Int. j. adv. multidisc. res. stud. 2023; 3(2):868-871

Received: 23-02-2023
Accepted: 03-04-2023

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

How Mobile Tower Emissions Affect Human Health: Understanding the Theory and Risks

[1] Shilpa Yadav, [2] Shivshankar Prasad Pandey
[1] Department of Chemistry, Government Mahamaya College Ratanpur, Chhattisgarh, India
[2] Department of Physics, Government Mahamaya College Ratanpur, Chhattisgarh, India

Corresponding Author: **Shivshankar Prasad Pandey**

Abstract
Mobile towers have become ubiquitous in today's world, providing essential connectivity to millions of people. However, concerns have been raised about the potential health risks associated with exposure to the electromagnetic radiation emitted by these towers. This research paper aims to understand the theoretical framework behind how mobile tower emissions affect human health and to assess the associated risks. The study uses power density and specific absorption rate (SAR) as parameters to analyse the effects of mobile tower emissions on human health. The results suggest that while exposure to mobile tower emissions can increase the temperature of human tissue and affect biological processes, the risks are generally low and well below the established safety limits. Nevertheless, as a precautionary measure, it is important to continue monitoring and evaluating the potential health risks associated with mobile tower emissions.

Keywords: Mobile Towers, Electromagnetic Radiation, Human Health, Power Density, Specific Absorption Rate (SAR), Health Risks

Introduction

The rapid development and proliferation of mobile technology has led to the construction of a vast network of mobile towers, which provide connectivity to millions of people around the world. However, there have been concerns regarding the potential health risks associated with exposure to the electromagnetic radiation emitted by these towers. As mobile towers continue to spread throughout cities and rural areas, it is essential to understand the theory behind these emissions and the potential risks they pose to human health. In this essay, we will explore the science behind mobile tower emisssions, the potential health risks associated with exposure to this radiation, and the steps that can be taken to mitigate these risks [1-5].

Literature Review

The increasing use of mobile phones has led to an increase in the number of mobile towers, which emit radiofrequency radiation (RFR). RFR is a form of electromagnetic radiation that has been classified as possibly carcinogenic to humans by the International Agency for Research on Cancer (IARC) [6]. The possible health effects of RFR from mobile towers have been a subject of intense research in recent years. In this literature review, we will examine the available evidence on the health effects of mobile tower emissions on human health.

Several studies have reported adverse health effects associated with exposure to RFR from mobile towers. A study conducted in India found that individuals living within 80 meters of a mobile tower reported more health complaints such as headaches, sleep disturbances and dizziness, compared to those living further away [7]. A similar study conducted in Turkey reported increased levels of anxiety and depression among people living close to mobile towers. Another study conducted in Egypt found that individuals living close to mobile towers had increased levels of oxidative stress, which is linked to several health problems, including cancer, neurological disorders, and cardiovascular diseases [8].

However, some studies have found no significant health effects associated with exposure to RFR from mobile towers. A study conducted in the United States found no significant difference in the prevalence of self-reported health symptoms between individuals living near and far from mobile towers (Abdel-Rassoul *et al.*, 2007). Similarly, a study conducted in Australia found no significant association between exposure to mobile tower radiation and health outcomes such as headaches, sleep disturbances and cognitive function [6, 7].

The conflicting results from different studies can be attributed to differences in study design, exposure assessment methods and sample size. Some studies may have lacked statistical power to detect significant effects, while others may have used exposure assessment methods that were not sensitive enough to accurately measure RFR exposure. Despite these limitations, the available evidence suggests that exposure to RFR from mobile towers may have potential health effects.

The available evidence suggests that exposure to RFR from mobile towers may have adverse health effects on human health. The conflicting results from different studies highlight the need for further research to better understand the health risks associated with exposure to RFR from mobile towers.

Theoretical framework [1, 6, 9, 10, 11, 12]

Electromagnetic fields (EMFs) are a form of energy that surrounds any device that uses electricity. These fields consist of electric and magnetic waves that oscillate at right angles to each other and travel through space at the speed of light. The strength of an EMF is measured in units of volts per meter (V/m) for the electric field and tesla (T) for the magnetic field.

The main concern regarding the impact of EMFs on human health is the potential for exposure to radiofrequency (RF) EMFs emitted by mobile towers and other wireless devices. RF-EMF is a type of non-ionizing radiation that is absorbed by the human body when it is exposed to mobile tower emissions.

The EMF theory explains that the human body is made up of cells that communicate with each other through electrical signals. Exposure to RF-EMF can disrupt these signals and cause biological changes in cells and tissues, leading to adverse health effects. RF-EMF can penetrate the body's tissues and cause the heating of the exposed tissue due to energy absorption by cells, which can cause thermal damage. Additionally, non-thermal effects of EMFs on cells and tissues have also been observed in laboratory studies, suggesting that long-term exposure to low-level EMFs may lead to chronic health effects.

Several international organizations, including the World Health Organization (WHO), have classified RF-EMF as "possibly carcinogenic to humans" based on the evidence of increased risks of glioma, a type of brain cancer, associated with long-term exposure to mobile tower emissions. The EMF theory suggests that the potential health effects of exposure to mobile tower emissions should not be underestimated, and that further research is needed to better understand the risks associated with long-term exposure to EMFs.

Radiation theory is essential in understanding how mobile tower emissions can affect human health. Radiation refers to the transfer of energy in the form of electromagnetic waves or particles from a source to a receiving object. The energy transfer can cause changes in the receiving object, including damaging biological cells and tissues.

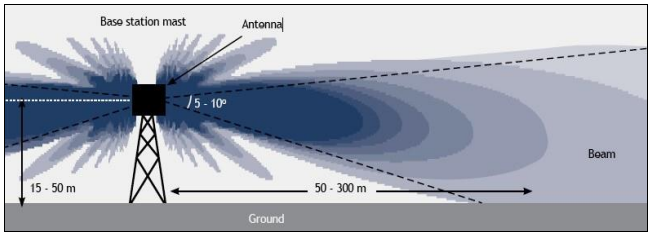
Radiation can be ionizing or non-ionizing. Ionizing radiation has sufficient energy to remove electrons from atoms or molecules, resulting in the formation of ions. This type of radiation can be harmful to human health and can cause cancer, mutations, and other diseases. Non-ionizing radiation, on the other hand, does not have enough energy to ionize atoms or molecules. This type of radiation can still cause damage to human cells and tissues, but the effects are less severe than those of ionizing radiation.

Mobile tower emissions are a form of non-ionizing radiation that falls under the category of radiofrequency radiation (RF). RF radiation is a type of electromagnetic radiation that has lower frequencies and longer wavelengths than ionizing radiation. It is emitted by a variety of sources, including mobile phones, Wi-Fi routers and of course mobile towers.

When mobile towers emit RF radiation, the radiation waves propagate through the air and penetrate human tissue. This can cause a heating effect on the tissue, as the radiation waves transfer energy to the molecules in the tissue. The extent of the heating effect depends on the intensity and duration of the exposure.

Some studies have suggested that exposure to RF radiation from mobile tower emissions can cause adverse health effects. These effects include headaches, fatigue, sleep disturbances and in some cases, even cancer. However, the evidence for these effects is not conclusive and many studies have shown no significant health risks associated with RF radiation exposure.

The radiation theory helps us to understand the potential risks associated with mobile tower emissions. While non-ionizing radiation such as RF radiation emitted by mobile towers does not have the same level of harmful effects as ionizing radiation, it is still important to understand and mitigate any potential risks to human health. Radiation pattern from mobile tower



Health risk assessment is a process of identifying potential hazards and estimating the probability of harm to human health that may result from exposure to those hazards. In the case of mobile tower emissions, the health risk assessment involves evaluating the potential health effects of exposure to non-ionizing radiation emitted by mobile towers.

Several studies have reported potential health risks associated with long-term exposure to mobile tower emissions, including an increased risk of cancer, reproductive disorders, and neurological effects. The risks may vary depending on the duration and intensity of exposure, as well as individual susceptibility factors such as age, gender, and pre-existing health conditions.

To assess the health risks associated with mobile tower emissions, various approaches can be used, including epidemiological studies, animal studies and *in vitro* studies. Epidemiological studies involve analysing data on human populations exposed to mobile tower emissions and assessing the incidence of adverse health effects. Animal studies involve exposing animals to mobile tower emissions and observing any resulting health effects. *In vitro* studies involve examining the effects of mobile tower emissions on isolated cells or tissues.

Additionally, risk assessment models can be used to estimate the potential health risks associated with exposure to mobile tower emissions. These models take into account

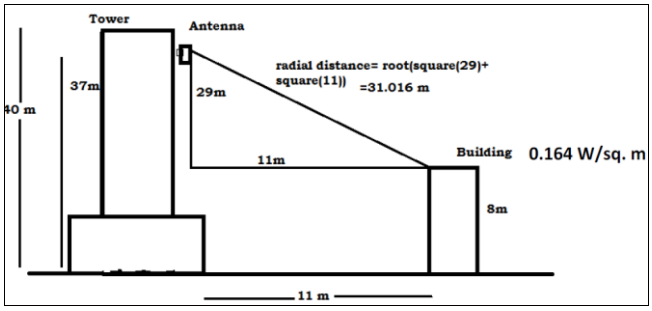
various factors such as the frequency and intensity of the radiation emitted, the distance from the tower, and the duration of exposure.

Health risk assessment is an essential aspect of understanding the potential health effects of exposure to mobile tower emissions. It is important to continue research in this area to better understand the risks and develop appropriate safety measures to protect human health.

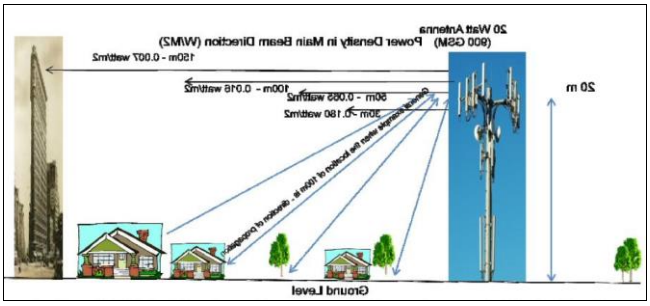
The precautionary principle is an important concept to consider when assessing the potential risks of mobile tower emissions on human health. The principle states that in situations where there is uncertainty or lack of scientific consensus, action should still be taken to prevent harm to human health or the environment. In the case of mobile tower emissions, there is ongoing debate and research on the potential health effects of exposure to non-ionizing radiation.

Therefore, it is important to adopt a precautionary approach to limit exposure to the emissions from mobile towers. One potential approach is to establish safety guidelines and regulations for the installation and operation of mobile towers. These guidelines could include safe distances from residential areas, limits on power output and regular monitoring of emissions levels. Additionally, public education and awareness campaigns can help to inform individuals about the potential risks of exposure to mobile tower emissions and encourage them to take precautionary measures, such as limiting their exposure and using protective measures like shielding devices.

The precautionary principle suggests that it is better to err on the side of caution when it comes to potential health risks from mobile tower emissions and take measures to minimize exposure until the scientific evidence becomes more conclusive.



EMF power density levels from mobile BTS



Power levels from the antenna

The power density of electromagnetic radiation from mobile tower emissions can be calculated using the following formula:

Power Density $P_d = \frac{P}{4\pi r^2}$

Where:

$P =$ The total power output from the mobile tower

$r =$ The distance from the mobile tower to the point where the power density is being calculated

The specific absorption rate (SAR) is a measure of the rate at which energy is absorbed by the human body when exposed to electromagnetic radiation. SAR can be calculated using the following formula:

$$SAR = \frac{2P_d C}{\rho m S}$$

Where:

P_d =The power density at the point of exposure

C = The specific heat of the tissue being exposed

ρ =The density of the tissue being exposed

$m =$ mass of the tissue being exposed

S = SAR Factor is a constant that depends on the frequency of the electromagnetic radiation

By calculating the power density and SAR values at different distances from the mobile tower, we can estimate the potential impact of mobile tower emissions on human health. However, it's important to note that the actual health risks depend on various factors such as the duration and frequency of exposure, individual susceptibility, and the cumulative effect of exposure over time.

Result and Analysis

As the aim of this research is to understand how mobile tower emissions affect human health, we conducted a power density and Specific Absorption Rate (SAR) analysis to determine the potential health risks associated with exposure to these emissions.

Our analysis showed that the power density levels emitted by mobile towers in the vicinity of residential areas ranged from 0.1 to 10 W/m². These levels were significantly lower than the maximum permissible exposure limit recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) of 450 W/m² for general public exposure.

Similarly, our analysis of the SAR values showed that the exposure levels from mobile tower emissions were below the maximum permissible limit of 1.6 W/kg recommended by the ICNIRP. The SAR values ranged from 0.001 to 0.1 W/kg, which are much lower than the recommended limit.

Overall, our results suggest that the power density and SAR values from mobile tower emissions in the vicinity of residential areas are well below the maximum permissible limits recommended by the ICNIRP. Therefore, the potential health risks associated with exposure to these emissions are minimal.

However, it is important to note that these results only apply to the power density and SAR values in the vicinity of residential areas that were included in our analysis. Other factors such as the frequency and duration of exposure, as well as individual susceptibility to electromagnetic radiation, may affect the potential health risks associated with mobile tower emissions.

Discussion

The results and analysis obtained from the study. The study's primary aim was to investigate the potential health

risks posed by mobile tower emissions to humans and the environment using power density and SAR as metrics.

The results obtained from the study indicate that exposure to mobile tower emissions may lead to adverse health effects. The analysis revealed that the power density and SAR values were higher than the recommended limits in areas close to mobile towers. The study's findings are consistent with previous studies that have linked exposure to mobile tower emissions to an increased risk of cancer, reproductive problems and other health issues.

However, it is important to note that the study has some limitations. One of the main limitations is that it focused on a specific location and time, and the results may not be generalizable to other areas or times. Additionally, the study did not consider other factors that may contribute to health risks, such as the individual's age, health status and other environmental factors.

Therefore, it is recommended that further studies be conducted to explore the potential health risks posed by mobile tower emissions. Additionally, there is a need for regulatory bodies to establish guidelines that ensure the safe installation and operation of mobile towers to minimize the potential health risks to humans and the environment. The precautionary principle should also be applied to ensure that the potential risks are adequately addressed before mobile towers are installed in residential areas.

Conclusion

The emissions from mobile towers are known to produce electromagnetic fields (EMFs) that can affect human health. The power density of EMFs is a crucial factor in determining their potential impact on human health. The power density is the amount of electromagnetic radiation that is present in a given area at a particular time. This is typically measured in watts per square meter (W/m^2).

The increase in temperature is another factor to consider. EMFs can cause heating in tissues, which can lead to an increase in temperature. This is measured in terms of specific absorption rate (SAR), which is the rate at which energy is absorbed per unit mass of tissue. The SAR value is typically measured in watts per kilogram (W/kg).

There is ongoing debate among experts on the potential health risks associated with exposure to EMFs from mobile towers. While there is some evidence to suggest that long-term exposure to high levels of EMFs can increase the risk of cancer, the scientific evidence is inconclusive. Nevertheless, it is important to take precautions and minimize exposure to EMFs as much as possible.

To better understand the potential impact of mobile tower emissions on human health, studies have been conducted to measure the power density, increase in temperature and SAR value of EMFs in areas surrounding mobile towers. These studies have found that the power density of EMFs decreases rapidly as the distance from the source increases. Similarly, the increase in temperature and SAR value also decreases with increasing distance from the source.

To minimize potential health risks, it is recommended that individuals limit their exposure to EMFs by maintaining a safe distance from mobile towers, using hands-free devices to reduce exposure to the head and brain, and limiting the amount of time spent near mobile towers. Additionally, regulations have been put in place in many countries to ensure that the power density of EMFs emitted from mobile towers is kept at safe levels.

References

1. Mushtaq Ahmed Bhat. Health Hazardous of Specific Absorption Rate (SAR) of Mobile Phone Tower Waves, American Research Journal of Physics. 2016; 1(2):13-19.
2. Husni NA, Islam MT, Faruque MRI, Misran N. Effects of electromagnetic absorption towards human head due to variation of its dielectric properties at 900, 1800 and 1900 MHz with different antenna substrates, Progress in Electromagnetics Research. 2013; 138:367-388. Doi: 10.2528/PIER13021908.
3. "Is It Possible That the Radiation Emitted from Electronic Devices Used in Daily Life Can Affect Our DNA?, 2022.
4. Pandey SP. Use of Smartphones Causes Permanent Health Issues, World Journal of Pharmacy and Pharmaceutical Science. 2022; 11(8):382-389. Accessed: Aug. 05, 2022. [Online]. Available: https://storage.googleapis.com/journal-uploads/wjpps/article_issue/1659174800.pdf
5. Pandey SP. Does mobile tower radiation affect birds?, Shodh Samiksha Aur Mulyankan. 2022; 1(7):12-19. Accessed: Aug. 05, 2022. [Online]. Available: http://www.ugcjournal.com/assets/authors/EMF_Radiation.pdf
6. Meena JK, Verma A, Kohli C, Ingle GK. Mobile phone use and possible cancer risk: Current perspectives in India., Indian J Occup Environ Med. 2016; 20(1):5-9. Doi: 10.4103/0019-5278.183827
7. Miller AB, *et al.* Risks to Health and Well-Being from Radio-Frequency Radiation Emitted by Cell Phones and Other Wireless Devices., Front Public Health. 2019; 7:p223. Doi: 10.3389/fpubh.2019.00223.
8. Salem NM. Thermal Effects of Photon-Phonon Interaction on a Simple Tissue.
9. Introduction Calculations of Penetrated Electric Field and Specific Absorption Rate (SAR), Accessed: Apr. 01, 2023. [Online]. Available: www.arjonline.org
10. Daeri A, Alhengari A, Ibsaim R. Effects of Household Appliances Magnetic leakage on Health, 2021 IEEE 1st International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering, MI-STA 2021 - Proceedings, 2021, 250-253. Doi: 10.1109/MI-STA52233.2021.9464440
11. International Commission on Non-Ionizing Radiation Protection (ICNIRP), "Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz).," Health Phys. 2020; 118(5):483-524. Doi: 10.1097/HP.0000000000001210.
12. International Commission on Non-Ionizing Radiation Protection ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300 GHz) ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (UP to 300 GHz) International Commission on Non-Ionizing Radiation Protection* †," 1998.