

# Electromagnetic hypersensitivity syndrome

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## Abstract

Today, we are living in an advanced technological world, and as we are in such technological world, we can name this period as “technology age” as well as “radiation age.” People today are bombarded with radiations from the sources they use every day such as laptops, cell phones, headphones, refrigerators, micro ovens, radio towers, televisions, satellites, broadcast antennas, and such more. The exposure to such radiations does not go away over time, in fact, it shows its effects on the body slowly based on their usage, and the effects so produced from such radiations are called as electromagnetic hypersensitivity reactions (or) electromagnetic hypersensitivity syndrome. The health professionals are facing challenges regarding the symptoms on prolonged exposure to frequencies of radiation (electromagnetic radiation [EMR]). Various organizations like the World Health Organization and some nation states started exploring about this clinical phenomenon to explain the prevalence of symptoms associated with non-ionizing EMR exposure. This article explains in detail regarding the common sources that produce EMR, its effects, and preventive measures to overcome such effects.

**Key words:** Electromagnetic radiation, cataracts, defender pad shield, radiation age, repetitive strain injury, toasted skin syndrome

## INTRODUCTION

Electromagnetic hypersensitivity is defined by World Health Organization (WHO) as: “A phenomenon where individuals experience adverse health effects while in the vicinity of devices emanating electric, magnetic (or) electromagnetic fields (EMFs).”<sup>[1]</sup> Electromagnetic radiation (EMR) or EMF’s are mainly responsible for this electromagnetic hypersensitivity. In general, these EMR are released from laptops, televisions, androids, home appliances (washing machine, oven, etc.). Further EMR is categorized into two types:

- Non-ionizing radiation
- Ionizing radiation.

### Non-ionizing Radiation

It is radiation with low energy and the health effects are not seen after exposure immediately. It causes serious health issues only on prolonged exposure to such radiations. It is said to be safer than ionizing radiation because it does not cause immediate damage.

### Ionizing Radiation

It is the radiation with high energy and is known to cause serious health issues like DNA damage immediately after exposure [Figure 1].

## STAGES OF EHS

### Stage 1

- Stage 1 is representative of initial sensitivity
- Generally connected to exposure to a newly acquired device that emits a signal that has never been experienced before
- Symptoms will disappear when the source signal is removed/cut off

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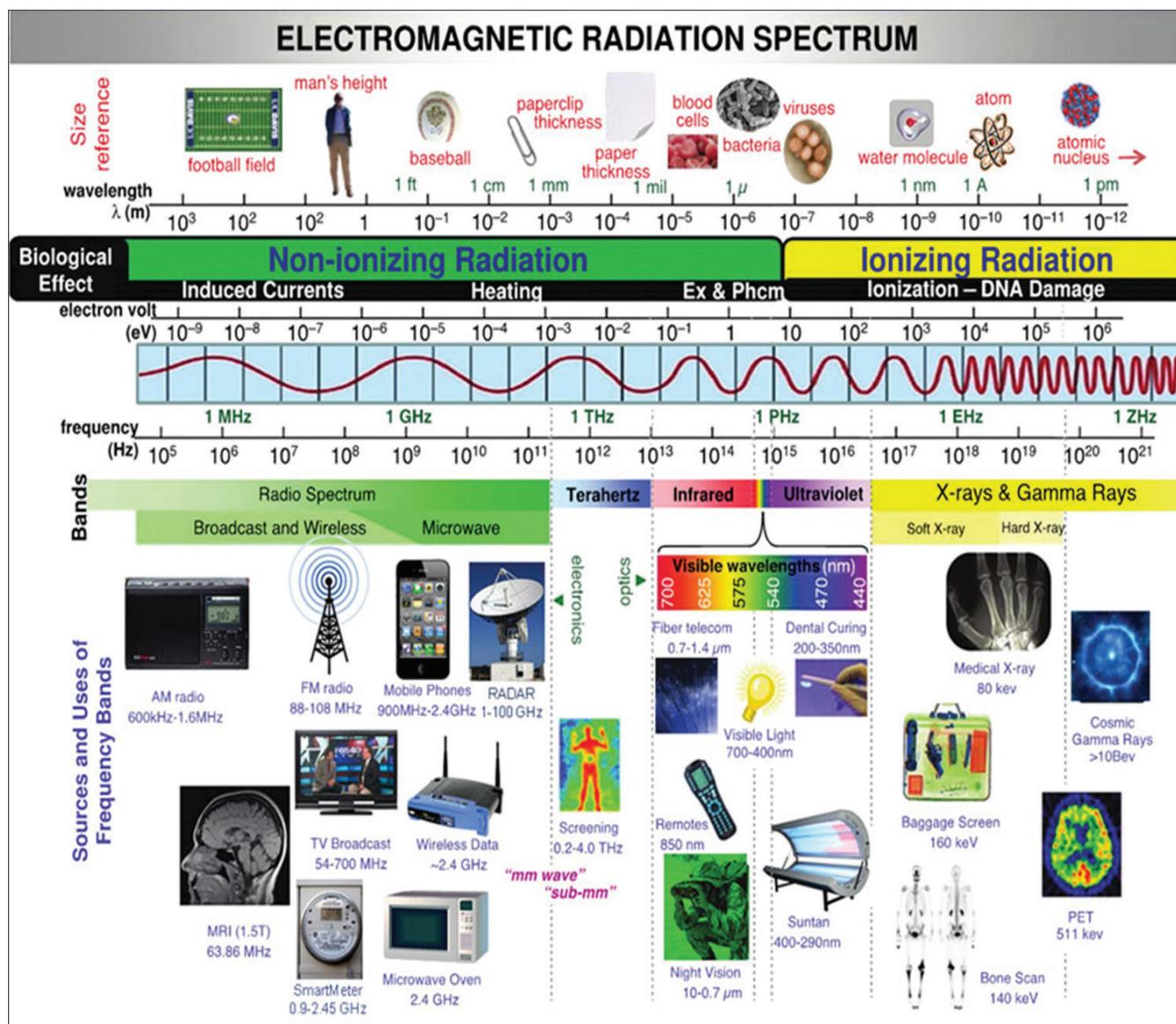


Figure 1: Electromagnetic radiation spectrum

- Repeated exposures result in more pronounced symptoms and the recovery period extends longer every time after the signal source is stopped (or) until it reaches a plateau.

### Stage 2

- Stage 2 is controversial but if the person is able to remove themselves from the source then their acuteness will become moderated
- There will be modifications in the behavioral activities which have a significant part to play as the victim has become conscious of what causes them to develop symptoms and so tries to actively avoid or minimize exposure.

### Stage 3

- Stage 3 is when the person is unable to cut off themselves from the cause of their symptoms

- Then, their health will begin to progressively decline
- Biological changes can be observed with blood and urine tests such as:
  - a. Decline in red blood cells, platelet count, globulin levels
  - b. Declining serotonin and melanin levels, etc.
  - c. Increase in bilirubin, pyrroles and glucose.
- Stage 3 often develops after the long periods of exposure.

### TOP SOURCES OF EMFS IN YOUR HOME

Each and every electronic device used in your home emits EMFs when it is connected to a power source (or) when it is on. Certain devices are highly risky sources because they emit higher levels EMFs. Here are some top sources of EMFs at home:

## Laptops

Laptops are a source of EMFs in most of the homes; they are the one's which emit high levels of EMFs (especially when using Wi-Fi or when connected up to a power cord), apart from this they are used by placing on laps!

### Laptop radiations burn your skin

- In general, when you place your laptop on your knees, it produces heat and the longer you use it the hotter it gets. The hidden fact behind this is that the heat radiating from your laptop can damage your skin, i.e., it can cause lifelong discoloration of the skin, and in rare cases it may cause skin cancer
- Whereas the heat generated by the computers cause a nettle sting-like rash – Which is named as “toasted skin syndrome”
- “Children’s skin is especially susceptible to heat” – So you should definitely have concern toward your kids, if they are using a laptop for homework or for playing games.

### Laptop radiation versus infertility in men

According to a study published in the journal “fertility and sterility” - Researchers in Argentina collected semen from 29 healthy men and measured the swimming ability of them after exposure to Wi-Fi radiation produced from an internet connected laptop. And after 4 h of such exposure, they found that one-quarter of the sperms lost their motility, i.e., they are no longer swimming. On comparison, 14% of the sperm cells kept at the same temperature but not exposed to Wi-Fi were swimming.

“If you are a guy, if you are using laptops, and if you are worried about fertility now or in your future you are advised to block the radiation and heat from your laptops to escape from infertility.”

### Pain in the neck

The laptop users use their laptop by placing it on their laps and this increases the tendency to bend the head, mounting tension in the neck which causes pain and in certain extreme cases, can lead to disc displacement.<sup>[2]</sup>

### Twitching and swelling in the fingers

The keys which are present on the keyboard are very clumsily placed, and they are confined to save space. While using the laptop, people may bend their fingers in inconvenient position which on long time use can cause agony in fingers and even inflammation in due course.

### Vision fatigue

As the gap between the laptop screen and the keyboard is very short, the constant looking at the flashing screen can

streak sorry-sore to the eye. Further it causes reddening of the eyes, tingling and blurring are some of the common vision problems.

### Spine and nerves

While using a laptop, our neck-curve straightens and affects the spring-like mechanism, leads to arthritis, nerve damage and spinal degeneration.

### Repetitive strain injury

The continuous usage of the laptop may lead to neck and shoulder strain, numbness of the fingers, and some other problems. But generally, people tend to neglect or skip all those cramps and they think that it's just a matter of time afterward it would be alright. However, the repetitive injuries does not allow us to do anything.

### Prevention

#### Remove the laptop from your lap

Don't use the laptop by placing it on your lap. Place it on a desk or table and treat it like normal computer.

#### Use a laptop shield

- There is an alternative for reducing exposure to laptop radiation directly if we choose to sit with the laptop directly by placing it on your lap, i.e., laptop shield. It's not a complicated or bulky device, it's just a simple pad engineered and tested whether is it effective hurdle between you and laptop radiation – like the DefenderPad laptop shield.

#### Use of DefenderPad shield to block laptop radiation and heat

- DefenderPad is the one that is commonly used to protect yourself from laptop radiation. When it is used under your laptop, its advanced shielding technology reduces harmful emissions to undetectable levels<sup>[3]</sup>
- Independent testing shows from what does DefenderPad protects you from:
  - Extremely low frequency
  - EMR
  - Radio frequency
  - Heat radiation.
- This DefenderPad is not only used for laptops but it is also used with tablets and eReaders and some other devices
- Turn off your Wi-Fi when you are not using it
- Don't use laptops, tablets, eReaders or cell phones while they are plugged in
- Try to make your calls on speakerphone or with earphones as possible
- Create a small distance between you and your electronic products which is present at your home - specially where you are going to spend a lot of time (like in bed)

- Use a separate keyboard: The laptop screen and the keyboard of the laptop are very nearer, which makes us to stick our face onto the screen. It may finally exert a stress on the eyes, resulting in strain and bulged eyes. Connecting a separate keyboard keeps you away from all such problems
- Take a break: Take short breaks every 2 h, keep your eyes off the screen and close for a while every ½ h for a minute or two. Make this a habitual routine.

## Cell Phones

You've probably heard about news stories claiming that "cell phones are dangerous" while others claiming that "cell phones have been proven safe." It keeps us in a confused state what to believe especially as we've grown depending on these convenient communication devices.

Cell phones provide an easy way of communication with friends, family members, and co-workers, etc., and excessive use of cell phones can take a toll on your health. Mobile phones use transmits radio waves through a series of base stations where radiofrequency waves are EMFs that cannot break chemical bonds or cause ionization in the human body, says the WHO. Although cell phones are considered to be low-powered radiofrequency transmitters, they transmit power when it is on, and it is therefore advised to stay as far as possible from your cell phones in order to reduce exposure of low-powered radio frequency transmissions.

### Risk factors

#### *Increases stress levels*

The frequent usage of cell phone can have a negative impact on our stress levels, causes constant ringing, vibration, etc., thereby keeping the cell phone users in trouble. According to a study conducted at the University of Gothenburg, Sweden, researchers examined whether there is any link between the psychosocial aspects of cell phone use and problems associated with central nervous system in young adults and found that high mobile phone use was associated with stress and sleep disturbances for women, sleep disturbances and symptoms of depression in men.

#### *Increases risk of illness in your immune system*

The nonstop touching of your phone can harbor germs on your handset. The greasy, oily marks you see on your cell phone after a day's use contains a number of disease-causing germs than those found on your toilet seat. In a study conducted at the London School of Hygiene and Tropical Medicine and Queen Mary, University of London, researchers had sampled 390 cell phones and hands to measure the levels of bacteria. The results of the study showed that 92% of the sampled cell phones had bacteria on them, 82% of sampled hands had bacteria of which 16% of cell phones and hands had *Escherichia coli*.

#### *Increases risk of chronic pain*

Cell phones require constant use of your hands, especially when sending text messages and e-mails. Responding to messages at rapidly can cause pain and inflammation of your joints. Long periods of cell phone use cause you to arch your neck especially if you hold the phone between your neck and shoulders.

#### *Increases risk of eye vision problems*

As the screens of mobile devices tend to be smaller compared to computer screens, you go closer to the screen, squint and strain your eyes for reading messages, etc. Staring at your mobile phones constantly for a prolonged time can cause problems in your vision later in your life.<sup>[4]</sup>

#### *Increases risk of tumor development*

There have been concerns, from both media and the scientists, that prolonged cell phone usage is linked to tumor development, but the tumor does not develop on immediate exposure it takes time for about 10-20 years to develop. In addition, the long-term risks are more with children than adults as their usage is high compared to others.

The International Agency for Research on Cancer (IARC), a part of the WHO, brought scientists together, including those who has financial ties with cell phone companies, to review all relevant data regarding radiation from wireless handheld devices such as cell phones. The IARC concluded that the radiation is "possibly carcinogenic to humans," and they were not in a position to conclude whether the cell phone usage is safe or dangerous as there is no enough research evidence.<sup>[5]</sup>

IARC created Interphone Project, an international effort (that did not include the United States) to investigate the risk of tumors on exposure to radiation from cell phones. It took about 10 years to complete the project and it was completed in February 2012. Scientists failed in concluding finally due of the biases in the study.<sup>[6]</sup>

Scientists around the world have published their own results and other health problems that appear as a result of frequent cell phone usage. The following health problems connected to cell phone radiation:

- Salivary gland tumors<sup>[7,8]</sup>
- Dizziness and migraines<sup>[9]</sup>
- Less sleep and poor sleep quality<sup>[10]</sup>
- Increases and decreases in production of specific proteins in human cells<sup>[11]</sup>
- Decreased sperm count and quality<sup>[12-14]</sup>
- Skin irritation, especially on the face (this is a condition known as electrohypersensitivity)<sup>[15,16]</sup>
- Behavioral problems and increased chance of cancer tumor development in children.

Meanwhile cell phone companies continued to insist by showing evidence that their cell phones are safe by drawing the conclusions based on the studies funded themselves. In

addition, the studies they had conducted were not performed recently; those studies were conducted years ago when cell phone usage was much lower for an average person than in today.

### **Prevention**

Precautions to be taken to limit effects of cell phone radiations are as follows:

- Limit the number of calls you make
- Limit the length of your calls
- Use hand free devices like Bluetooth
- If you are not using a hand-free device, put the cell on “speaker mode” or hold the phone away from your ear such that exposure to radiations can be minimized to certain extent
- When speaking on your cell phone, don’t speak continuously by holding it one side use the alternate side of your ear
- Avoid carrying your phone in your pocket, or on your belt, or anywhere close to your body because the cell phones emit radiation even when they are not in use
- Limit your cell phone use in rural areas or in any place where there is no proper reception of signals because more radiation is emitted when you are farther from a cell phone tower
- Text message what you want to speak to the other person instead of talking
- Check out how much radiation is your phone emitting by looking at its specific absorption rate (SAR). SAR measures the amount of radiation that is absorbed by your body on exposure
- When you are going to buy a new phone, try to select one with a lower SAR.

### **Headphones**

Previously, the leading cause of hearing impairments used to be because of exposure to excessive noise in the workplace, nowadays the leading cause of hearing impairment is due to exposure to excessive noise from portable stereo earphones. Today, 1 in 5 teens has some form of hearing loss - About 30% higher than it was in the 1980s and 1990s, many experts believe that this is due to increased use of headphones.<sup>[17]</sup>

Listening through headphones at a high volume for prolonged periods results in lifelong hearing loss in children and teens. Experts advise people not exceed 60% of maximum volume when listening through headphones. Earphones, especially the ear bud earphones amplify the sound you are hearing five to six times, so it is advised to use normal earphones than ear bud earphones to minimize the hearing loss.

If you cannot hear anything going on around you when listening to headphones, it indicates that the decibel level is “too high” (or) if a person next to you can hear the sound being

delivered into your ear through headphones or earphones, it indicates the sound is too loud and over an extended period it can lead to irreversible hearing loss. “Even a mild hearing loss due to excessive noise could lead to developmental delays in your speech and language.”

Listening to sounds at a level of 120 dB can cause hearing loss after an hour or within 15 min.” As a rule of thumb, you should only use MP3 devices at levels up to 60% of maximum volume for a total of 60 min a day. The louder the volume you use, the shorter your duration of listening should be. If you want to listen to music at maximum volume, it is advised to listen for only about 5 min a day.

The amount of hearing loss that one will suffer depends on both to the volume (measured in dB), and the duration that one is exposed to the sound. The below-mentioned data provide information regarding the loudness and duration of time to be considered while hearing:<sup>[18]</sup>

- a. At 85 dB (or) below 85 is considered safe
- b. At 90 dB, damage will occur after 8 h of exposure per day
- c. At 95 dB, damage will occur after 4 h of exposure per day
- d. At 100 dB, damage will occur after 2 h of exposure per day
- e. At 105 dB, damage will occur after 1 h of exposure per day
- f. At 110 dB, damage will occur after 30 min of exposure per day
- g. At 115 dB, damage will occur after 15 min of exposure per day
- h. At 120-plus dB, damage occurs almost immediately.

### ***Mechanism involved in noise induced hearing loss (NIHL)***

When you listen to music for prolonged time or listen to music at maximum volume, the tiny hair like structures in your ear (they help in sending signals to your brain to cognate a sound) get damaged and eventually their outer covering gets stripped off leading to hearing loss. This type of hearing loss (that occurs due to prolonged earphone use) is called NIHL and it is often irreversible.

### ***Signs of hearing loss***

- Hearing loss due to headphone use is typically gradual, cumulative, without obvious warning signs
- However, if you experience any of the following symptoms experts recommends you to visit physician immediately.
  - a. Ringing, roaring, hissing, or buzzing in the ear
  - b. Difficulty understanding speech in noisy places or places with poor acoustics
  - c. Muffled sounds and a feeling that your ear is plugged
  - d. Listening to the television or radio at a higher volume than in the past.

## Prevention

- First and foremost, follow the 60/60 rule which is the ratio of maximum volume and duration of time
- Start using older models, i.e., larger headphones that rest over the ear opening instead of earphones that are directly placed in your ear canal
- Avoiding excessive use of listening devices helps in minimizing or preventing hearing loss
- Avoid using the phone while driving or operating the machinery as it increases the attention load and lowers reaction time
- Radiation penetration into the brain and tissues is more in children than in adults, so keep the mobile phones away from the children
- Avoid conversations more than 10 min and do not talk for longer time, i.e., more than 60 min in a day<sup>[19]</sup>
- Check for ear damage if you have sinus or cold.

## Microwave Ovens

### What are microwave ovens and how do they work

- Microwave ovens are appliances used in kitchen to cook or reheat food by emitting microwaves
- Microwaves are also a form of EMR, and they are on the lower energy end of the energy spectrum, next to radio waves. The waves are generated by magnetron found within the microwave ovens
- Magnetrons produce an EMF with a microwave frequency of approximately 2450 MHz
- Microwaves produced within the microwave oven causes dielectric heating, these microwaves bounce inside the oven and get absorbed into the material whatever is placed in the oven
- To heat something in a microwave oven, water must be present within the substance
- If there is no water, heating will not occur and it will remain cool and you might wonder why the food that you have placed has been heated unevenly. The reason for this is that generally the water molecules within the food vibrate at incredible speeds and creates molecular friction for heating of the food, and as all the areas of food does not contain the same amount of water heating becomes uneven.<sup>[20]</sup>

### Complications on exposure to microwaves of micro ovens

#### Cataracts

Eyes are vulnerable to microwaves because compared with other areas of body they lack blood vessels to dissipate heat and cellular stress and the first suspected clinical case of microwave caused cataracts was reported by Hirsch and Parker in 1950's, followed by Sulman in 1980.<sup>[21]</sup>

#### Micro waves zap food nutrition

Heating the food in the microwave ovens can take away its original nutrients. Nothing but nutritious plate of food placed

in oven turns to dead food due to the dielectric heating of microwaves.

#### Microwaves creates carcinogens in food

When you heat the foods wrapped in plastic, microwaves release from the oven create carcinogens in the food. These foods are found to contain toxic chemicals such as bisphenol-A, polyethylene terephthalate, benzene, toluene, and xylene says Foodbabe.com.

#### Microwaves can change heart rate

A study conducted by Dr. Magda Havas of Trent University found that the radiation that is emitted by a microwave affects the heart rate. If you experience irregular heartbeat or any chest pain regularly on eating microwaved food, it is best to cease (or) discontinue eating microwaved foods.<sup>[22]</sup>

#### Microwaved meals can change blood chemistry

The following are the changes that are observed usually on eating microwaved meals frequently:

- Cholesterol levels are rapidly increased
- Hemoglobin decreased significantly (creates anemic problems)
- Lymphocytes (called as white blood cells) showed a significant decrease in its number
- Increased stress (evidence showed it is due to the increase in leukocyte number).

#### Microwaving human breast milk

The following are observed on microwaving human breast milk:

- Declines the lysozyme activity
- Reduces the number of essential antibodies
- Promotes potentially dangerous bacteria
- Milk heated to 72°C loses 96% of all immunoglobulin-A antibodies, which fight invading microbes.

#### Some other dangerous side effects that are associated with the use of microwaved food are as follows

- The important nutrients, minerals, and vitamins which are present in the food are changed into toxic substances that cannot be broken down or it cannot be absorbed in the human bodies due to the use of microwave to cook or reheat it
- A continuous use of microwaved food can be a reason for brain damage because it decreases the electrical impulse that is produced by the brain
- The hormones that are produced in both males and females is altered or ceased due to the usage of microwaved food
- The byproducts obtained from the microwaved food usually have long-term persistent effects on the human body that weakens the body slowly but continuously
- Due to microwaved food, there will be the production of cancerous tumors in the human stomach and intestines
- Colon cancer is increased rapidly in people who are living in developed countries in the present era is mainly

due to the use of microwaved food which hits the human intestines that are dangerously enough to cause cancer

- The human blood develops the cells that cause cancer if they take the microwaved food for a prolonged period
- The lack of concentration, decline in intelligence power, emotional instability, and memory loss are caused due to eating too much of microwaved food
- The cereals and the milk which are placed in microwave oven convert the essential amino acid into carcinogen products
- The nucleoproteins that are present in the meat gets loose when it is placed in microwave oven
- The resistance capacity of the body against the different viral and bacterial infections gets lowered due to the eating of microwaved food
- Anemic conditions are increased in the body due to a decrease in hemoglobin in the blood gradually. The main cause is due to the excessive intake of microwaved food.<sup>[23]</sup>

### Prevention

- First, dispose the microwave. Do not use microwave ovens as much as possible. Keep your food in the conventional oven. We can make use of convection oven or a toaster oven as an alternative
- Start consuming more raw food – So that it limits the chances that you need not to use a microwave, and it's extremely healthy.

It doesn't seem to be any reason to use microwave ovens when comparing benefits and the risks. No one noticing the dangers of microwaves has an agenda. Invest your money in a commodity which will secure you against EMR. By doing this, you will more or less eliminate the radiation aspect of microwaves.

## CONCLUSION

The prevalence of wireless telecommunication has increased throughout the world in the recent "radiation age." Without these electronic devices, the present generation cannot imagine their life. There is no other way to avoid such sources. The only way to get rid of these effects is by taking preventive measures. However, The UK Health Protection Agency reviewed treatments for electromagnetic hypersensitivity, and success was reported with "neutralizing chemical dilution, antioxidant treatment, cognitive behavioral therapy, acupuncture, and shiatsu."

In general, children use electronic devices for playing games and for entertainment purpose. However, they are unaware regarding the effects caused on exposure to such radiations. Hence, it is the responsibility of the parents (or) guardians to protect their children from the future effects. Whereas coming to the adults, it is their own responsibility to take care of their health.

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