

Study on Health Effects of Mobile Tower Radiation on Human Beings

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Abstract – Cell phones have become the basic need of today and there has been an unprecedented growth of mobile industry in India during the last decade. Every technology has some positive as well as negative impacts. There has been a public concern over the adverse impacts of harmful radiation from mobile towers and mobile phones on human health. Social activists and some NGO's are resisting the erection of mobile towers in residential colonies. A study on the quantification of electromagnetic field (EMF) radiation from mobile towers and their health impacts on human beings have been carried out in Kota city of Rajasthan. It has been noticed that EMF radiation from almost 50% of the mobile towers installed in Kota city is beyond the permissible limits prescribed by the DoT, Govt. of India. To get an idea of harmful health impacts on human beings, a public survey through questionnaire was also held. The results of public survey indicate that people have seen a rise in health related issues since last decade, when installation of mobile towers has got momentum. However, the public is not sure whether it is due to EMF radiation of mobile towers or otherwise. Hence, based on studies and research carried out so far, it can be concluded that although there is no scientific cause behind harmful radiation from mobile towers, there is an increase in short-term and long-term diseases in general.

Key Words: Mobile tower, mobile phone, electromagnetic field radiation, health effects, diseases

1. INTRODUCTION

Electromagnetic field (EMF) radiation is defined as the flow of photons in space. The photons contain energy and depending on the amount of energy found in these photons, different types of radiations are defined. EMF radiations are classified into two types, known as ionizing radiation and non-ionizing radiation. Ionizing radiations are those which contain energy sufficient to overcome the binding energy of electrons in atoms or molecules, and hence creating ions. Examples of ionizing radiation are UV rays, X-rays, gamma rays, cosmic rays etc. Non-ionizing radiations are those which do not carry much energy per quantum to ionize atoms or molecules. Examples are low frequency radiations such as radio waves, microwaves, and infrared radiations.

1.1 Frequency Range of Radiation

The frequency range of non-ionizing radiation is from 1 Hz to 1THz (i.e.1000 GHz) and that of the ionizing radiation is above 1THz. Therefore, non-ionizing radiation has less health effects on human beings whereas ionizing radiation can change the chemical bonds of human tissues and even genetic damage can also occur.

1.2 Effects of EMF Radiation

Effects of EMF radiation can be divided into two categories: Bio-effects and health effects.

Bio-effects can be measured against any change in the atmosphere and these may not be harmful to human health. Bio-effects are again classified into two types, thermal and non-thermal effects.

Thermal effects are due to the heat generated when EMF radiation is absorbed whereas non-thermal effects are due to the induced electromagnetic effects inside the biological cells of the body, which may be more harmful.

Health effects are those changes which may be either short term or long term and they stress the system and may be harmful to human health.

1.3 EMF Radiation from Mobile Services

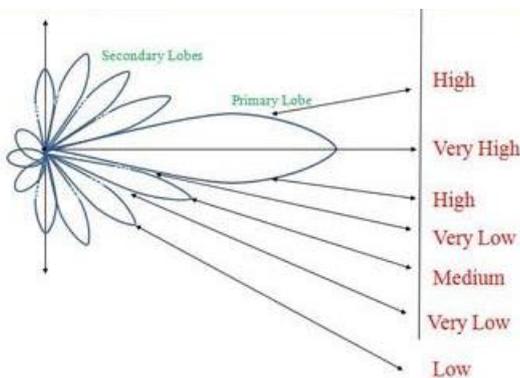
The EMF radiation in mobile services originates from two sources, base transceiver station (BTS) and mobile handsets. These radiations are relatively at the low end of the electromagnetic spectrum and hence the energy carried by them is unable to break chemical bonds in molecules. Therefore, they fall under the non-ionizing radiation category.

To provide mobile services in a particular area, telecom companies install their base transceiver station (BTS), at suitable locations, according to their radio frequency (RF) network planning for better coverage of the area and for meeting consumer requirements. The mobile towers have antennas which radiate electro-magnetic power. The BTS also contains radio transmitters whose outputs are combined and fed via cables to the base station antenna, which is mounted at the top of the mast.

The actual source of radiation is the transmitting antenna and not the transmitter itself, because the transmitting antenna is the main source which determines electromagnetic field distribution in the surrounding area of a transmitting station.

1.4 Radiation Pattern of a Mobile Tower Antenna

Radiation is highest from the primary lobes in the horizontal direction. The direct exposure towards the primary lobes along the line of antenna is the most severe case of the exposed radiation. Radiation from secondary lobes ranges from medium to very low. The distance from the source of radiation is also an important factor. The power density varies by $(1/R^2)$, where R is the distance. The pattern of radiation is shown in the figure below.



2. LITERATURE SURVEY

The international organizations like WHO and others have made it clear that there is no convincing evidence between EMF exposures and health effects in human beings. Moreover, various academic studies have been published worldwide on the effects of EMF radiation deriving from mobile towers. Some studies report the absence of any risk to human beings from EMF radiations, whereas others report the presence of a risk; however, most of them are away from any conclusive remarks and come with the usual academic stipulation about further studies. In short, there are no clear-cut scientific evidences available as of today which can establish direct relationship between mobile tower EMF radiation and diseases in human beings.

3. EMF RADIATION NORMS IN INDIA

International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an international body which studies possible adverse effects on human health from exposure to non-ionising radiation.

In 2008, Department of Telecommunication (DoT), Govt. of India has adopted the ICNIRP Guidelines and prescribed limits/levels for antennas (Base Station Emissions) for general public exposure. However, from 2012, norms of mobile towers' EMF exposure limits have been revised to 1/10th of the existing prescribed limits of ICNIRP as a matter of abundant precaution, as shown in table 1:

Table1: Revised EMF Radiation Norms for Mobile Towers in India

Frequency in MHz	ICNIRP Radiation norms	Revised DoT Norms effective from 01.09.2012
900	4.5 watt/m ²	0.45 watt/m ²
1800	9 watt/m ²	0.90 watt/m ²
2100	10.5 watt/m ²	1.05 watt/m ²

Present limit for antennae (Base station) EMF emission for general public exposure are as per the table 2, given below:

Table 2: Permissible Limits for Cell Phone Antenna

Frequency Range	E-field strength (Volt/m)	H-field strength (Amp/m)	Power density (Watt/m ²)
400 MHz - 2000MHz	$0.434f^{1/2}$	$0.0011f^{1/2}$	$f/2000$
2GHz - 300GHz	19.29	0.05	1

Where f is the frequency in MHz.

4. METHODOLOGY AND PUBLIC SURVEY

To study the effect of EMF radiation from mobile towers, first it was decided to measure the radiation emission from mobile towers in Kota. We divided the city into four zones and in each zone, total 10 sampling locations were identified. So, overall 40 mobile towers were studied from all the zones. The following zones were taken up:

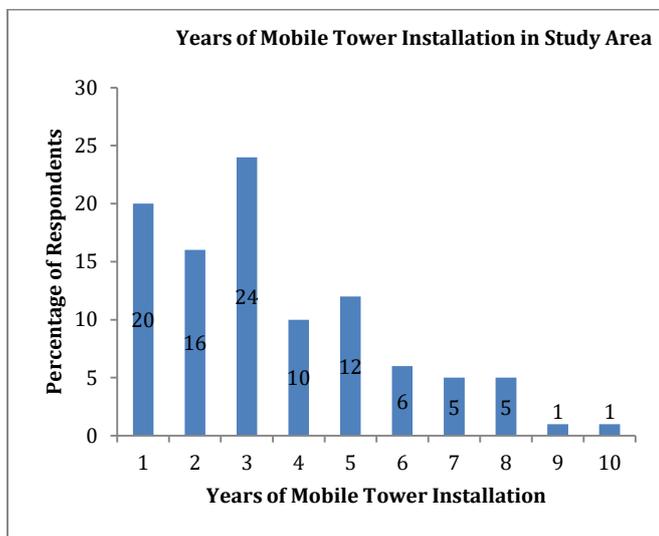
1. Residential area (Zone-A)
2. Commercial area (Zone-B)
3. Agriculture and rural area (Zone-C)
4. Highway and far flung area (Zone-D)

After zone wise distribution of mobile towers, observations of radiations from mobile towers were made using a mobile app known as EMF detector and mobile tower radiation detector. The measurements were taken for a year long period from April 2016 to March 2017 throughout the Kota city in residential area, highways, far-flung agriculture area and commercial area. Total 40 observations have been recorded using detector.

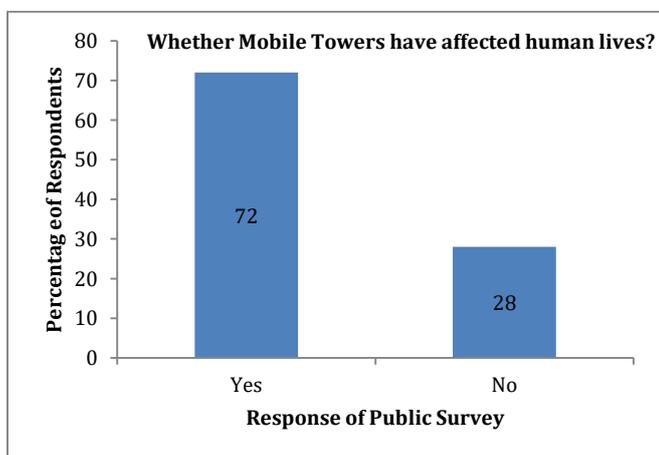
Simultaneously, a public survey was also conducted in all the zones to get views of public regarding any health effects on mobile radiation and status of diseases in their families. The survey was performed through a properly designed questionnaire and then the responses were analyzed with the help of statistical tools. The final results of the public survey are represented here.

5. RESULTS AND DISCUSSION

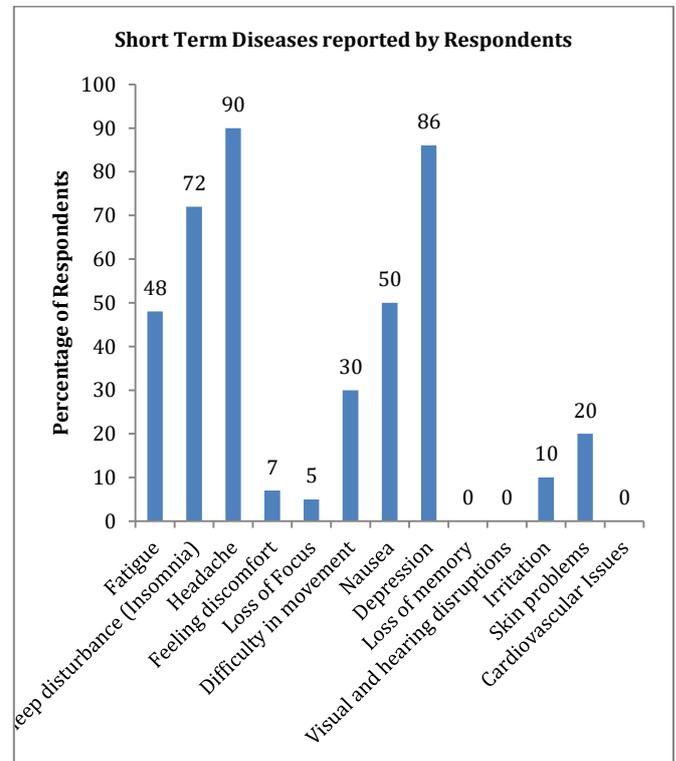
Out of the designed questionnaire, the results of important questions are presented below in graphical form. The respondents were asked to tell the number of years of mobile tower installation in their locality. The following graph shows the response.



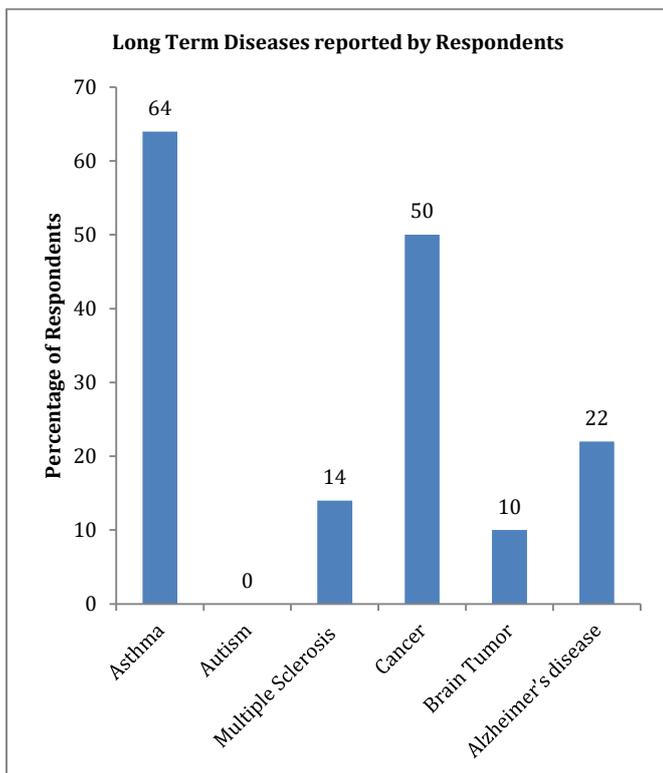
It shows that most the towers are installed during last five years and hence their effect on human health will show only the short-term effects. Although, there were some mobile towers as old as 10 years of installation and they may represent some cases of long-term diseases, if any, reported by the respondents.



72% of the respondents accepted that installation of mobile towers in their locality has affected their lives in some or the other way, while 28% were not sure whether mobile towers have anything to do with their normal daily lives.



The respondents were asked about occurrence of any of the 13 types of short-term and common diseases. When asked regarding some kind of discomfort, irritation or disease after installation of mobile towers in their vicinity, the respondents replied positively and about 90% respondents admitted that they are facing problem of headache. 86% accepted that they are undergoing depression, 72% reported sleep disturbance (insomnia), 50% reported nausea, 48% reported fatigue and likewise others also told that they are facing some type of physical and mental illness due to these mobile towers. However, they were not aware of the exact reason of their illness and discomfort, but they agreed that before the installation of towers, there were less number of evidences of such common diseases in their families. The older persons in their families accepted that they never faced such type of diseases in their lives but these days, even young children are also complaining about such problems. Hence, it can be inferred that, although radiation from mobile towers may not be the exact cause behind these diseases, but there is some linkage between either the radiation or the overall scenario due to mobile towers (creating air or noise pollution) and the public health.



Regarding long-term health effects of mobile tower installation, the 64% respondents complained that they have become patients of asthma, 50% respondents blamed these mobile towers for cancer, 22% for Alzheimer's disease, 14% for multiple sclerosis and 10% for brain tumor.

6. CONCLUSIONS

It has been found that out of the total observed mobile towers; almost 50% are in the category of medium to high risk level. This is an alarming situation that mobile towers are emitting radiation beyond the permissible limits and common man is not aware of this fact. During public survey, it has been accepted by the people that they are facing some kind of physical or mental illness after the installation of mobile towers. In fact, in short term duration, the ill-effects of radiation are not known properly or sometimes people do not take them seriously. But in long-terms, the harmful environmental and health issues may prove to be very critical and therefore, it is the right time to take precautionary measures by doing more research and detailed study on human health

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