nausea and sleep disturbances are experienced in a significantly higher way by the subjects located at a distance up to 150 m versus subjects at a distance more than 50 m [10-11]

It should be noted that some symptoms such as nausea, loss of appetite, visual disturbances were no more existed in a significant way beyond 10m. Moreover, symptoms such as headaches, sleep disturbances and fatigue were experienced significantly at considerable distances from BTS and exhibit no notable decrease with increased distance. [12]

In most countries there are no legal penalties concerning the erection of mobile telephone base-stations that are related to protection of the public to possible adverse effects of microwave irradiation. Compliance with guidelines limiting the exposure to EMFs is easily guaranteed because the cellular structure of modern telecommunication networks forces to low emission power. Now days it has become a raising concern in our country also. Prior permission from municipal corporation or any civil body and consent of neighbors has become mandatory before installing mobile base station.

Limitations-

This study was limited to chronic effects of base station signals. There may be other reasons responsible for some of the symptoms found. There are a number of different problems for investigating the effects of base station signals. Acute effects of base station signals can be examined experimentally in the lab or in the field, and observational studies can be carried out applying different methodologies such as exposure estimation, spot measurements, or personal dosimetry. The study of chronic effects can be an epidemiological design with cross-sectional, case-control, or cohort studies as the most frequent choice. [13-15]

VI. CONCLUSION

More accurate long term follow-up studies are needed for the evaluation of the effects of the BTS antennae. On the basis of these results, it can be concluded that mobile phone BTS antenna may have health effects on inhabitants living near the station (less than 300m distances).

Therefore, placing of base stations should be such as to minimize exposure of neighbors. It is suggested that cellular phone base stations should not be sited closer than 300m to populations, because exposed people can have different

related sensitivities particularly to their gender and their age. Or some other alternative of mobile base station should be explored to provide continue and good network to people and not affecting their health at the same time.

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