

Debunking the Fabricated Myths Around 5G: A Review

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Abstract

Recently there is a growing concern regarding potential health hazards linked with 5G deployment and radio frequency emitted by these stations. It becomes fundamentally important to scientifically address these concerns. In this paper, the health risks incorporated with 5G are discussed critically in the light of scientific work and debunk these tittle-tattles where required. We confute scientifically the “5G appeal”, discuss effects of 5G on health, its implications on privacy, pandemics, ecosystem and role of world health organization in fighting these narratives. Finally, we provide future direction to negate these false claims linked with 5G.

Keywords: 5G, health risks, EMP exposure, health hazards

1. Introduction

Over the last decade, wireless communications technology has become increasingly important. Advances in technology has facilitated improvements in technology, transportation [1-2] leisure, education, business and ecosystem. World is changing every day and every day the need of data capacity is increasing manifolds. The escalating need of high data rate is expected to be met with 5G and beyond 5G networks [3-4]. Indeed, 5G concept will revolutionize and transform the world by offering greater speed in transmission, lower latency, higher number of connected devices and allowing implementation of virtual networks (network slicing). Other than downloading a high definition movie in seconds, it will help the medical professionals to perform surgeries in real time and will make self-driving cars safer and smarter.

However, with the promotion and roll out of 5G as a new connection around, 5G faces many challenges and one of them is coverage which can be limited due to obstacles such as walls and trees [5]. This will tend to make the density of the network quite extensive as compared to 4G networks.

The increase in density of radio waves swimming around us has led to controversies around the world which demand thorough and independent tests for potential long-term adverse health effects of 5G technology. Apart from being carcinogenic, it is suspected that exposure to radiation from 5G transmitters will cause numerous health ailments [6].

Fig. 1 presents the cluster diagram related to “5G” and “health hazards” which has been searched enormously over the internet over five years. The sentiments against 5G rollout is increasing due to concocted stories, lies and in valid arguments spreading all over the internet fueled by social media.

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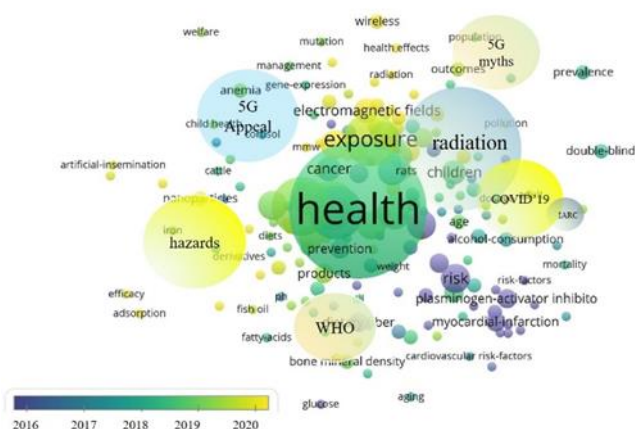


Fig. 1. Cluster of keywords related to “5G Health Hazards” for last 5 years.

We would like to discuss these clusters one by one in this article in light of scientific evaluations. The main clusters that appear are 5G Appeal, Hazards, Health, radiation, World Health organization (WHO), IARC, exposure, COVID’19 and 5G myths.

The group, which is against 5G known as “5G Appeal”, claims that there are 13000 individuals from 350 environmental organizations which have supported the petition in favor of stopping 5G. They claim that 26000 scientists are supporting No 5G /Ban 5G campaign [6-7].

Similarly, a toxicology report released by US Department of Health in 2018 pointed out that the tests were conducted on male rats that were exposed to high doses of radio frequency radiation.

As a result, these rats developed cancerous tumors. The study explains that these rats were exposed to mobile phones radiation for 9 hours a day constantly for two years’ time frame [8].

Moreover, in 2011 the International Agency for Research on Cancer (IARC) termed radiofrequency radiation (RFR) as being

human carcinogenic in the category 2B [9]. Recently, Ramazani Institute (RI) Bologna, Italy performed a study spread over the life span of Sprague-Dawley rats (2448 in number) for studying the effects of RFR on their health. They were exposed to a 1.8 GHz GSM far field of 0 up to 50 V/m for 19 hours a day. This study is the widest & longest run study ever performed on rats for studying the health impacts of RFR. The study concluded that an increase in the occurrence of malignant glial tumors were analyzed in female rats for 50 V/m. The studies concluded that exposure to RFR could impact public health in large numbers and IARC should re evaluate the conclusions it made about carcinogenic potential of RFR in humans. However, it must be noted that there are some serious technical flaws in this study. Firstly, the base station utilized is of GSM standard while 5G is different than this. Similarly, they draw conclusion on 50 volts for a meter study which is quite a lot and is not the one used for 5G systems. The results would have made more sense if it had brought serious ailments for 5-7 V/m.

In a similar study, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a private German non-governmental organization released a draft of the recommendations for restricting exposure to time-varying electromagnetic fields which rejected all the health effects caused by RF radiations [10].

To date, World Health Organization (WHO) is of view that in light of research performed on the frequencies used by 5G, there is no adverse effects linked with exposure to wireless technologies. WHO has stressed that there is negligible temperature rise in the human body due to increase in exposure level from radio frequencies [11].

The 5G network cover several frequency bands as given in Table I. The first band consist of lower frequency band and it being used now for the present phase of 5G deployment [12-13]. Similarly, in addition to ultra-high frequencies (UHF) bands, the new bands allocated for 5G networks include much higher radio frequencies (RF) having wavelength in the centimeter or the millimeter ranges.

TABLE 1. 5G FREQUENCY SPECTRUM

Frequency Range	Application
<1 GHz	IoT
1-6 GHz	IoT
>6 GHz	High data transfer

In this article, we focus on the claims that associations against 5G roll out have been making and assess the facts for effect of 5G on health, privacy, temperature, ecosystem and epidemics. Moreover, the 5G appeal that was made against 5G roll out has been rebutted point wise considering scientific evidences followed by the role of world health association in this 5G-No 5G-crisis. As a last point, we present the recent controversy of COVID'19 outbreak and possible 5G health effects. Finally, conclusions are drawn.

2. Summary of 5G Appeal

Since WHO IARC classified radiofrequency EMF as "possible carcinogenic to humans" in 2011, recently IARC has prioritized the EMF radiation for review in next 5 years between 2020 and 2024 [14]. This has been done in light of 5G appeal submitted

to United Nations in 2015 and European Union in 2017 respectively. This appeal recommended a moratorium on the deployment of 5G until the potential hazards on human health are not evaluated independently [7].

The summary of this appeal is given below:

1. To halt the implementation & installment of the fifth generation, 5G, till proper investigation is done for potential hazards for human health. To establish immediately, without any exertion of influence, an EU taskforce of impartial and independent EMF scientists & health experts with absolutely no conflicts of interest.
2. To decide about revised & safe "maximum total exposure standards" for microwave radiation all across EU.
3. To intercept & halt the wireless or telecom industry to exert pressure or from persuading EU- policymakers, taskforce or personnel to make instant decisions about propagation of RF radiation particularly 5G.
4. To extend favor to or implement wired digital telecommunication rather than wireless.

In the discussion below, each aspect of this appeal and myths linked with 5G will be discussed critically with facts and references. The facts presented will bust the ignorance or false facts presented over digital media.

3. Is 5G Harmful?

Similar to all older generation of mobile systems, 5G also operates on radio frequency spectrum. The radio frequency waves that are utilized in wireless communication are categorized as non-ionizing radiation. Simply stated, it means that they do not contain adequate required energy to break away electrons from the atomic orbital. But they have sufficient energy to excite unbound electrons into a higher energy state. This electromotive force is then transformed into kinetic energy and thereby heat as the unbound electrons & polar molecules collide [10].

The International Commission on Non -Ionizing Radiation Protection has set a conservative range of EMF exposure above which the exposure to such radiation can be hazardous to health or have adverse effects [15].

Measurements reveal that the Electromotive Force levels drop as the distance from the source, in this case antennas, increases. Hence, it is very crucial that in location of occupational exposure, the people are trained or well-aware of the radiation risks [16].

To bust the myth that 5G radiation causing the COVID 19 global level pandemic disruption, we take into account the frequencies that were already in use before deployment of 5G. 5G operates of a lower band (700 MHz), low band (3.5 GHz) and a higher band (mmWave) for coverage, the same was being utilized before 5G was deployed for use.

No study conducted yet can conclusively accepts that 5G radiation is harmful, having said that, World Health Organization based on studies conducted by IARC concludes that RF radiation is as baleful to human lives Aloe Vera, Petrol and pickled vegetables and less carcinogenic than red meat!![17].

4. Does 5G Densification Causes Temperature Rise?

As explained in Table I, 5G will elevate the number of wireless devices, requiring a high density of infrastructure. This means that higher network density will have frequencies with shorter ranges. The penetration of electromagnetic radiation in human body increases as the frequency goes up [18], So, this means that higher frequencies can cause health effects? Accompanying this fact, there is another aspect of the hoax accompanying 5G that it results in high temperature. According to the explanation in [19], the main biological effect of the electromagnetic radiation from mobile phones is rise in temperature. The penetration of electromagnetic radiation in human body increases as the frequency goes up. However, to best of our knowledge, generally, in mobile communications and 5G to be precise, the power levels involved are incredibly low which at most can produce rise in temperature in human tissues of few tenths of a degree [19], Therefore explicit biological changes are very difficult to occur.

5. 5G Implications on Privacy

5G concept was initiated for increased connectivity, lower latency and higher data rates to support health, education, transportation and many other things, however, vulnerabilities on privacy is a major concern which needs to be addressed. In 2019 at Black Hat Security conference, researchers shared 5G implications that allowed them to access devices location and attack on devices. However, researchers at CCS Insight suggests that operator can provide visibility to offer security insights to businesses if someone is intercepting or trying to make anomalous actions. Similarly, network slicing adds security capabilities for 5G. This is because slicing can add extra layer of security making the network as almost private channel.

Indeed, every technology has advantages and disadvantages and we can expect that each evolution us more secure than its predecessor and 5G should be expected to do the same.

6. Role of WHO in 5G-No-5G Crisis

As far as halting the ongoing 5G roll out is concerned, since the inception of 5G, all the stake holders under WHO have been vigilant to keep an eye on the health hazards of the new 5G technology. In this regard, WHO held a health risk assessment from RF exposure that includes 5G spectrum and will be published in 2022. It constituted the International Electromagnetic Fields (EMF) Project to investigate the health impact of exposure to electric and magnetic fields in the frequency range 0-300 GHz and advises national authorities on EMF radiation protection.

WHO recommends for further research into the possible long-term health impacts of all aspects of mobile telecommunications. Apart from this, there are independent bodies which provide guidelines on electromagnetic exposures. These bodies include The International Commission on Non-Ionizing Radiation Protection and, The Institute of Electrical and Electronics Engineers (IEEE), So the validity of the argument that there should be independent studies that are not influenced by industry seems speculative [20].

7. 5G and COVID'19: A Toxic Cocktail of Misinformation³

In December 2019, Corona Virus 19 (COVID'19) outbreak started in Wuhan, China and by the early 2020, the world was taken aback by the global pandemic. Conspiracy theorists and dark forces concocted their own narrative and linked the pandemic with 5G, pushing it to dangerous implications without any credible argument and reasoned evidence. Out of all the conspiracies, the following were the theories that got the most attention:

1. Corona Virus was deliberately created so that 5G engineers can install the technology everywhere (this theory has no significant grounds as the roll out is done in phases and worldwide installation would have caught an eye of at least some one in this age of digital media).
2. 5G was trialed in Wuhan, China and the pandemic began (this theory has no grounds as 5G was already being rolled out in many parts of the world).
3. 5G directly transmits the virus (COVID'19 is spread person to person while 5G uses radio waves that uses beam-forming technology to go directly where needed).

These theories and many others don't provide any scientific evidence whatsoever that 5G has caused this pandemic. Similarly, there were many countries like Iran, where there is no 5G roll out implementation going on, still it was one of the countries that was badly affected. On the other hand, South Korea is one of the largest 5G deployment center and it has effectively contained the outbreak.

According to [21], multiple exposures of innocuous exposures do not add to produce any adverse biological effect. This means that there is no technical evidence that 5G would cause health issues provided the exposure limits said by IEEE and ICNIPR are met.

8. 5G Effect on Ecosystem

There is a lot of speculation around the environmental hazards caused by 5G radiation. 5G was claimed to be the sole reason of change in sparrow behaviors and change in bee behavioral patterns or massive birds killing which circled several news platforms recently. Direct blame cannot be placed to 5G, because 5G field beams will not be as dispersed and will penetrate the tissues less causing their impact to be smaller. Or something as trivial as a farm disease could also have caused the bird killings.

Similarly, there has been a lot of talks about the fact that certain auctioned bands are interfering with water vapor bands that are required for weather forecasting satellites. This issue was taken into consideration in ITU conference in 2019 and it was settled by inserting a restriction on out of band emissions from base stations. This will minimize the interference disturbing satellite bands [22]. In order to overcome this effect, there is a need to technically cross check these speculations and do more rigorous pattern tests in order to take preventive steps for maintaining the balance in ecosystem.

9. Future Directions

As far as radiation levels are considered, since many decades, there are consortiums on international level which are keeping a tight check on the regulations. There must be more investments for research in order to disperse the wrong perceptions on radiation hazards. There should be more investment in research on RF exposure levels in present mobile communication system so that we can make our eco-system a safer habitat. As far as privacy is concerned, vulnerabilities on privacy is a major concern which needs to be addressed properly on all the platforms. As explained in the paper, network slicing will be key to improve concerns related to security breaches.

The most important step to stop this rise in sentiments against 5G is to stop the spread of these conspiracies that are circling over the social media. The only method is to have webinars and social media conference to bust these myths. Having said that, scientists, doctors, engineers & policymakers need to recognize the significance of debate over economic, social, environmental, technological & physical aspects of 5G radiation to exploit the benefits of 5G technology just like it is done for any other technological advancement.

10. Conclusions

In the light of discussions carried out above, it is safe to conclude that 5G is a technological advancement for good. 5G services require antenna towers installment because buildings, trees or hills may block the high frequency 5G signals because the signals do not penetrate. 5G has been placed as being as carcinogenic for human beings as pickled vegetables, that tells a lot about the adverse effects of 5G radiation on human health! The penetration of radiation in human body with increase in frequency is minimal; hence biological changes are next to impossible to occur.

Multiple theories about causal relationship of 5G & COVID-19 were not backed by evidence. They were either impossible to be true or just a hoax with no examples from present world incidents. Not a long time ago, news platforms circulated images & hype was created about bird killings, bee & sparrow changing behavior and hazardous impact of radiation on the ecosystem. All of which was refuted by the fact that the research studies did not take a holistic view of the changes in behavior. The series of events were unrelated with no geographical or contextual link to one another.

There has been mounting concerns that along with its promised benefits, establishment of 5G poses a threat to security. Every technology accompanies such threats but evolution of technology, if met with an evolution of regulatory body – brings only good. At international level, United Nations has established a regulatory body, International Telecommunications Union (ITU) which coordinates the global use of radio radiation spectrum & revises the international technical standards. Moreover, there are several regional & national regulatory bodies all over the world that look into the exposure measures & directives of use of radiation. Europe Union Council Recommendation sets out a directive about safety requirements regarding RF EMF exposure. Having said that, it is very important to review the concerns of masses time

to time. However, it is safe to say in light of these arguments that 5G has no health hazards associated with it and it is beneficial for us.

Conflict of interest

The authors declare no conflict of interest in this paper.

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