

Impact of Wireless Devices on Health

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ABSTRACT

In this modern ultra scientific horribly civilized society, several diseased & harmful habits, practices & cultures have become the parts of our day to day life. Among those habits & practices, technological dependence & whimsical uses of technologically ultra modern gadgets is a principle one, particularly mobile phones, computers, laptops, wi-fi, Bluetooth devices, microwave oven, television, washing machine e.t.c.. This paper is mainly focused on the health hazards produced by the wireless devices, which are emitting non-ionizing radiation. Although the business policy makers & lords are promoting that, NIR is safe, does not have any potential to damage our health, but the actual scenario is something different from these declarations. Actually, business policy makers are mainly playing with the human psychology, particularly their copy-paste mentality, exhibitionism & sociophobic mentality; as a result of that entire human race is going to be submerged under dump of the diseases, which are mainly irreversible in nature. Not only is the human race, rather entire environment facing serious threats due to these irresponsible worthless attitudes from the end of the humans. Non-ionizing radiation is dangerously damaging the electromagnetic field of nature, as a result of that; a gross psycho-somatic deprivation is encountered in all of the living beings & in the nature also. The one-sided implementation of the diseased policies of a single species is damaging the entire ecosystem in an irreversible manner. From the research work, the uprising disease pillars have encountered which are directly or indirectly related to these radiations. Diseases, which are ruling the society, are just the manifestations of these harmful practices and those are going towards a dangerous end in the comet speed. The purpose of this study is to investigate the negative effects of wireless devices in houses on human health. As these devices have become an essential part of daily life, they are widely used for communications and the Internet. No house can do without it, simultaneously no person is now disease free. The radiation emitted from these sources causes many symptoms, such as heart diseases, sleep disorders, brain tumors, ear hearing problems, male infertility, etc.

KEYWORDS: *Health Hazards by Wireless devices, Impact of Wireless devices on Health, Mobile phone on Health, Health Hazards, Radiation damage, Non-ionizing radiation, NIR, Wi-fi on health, Carcinogenesis, Circadian disruption, Ecological deprivation by NIR*

INTRODUCTION

Life or better to say 'lifeless life' is the current state what we are living. In this horribly modern time, we are very much focused on the lucrative machines & technologies by compromising the morality & purity of life. As a result we are becoming robots day by

day, where we love to adopt the characteristics of 'exhibitionism', to become socially acceptable as per the preset social bench marks. This tendency can be described more easily by the term '**copy-paste mentality**', without noticing more important &

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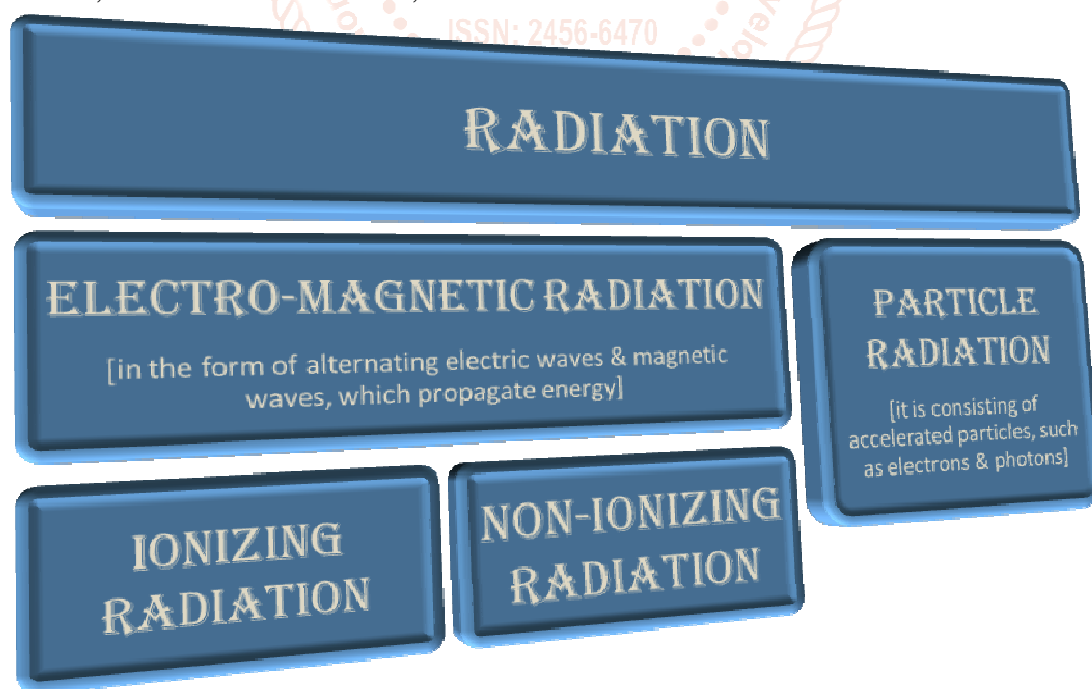


valuable facts of life, which can be termed as '**Ignorance**', may be willing or unwilling in nature. Actually, we have created some beautifully dangerous threats to ruin our present, as well as future, which are '*Ignorance, Manipulation, Copy-Paste Mentality & complexes*'. These are the important contributing factors of 'exhibitionism' & preceded by '**Sociophobia**', another threat of the modern civilization. This sociophobia directed the society to act as per the socially constructed bench marks; otherwise you have to be considered as out dated; as a result of that people are spending their cream time for the machines & gazettes. Instead of actual need, the gazettes are generally used to make people addicted, by means of several apps, games, media features, e.t.c. ; as a result of that the never ending expectations of people compelled them to invest more & more of their wealth for these instruments & gazettes., in the exchange of their health. Like the sociophobia, the entire civilization has learnt to ignore fundamentals & actuality of life. Although it is a horrible trend, but it is a very carefully constructed policy to do business with the individual or communal or social health, obviously due to the dangerous friendly enemies, i.e. **Ignorance & Sociophobia**.

Among these enormously threatening practices of the modern life, uncontrolled, whimsical & manipulatively logical uses of electronic gazettes (microwave, washing machine) & wireless devices (Wi-Fi, Bluetooth, Bluetooth instruments, Mobile

phone, Laptop e.t.c.) are very common. This paper is mainly focused on the health hazards of Wi-Fi, Bluetooth devices & Mobile phone. Wireless technology was invented in 1880 by Alexander Graham Bell and Sumner Tainted at the same time as the invention of the photo phone. Nowadays, our life has become easier with Wi-Fi. Although we are not tethered to a large computer that is physically connected to the Internet, Wi-Fi enables us to connect to the Internet from a coffee shop or your living room comfortably, but this luxury comes at a price. People use many types of wireless devices to communicate. The wireless network and mobile phone are an essential part of daily life all over the world. Wi-Fi device exchanges data by sending and receiving it wirelessly using radio waves. There are many devices that use Wi-Fi technology, including tablet pc, cell phone, audio player, PC and digital camera, wireless router, Bluetooth device, laptop connected with the wireless router. Before going to the detail of the materials & methods let us take a short snap from the fundamentals of radiation, which is going to be important for the further discussion.

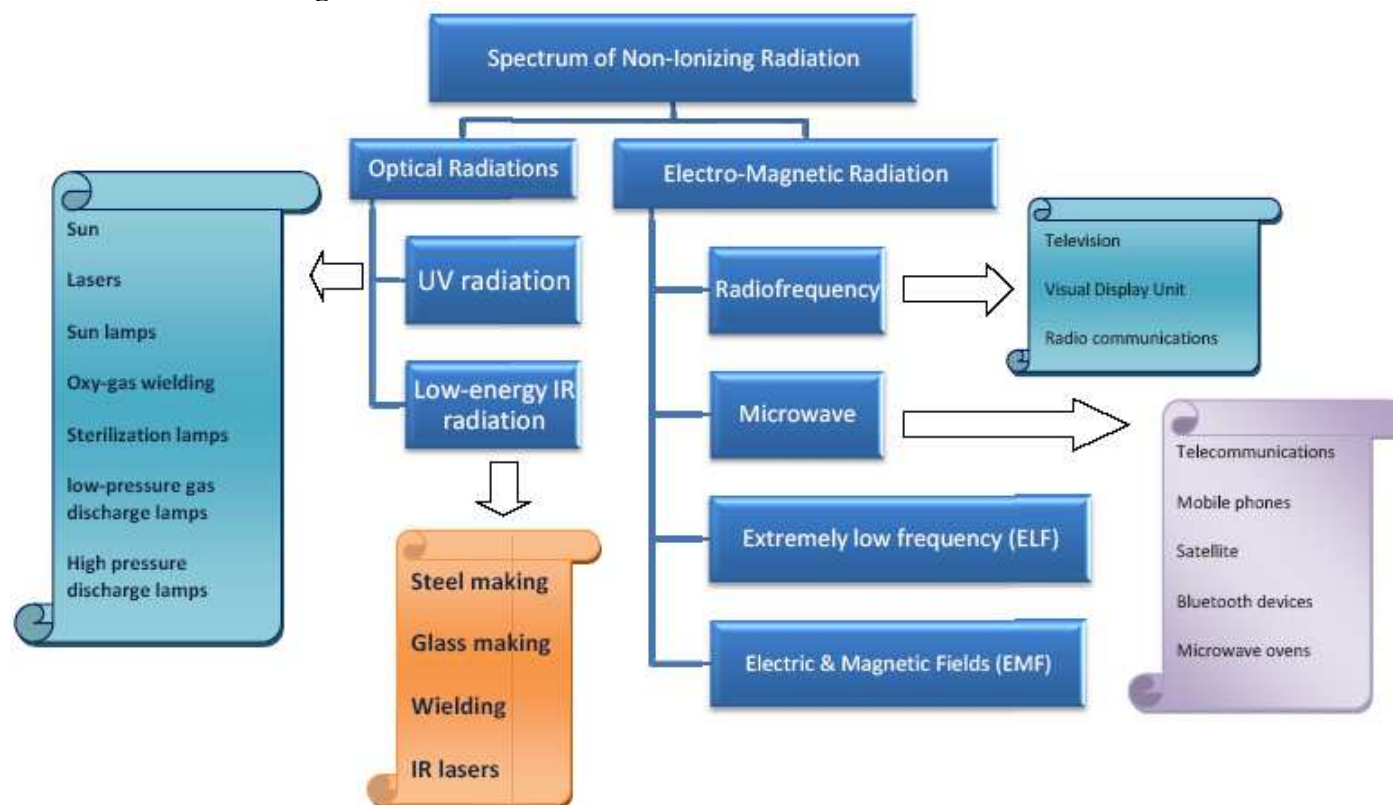
Radiation: Radiation is an energy, which is emitted by unstable or excited atoms or the oscillations of the molecules. Radiation is the wave characteristic of a particle. Radiation exists in two main forms, which are: 1) Electro-magnetic radiation (EM) & 2) Particle radiation.



Ionizing radiations are high-energy electromagnetic waves, which can easily remove electrons from molecules & cause damage to the cells by forming oxidative radicals. The ionizing radiation is proved to cause several damages in DNA & causes cancer subsequently. While, Non-ionizing radiations transmits directly electromagnetic energy, sound energy or thermal energy without breaking the chemical bond. As we are discussing about the instruments emitting Non-ionizing radiation in this paper, we will discuss non-ionizing radiation in detail.

Non-ionizing radiation includes the long wavelength, low photon energy, i.e. $<12.4\text{eV}$ portion of the electromagnetic spectrum, from 1 Hz to 3×10^{15} Hz. Non-ionizing radiation is not at all perceivable by the human senses, unless the intensity is so grave, which can be felt as heat; except the narrow visible region. The gradation of penetration of non-ionizing radiation, its sites & extent of absorption & subsequent health effects are absolutely frequency dependent. Non-ionizing radiations have many detrimental effects on health just like the ionizing radiation, e.g. photocarcinogenesis, oncogenesis, premature aging, immature cell death, epigenetic changes e.t.c.. Among the varieties of radiation, this paper is largely focused on the non-ionizing radiations, as those are linked to the wireless devices mainly.

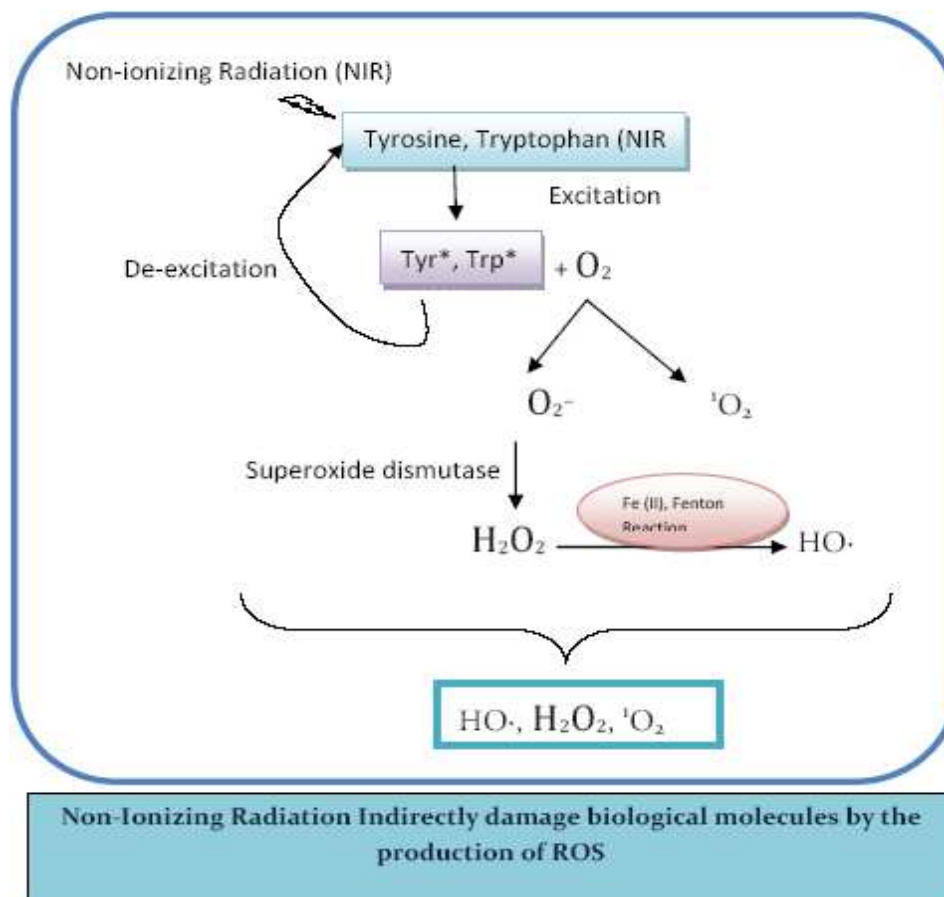
Sources of non-ionizing radiation:



Absorption of Non-ionizing Radiation:

Molecules or regions of molecules that absorb non-ionizing radiation are referred to as NIR chromophores. Biological systems are rich in NIR chromophores, including DNA and some amino acid residues. In DNA, the nucleotides thymine and cytosine absorb NIR to become electronically excited. In proteins, the amino acid residues tyrosine (Tyr), tryptophan (Trp) and cystine (double-bonded cysteine) absorb NIR, with an absorbance peak at 280 nm for Tyr and Trp and lower for cystine. For Tyr and Trp, their benzene ring structure facilitates an electronic transition from the ground state to the singlet excitation state that requires photons in the NIR region (180–270 nm). The excited chromophores can then transfer their energy or donate an electron to O_2 , forming several reactive oxygen species (ROS). The excess energy can cleave intermolecular bonds, such as disulphide bonds, or facilitate the formation of pyrimidine dimers in DNA.

The damage in the biological organisms by the non-ionizing radiation is largely mediated indirectly via the photodynamic production of unstable ROS. Reactive Oxygen Species (ROS) is generated via the reaction between the NIR chromophores & molecular oxygen. A superoxide anion radical (O_2^-) is produced via the electron transfer or singlet oxygen ($^1\text{O}_2$) is produced via the energy transfer, through the reaction between excited NIR chromophores & molecular oxygen. The superoxide anion radical is then converted into the Hydrogen peroxide by the Superoxide dismutase, which is present within the cell & extracellular matrix. Through the Fenton reaction, Hydrogen peroxide is converted into the hydroxyl radicals ($\text{HO}\cdot$). These intracellular ROS are known to damage both proteins & DNA.



Biological Consequences of the Exposure to NIR:

Intracellularly, NIR can be absorbed directly by the DNA nucleotides thymine and cytosine to form cyclobutane pyrimidine dimers (CPDs) and 6-4 photoproducts (6-4PP). These photoproducts can further absorb residual NIR to form Dewar valence isomers. CPDs, 6-4PP, and Dewar valence isomers are known as photolesions which disrupt the base pairing of DNA, preventing DNA transcription and replication. Photo-dynamically produced ROS may cleave the DNA sugar backbone causing single-stranded breaks (SSB) or oxidise guanine nucleotides to produce another photolesion, 8-oxoguanine, which can cause mismatched pairing between the DNA bases.

The ROS, ¹O₂ and HO· produced by NIR are strong oxidising agents that also target amino acids vulnerable to oxidation, including tryptophan, tyrosine, histidine, cystine, cysteine, methionine, arginine & glycine. Oxidation-associated changes in protein structure may, in turn, affect functions. NIR exposure can also break or form intermolecular bonds in proteins. In particular, di-sulphide bonded cystine can be reduced to cysteine. These amino acid level changes can affect protein function, with high and low NIR doses decreasing and increasing the thermal stability of collagen, respectively. UVR can also disrupt the function and structure of lipids via lipid peroxidation, resulting in compromised cell membranes. Extracellularly, ROS may cause damage to abundant ECM proteins, such as collagen and elastin, & to UVR-chromophore-rich proteins, such as fibrillin microfibrils and fibronectin.

Mechanism of Interaction:

When a NIR electromagnetic field in air impinges on a biological body it is reflected, transmitted, refracted or scattered by the biological body; the refracted and scattered fields may proceed in directions different from that of the incident NIR field. These phenomena are described and governed by the well-known Maxwell's equations of electromagnetic theory. The transmitted and refracted fields from the NIR exposure induce electric and magnetic fields in the biological systems that interact with cells and tissues in a variety of ways, depending on the frequency, waveform, and strength of the induced fields and the energy deposited or absorbed in the biological systems. Thus, to achieve a biological response, the electric, magnetic or electromagnetic field must couple into and exert its influence on the biological system in some manner, regardless of what mechanisms may be accountable for the response. Nevertheless, knowledge of the specific mechanism responsible for a given observed biological effect is of scientific interest because:

- (1) they facilitate understanding of the phenomenon,
- (2) they help in analyzing relationships among various observed biological effects in different experimental models & subjects and

(3) they serve as guides for comparison and extrapolation of experimental results from tissue to tissue, from tissue to animal, from animal to animal, from animal to human, and from human to human undergoing NIR exposure.

Therefore, it is important in assessing the health and safety risk of NIR to determine not only the fields induced in biological tissues, but also the mechanisms underlying its biological interactions with cells, tissues and the human body. However, while a mechanisms must be involved in giving rise to biological effects from NIR exposure, it is possible that because of their complexity and the limitations of our scientific knowledge some mechanisms responsible for producing a significant effects are still remained unclear.

The behavior of NIR fields and their coupling and interaction with biological systems are very different in the near and far zones. The demarcating boundary between near and far zones occurs at a conservative distance of $R = 2 D^2 \lambda^{-1}$, where D is the largest dimension of the antenna. Furthermore, the near zone can be divided into two subregions: the radiative region and the reactive region. In the radiative region, the region close to and within $2 D^2 \lambda^{-1}$, the radiated power varies with distance from the source. The vicinity of the source where the reactive components predominate is known as the reactive region.

At the lower frequency of 100 kHz, the wavelength in air is 3 km and the $\lambda/2\pi$ distance is about 477 m for the reactive and radiation fields to have equal amplitudes. In contrast, at 900 MHz, the wavelength in air is 33 cm and the $\lambda/2\pi$ distance is 5.3 cm, which comes very close to the $2 D^2 \lambda^{-1}$ distance of 6 cm for a 10-cm NIR source operating at 900 MHz in air. Clearly, both near-zone reactive and far-zone radiative interactions are encountered in the vicinity of personal wireless telecommunication systems. Some of the salient features of near zone field are:

1. NIR electric and magnetic fields are decoupled, quasi-static, and are not uniform,
2. wave impedance varies from point to point,
3. beam width from the source is divergent and is small compared with the head or human body
4. the power varies less with distance from the source and
5. the power transfers back and forth may be nearly constant between the source and its surrounding medium.

In the far zone, RF fields are characterized as follows:

1. they have plane wave fronts and are independent of source configurations
2. the radiated power decreases monotonically with distance from the source, &
3. the electric and magnetic fields are uniquely defined through the intrinsic impedance of the medium. Thus, a determination of the electric or magnetic field behavior is sufficient to characterize the exposure in terms of power density.

An important consideration in NIR exposure is the coupling of NIR fields and their distribution inside the body. This association is also valuable in human epidemiological investigations on the health effects of NIR field usage. The coupling of NIR electromagnetic energy into biological systems may be quantified by the induced electric and magnetic fields, power deposition, energy absorption, and their distribution and penetration into biological tissues. These quantities are all functions of the source and its frequency or wavelength, and their relationship to the physical configuration and dimension of the biological body. Furthermore, the coupling is more complicated in that the same exposure or incident field does not necessarily provide the same field inside biological systems of different species, size, or constitution. Additionally, the interaction of RF energy with biological systems depends on electric field polarization, especially for elongated bodies with a large height-to-width ratio.

It is emphasized that the quantity of induced field is the primary driving force underlying the interaction of electromagnetic energy with biological systems. The induced field in biological tissue is a function of body geometry, tissue property, and the exposure conditions. Moreover, determination of the induced field is important because:

1. it relates the field to specific responses of the body,
2. it facilitates understanding of biological phenomena, &
3. it applies to all mechanism of interaction.

Once the induced field is known, quantities such as current density (J) and specific energy absorption rate (SAR) are related to it by simple conversion formulas. In this case, for an induced electric field E in $V \cdot m^{-1}$, the induced current density is given by

$$J(x,y,z) = \sigma(x,y,z)E(x,y,z)$$

where σ is the electrical conductivity (S m⁻¹) of biological tissue and SAR is given,

$$SAR(x, y, z) = \frac{\sigma(x, y, z) |E(x, y, z)|^2}{\rho(x, y, z)} \left[\frac{W}{kg} \right]$$

where ρ is the mass density of the tissue (kg m⁻³).

At lower frequencies, where the wavelength of NIR is at least an order of magnitude longer than the dimensions of the human body, field behavior inside the body is characterized by near-zone reactive field and is quasi-static in character. The electric and magnetic fields become decoupled, and they act separately and additively inside tissue medium. For all practical purposes, the induced fields can be obtained by combining the two independent quasi-static electric and magnetic solutions of the electromagnetic field theory. For example, an externally applied uniform electric field gives rise to a uniform induced electric field inside the body that is in the same direction, but reduced in strength by a factor inversely proportional to the dielectric constant and is independent of body size. The magnetically induced electric field amplitude inside the body is given by

$$E(x, y, z) = \omega B(x, y, z) r / 2 = \pi f \mu H(x, y, z)$$

$$\left\{ \begin{array}{l} \text{where } f = \omega/2\pi \text{ is the frequency} \\ \mu = \text{magnetic permeability} \\ r = \text{equivalent radius of a region with homogeneous electrical conductivity} \\ B = \text{magnetic flux density \&} \\ H = \text{strength of the magnetic field component} \end{array} \right\}$$

A uniform magnetic field produces an internal electric field that increases in proportion with distance away from the body center. Thus, magnetically induced electric field, i.e., inductive coupling, would dominate inside a biological body except for tissue bodies that are 1 nm or less in size. A similar scenario exists in the near-zone-reactive region of all NIR sources and radiating systems. A case in point, the interaction of a cellular mobile telephone handset with the user's head & heart is quasi-static in nature and inductive coupling of antenna-current-generated magnetic field dominates power deposition in the head & heart.

Materials & Methods:

The study is designed to identify the potential health damages by the Wi-Fi, Mobile Phone, Bluetooth devices, Headsets & Wireless gazettes. The study was designed in five different metro cities of India & several rural areas of West Bengal & Mumbai. Researchers are there to monitor life styles & day to day activity of the villagers & citizens very closely. Several questionnaires are designed to assess their Psycho-somatic level. This paper is mainly focusing on the following-

- Psychological issues
- Gastro-intestinal disturbances
- Cardio-Vascular diseases
- Auto immune diseases
- Musculo-Skeletal pathologies
- Oxidative stress
- Male infertility &
- Cancer

To rule out the above mentioned pathologies different varieties of questions & case taking proforma was designed. The study sector is classified into three broad categories-

- Rural- who are not adequately equipped with the gazettes like the citizens of the metro cities
- Mofussil- who are in the mid position regarding the uses of these devices between the rural & cities; ignorance & copy-paste mentality is largely encountered in these regions.
- Metro cities- who are readily exposed to the wireless devices, Wi-Fi & the electronic gazettes; who are more into the desperate ignorance & exhibitionism than others.

Groups	Areas	Population
Group-A	Rural	2546
Group-B	Mofussil	2289
Group-C	Metro cities	1758

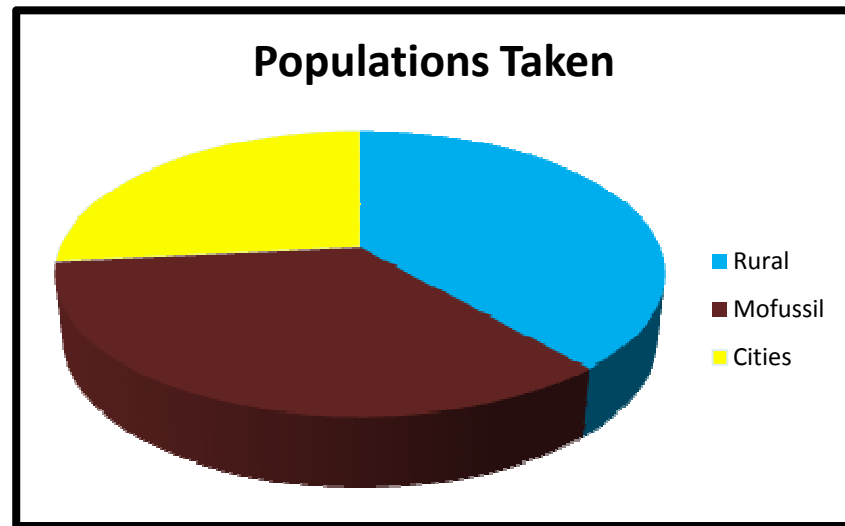


Chart- 01

Further, each group is further subdivided into several subcategories, to rule out the pathologies in different sectors.

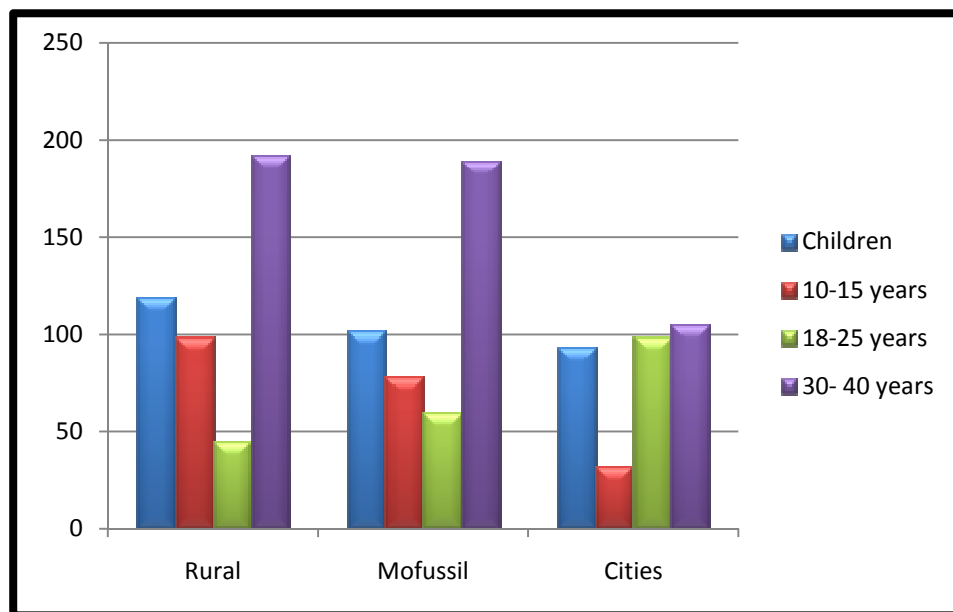


Chart-02

Findings:

Before diving in a deep discussion regarding the findings related to health hazards, at first we have to observe the results about the devices, which are readily affecting our health in several degrees.

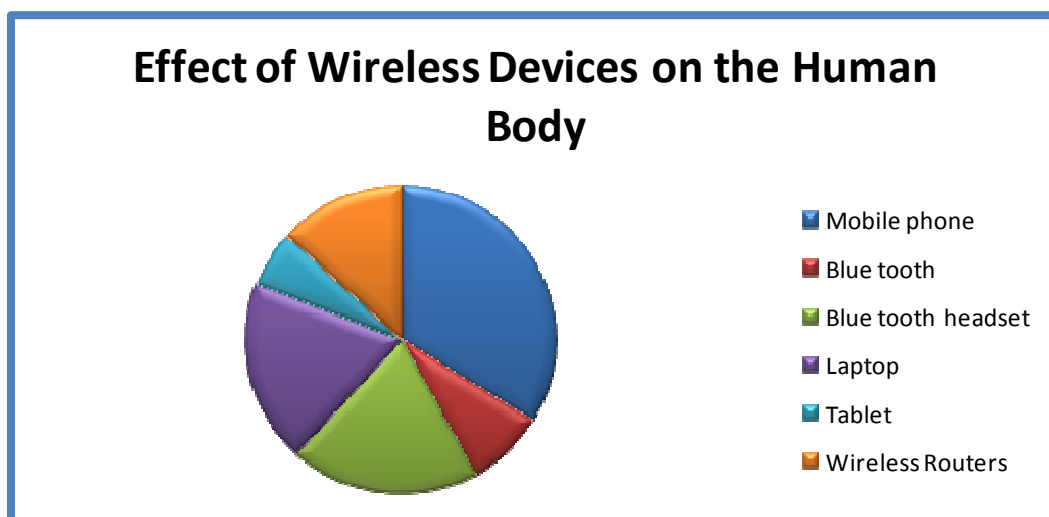


Chart-03

Chart-03 is clearly showing the gradation of the effects produced by the devices, among which maximum magnitude is covered by the mobile phone, then blue tooth headset, Laptop, wireless routers, Blue tooth & Tablet affects accordingly.

It is very difficult to categorize diseases as per the radiation & non-radiation cause; because all the diseases are basically chronic in nature & all are having multidimensional approaches & aetiological contributors. The diseases on which we are concentrating, prevalence of those are considerably higher in the cities & mofussils in comparison with the rural areas. But now days, as the business giants are expanding their web of torture, a more diffuse global natural disaster is encountered. Not only in the health of the human beings, rather the entire ecosystem facing threatened for these radiations.

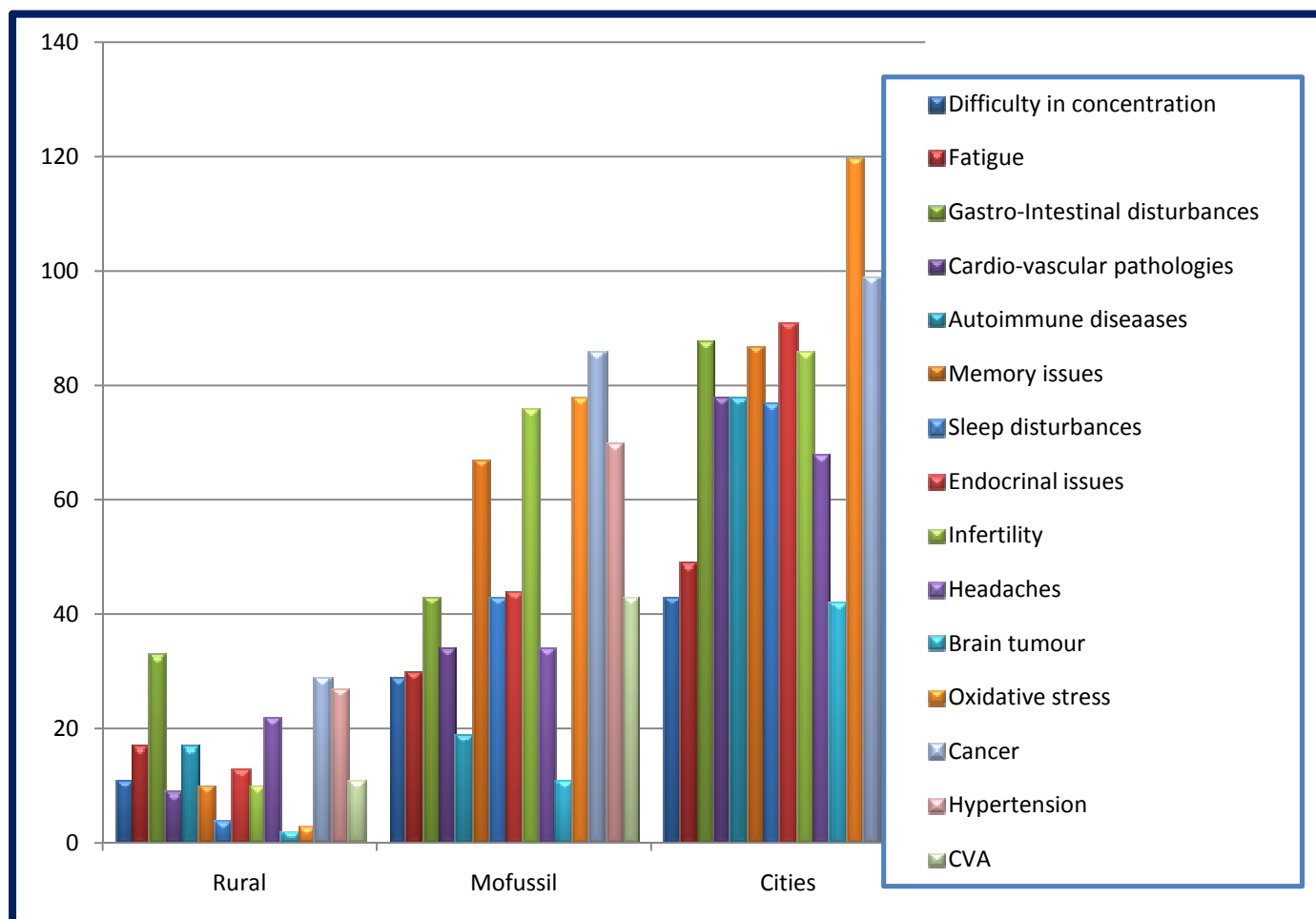


Chart-04 Diseases Related to Radiations, a Comparative Representation between Rural, Mofussil & Cities

Chart-04 is demonstrating the comparative data regarding the health hazards & diseases produced by the above mentioned devices in the rural, mofussil & cities. In the rural areas, where the availability & uses are much more less than the mofussil & cities, number of sufferers are much less in comparison with the cities & mofussils. The damages are not confined in any one area or in a specific time or period; nor it be isolated in any sector, rural/mofussil or cities. It is a gradual & long-continued degradation endorsed in our lives in a much planned way. In the following chart, we are going to explain such a shocking result, where we are going to present the data of last 12 years of two villages of West Bengal & Mumbai. In this period the uses of gazettes & cases of diseases both have increased in a considerable amount. Among the pathological conditions rise of metabolic syndromes & psychological issues are remarkable.

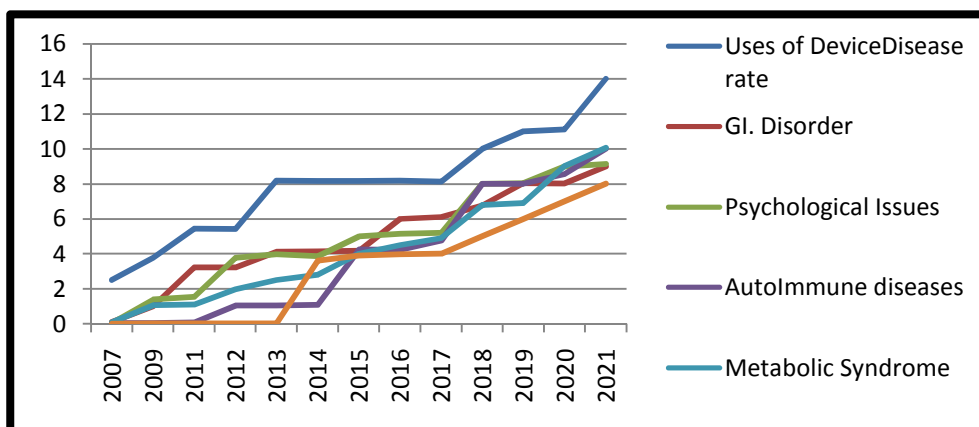


Chart-05 Interrelationship between Uses of Devices & Several diseases

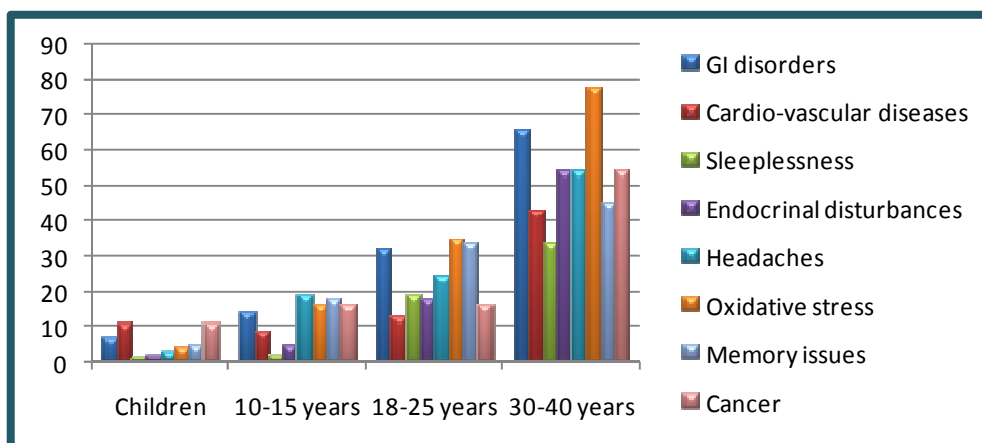


Chart-06 Categorization of the diseases as per the Age

Chart-06 is demonstrating the age specific disease scenarios, where genotoxicity & DNA damage is very much evident, especially for carcinogenic issues, cardio-vascular issues, gastro-intestinal issues particularly hepatic pathologies is evidenced. For the next age group, ranging from 10 years to 15 years, headaches, memory issues, oxidative stress, carcinogenic issues, memory issues & gastro-intestinal disturbances are evidenced. For the third age group, ranging between 18 years to 25 years, oxidative stress is rising in a jet speed, which in turn may become one of the responsible factors for a number of chromosomal abnormalities, neurological issues, psychological issues, metabolic syndromes, cardio-vascular issues, hypersusceptibility to the infections & many more in the next generation & later life; which is clearly seen in the findings of the next age group ranging between 30-40 years.

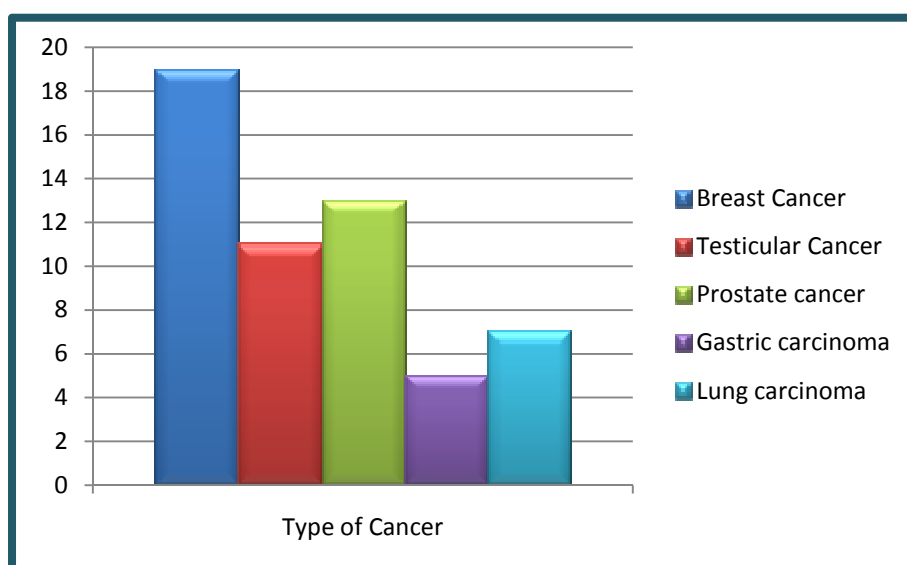


Chart-07 Incidence of Cancer & NIR

Chart-07 is demonstrating the association between carcinoma & exposure to NIR, where rate of breast cancer possesses higher risk factors than prostate cancer, then testicular cancer, then rests are following the path. During

the study, a notable disturbance is encountered in the HPO, HPA & HPT axis. As a result of that, a series of pathologies can be encountered related to those axes, including these cancers. Majority of the cases with breast cancer are presenting an associated axillary gland swelling. Premature enlargement of the prostate is an alarming precursor of cancer in prostate. Psycho-sexual compromization is an unavoidable association one can encounter in the cases with testicular carcinoma. Exposure to the NIR and circadian disruption are the conjoint attackers evident to produce gastric carcinoma, associated features of which are Hyperchlorhydria, loss of appetite or ravenous appetite, irritable bowel habit, habitual constipation, flatulence e.t.c. The above mentioned pathologies are associated with fatigue, deficient memory, sleeplessness, loss of energy, irritability, difficulty in problem solving capabilities e.t.c.; which could be the aetiologies of taking of abusive substances, which can damage our health in a more decorated manner.

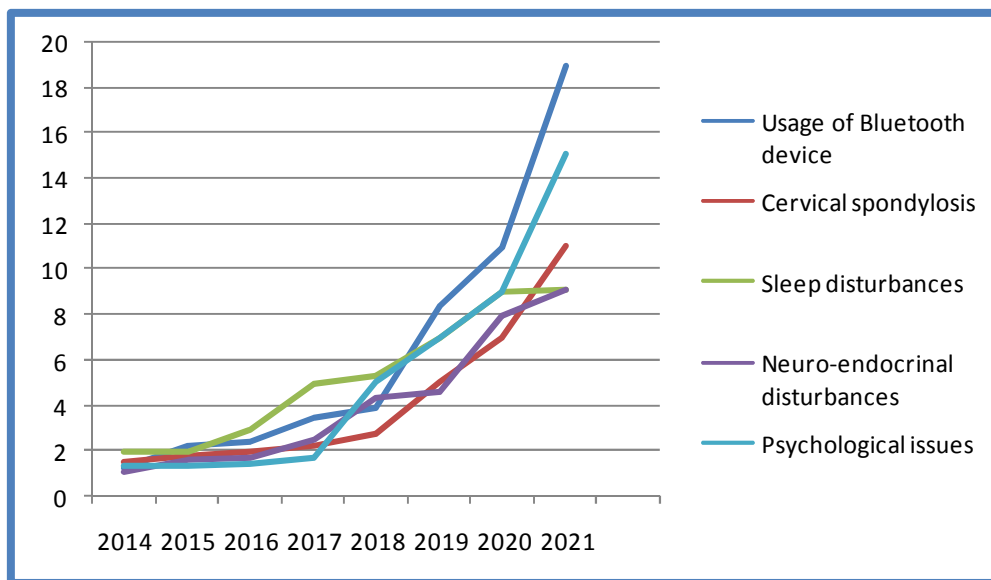


Chart-08 Association between Usage of Bluetooth devices & Disease incidences

Chart-08 is demonstrating the association between usage of Bluetooth devices & disease incidences in a period of 07 years. The study is designed with the carefully selected subjects who are not exposed to any occupational hazardous situation which can be a factor for these pathologies, nor have any genetic predisposition to the particular pathologies. Uses of the Bluetooth devices & pathological conditions are directly proportional; the disease scenarios are growing simultaneously along with the uses of the devices over the last 7 years. This association is sufficient to demonstrate the unavoidable health hazards of these so-called harmless devices. Particularly an association between Bluetooth headset & cervical spondylosis is encountered, where majority of the cases represents cervical gland swelling, lymph node enlargement e.t.c.

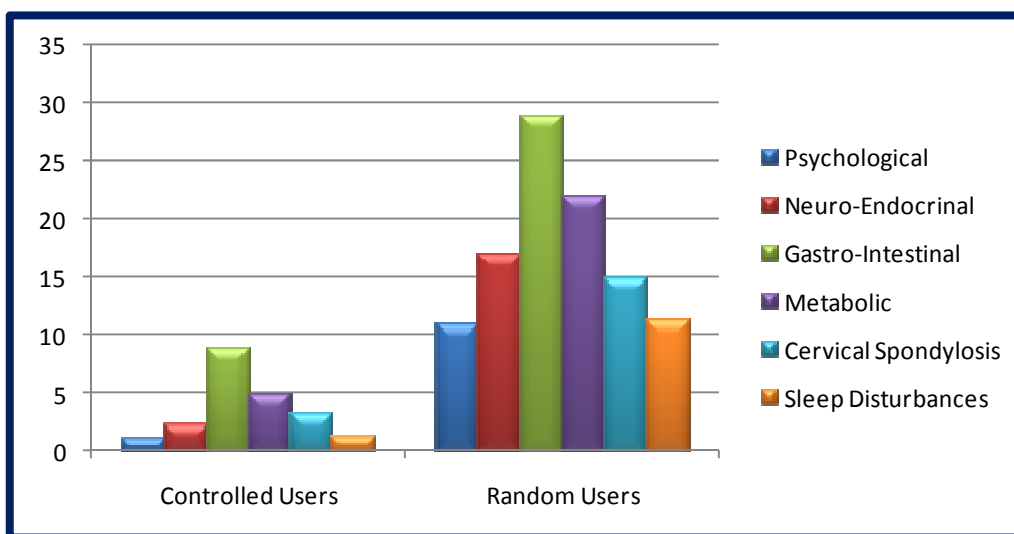


Chart-09 Comparative Study Between two groups (Controlled Users advised to use the devices for a stipulated time & Random users, who are free to use the devices as per their will)

Chart-09 is demonstrating the comparative study between two groups, participants of one group are asked to use the devices in a very controlled manner, for a stipulated time and rests are allowed to use those devices as per

their wish. The incidence in the next group is relatively higher, which is sufficient to demonstrate the unavoidable association between Bluetooth devices & disease scenarios. Among both groups gastro-intestinal issues play a considerable role. One can easily encountered the disease hike in the next group of randomized users. Dangerous pathological results are encountered from each of the groups, irrespective of the uses of the wireless devices, only hike of the scenario is different.

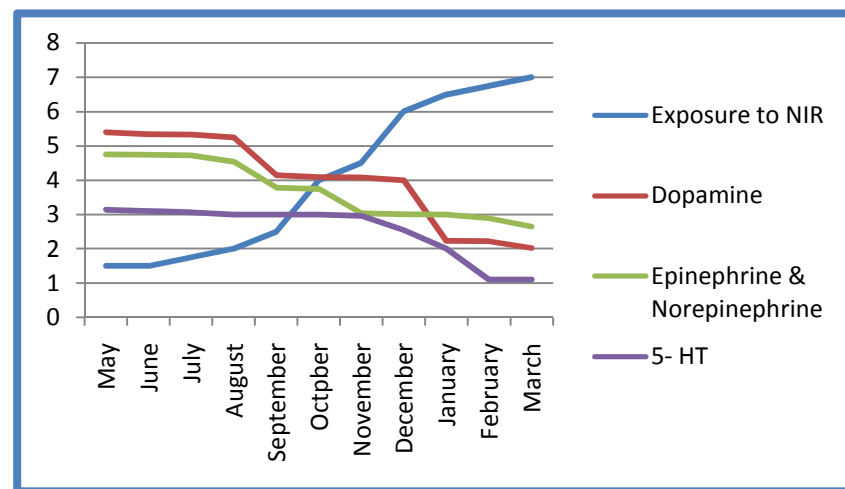


Chart- 10 Association between Exposures to NIR & Release of Neurotransmitters

Chart-10 is demonstrating the correlation between the exposure to NIR & decreasing secretion of dopamine, epinephrine & norepinephrine & 5HT. The deficiency of these neurotransmitters resulting into the stress-mediated damages which are inevitable due to this unnecessary use of the devices emitting NIR.

Conclusion:

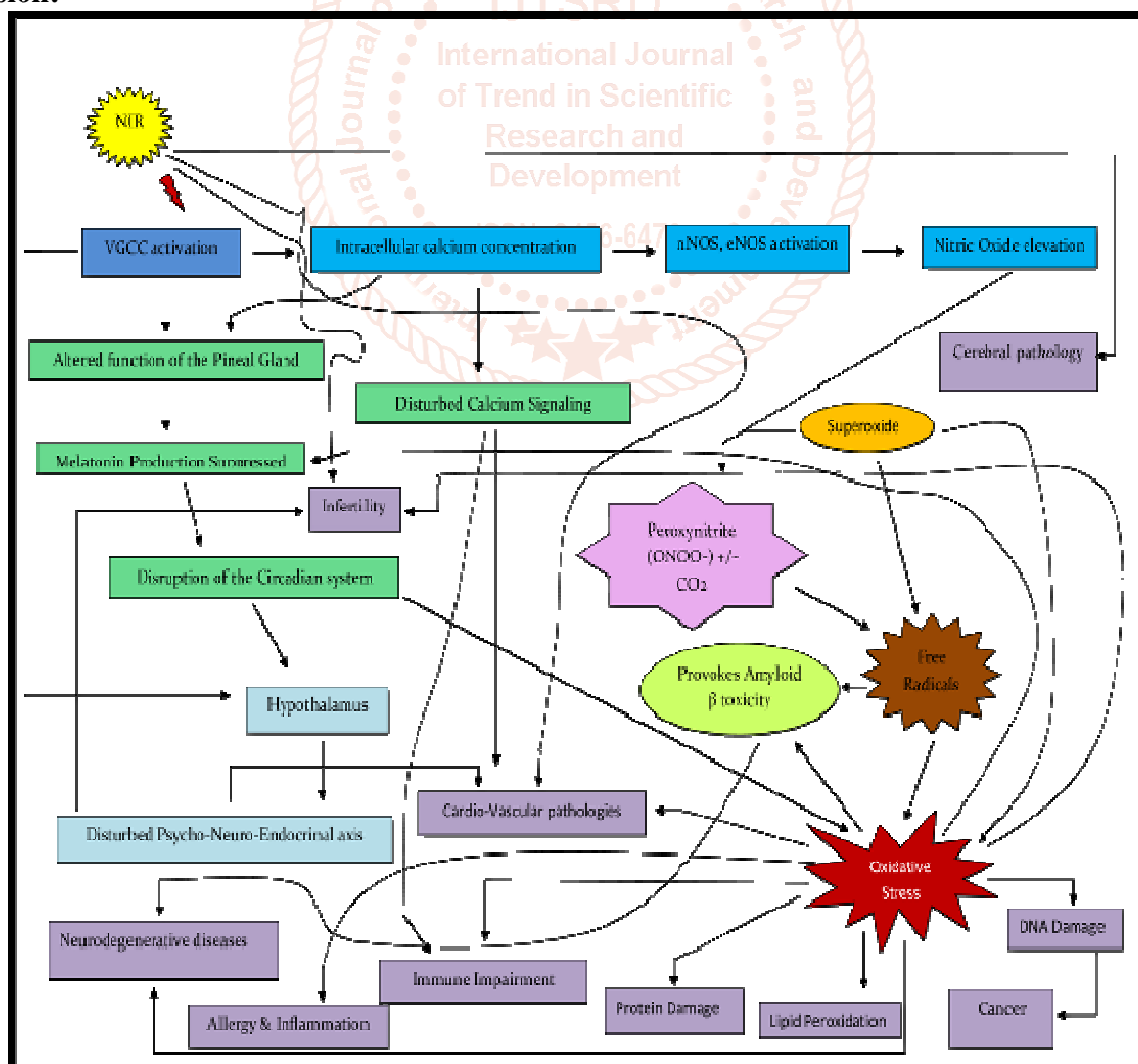


Chart-11 NIR induced Pathological condition & their Pathogenesis

Chart-11 is the summarized form of the damages made by the NIR with the pathological mechanisms, by which our psycho-somatic health has become readily damaged. From the discussion, one can able to understand about the unavoidable pathologies made by NIR, irrespective of their acceptance & denial. The NIR is not damaging the human health only, rather it is damaging the entire nature & has become a curse for the entire creation. The uncontrolled & whimsical usage of the NIR emitting devices are the planfully ignored aetiological factors for the disease pillars of the modern time.

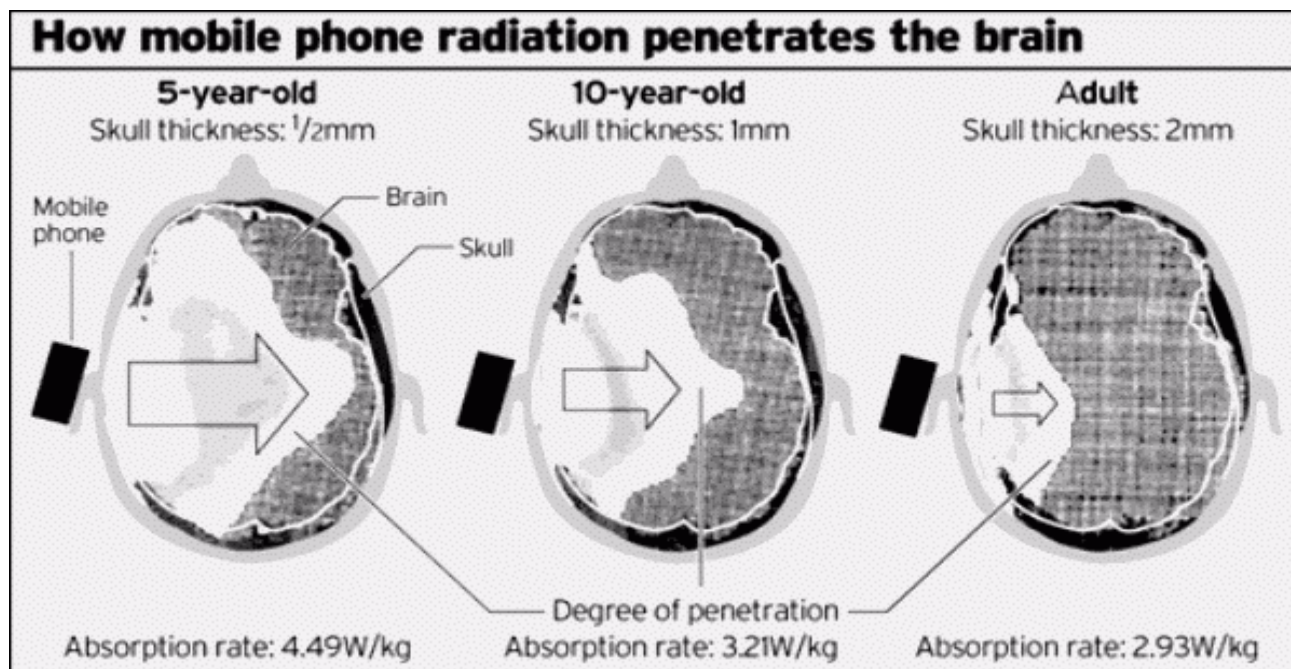


Chart-12 Drastic Effects of Mobile phones on human brain

Chart-12 is showing the degree of penetration of the NIR of the human brain, where absorption rate in the brain of a child is quite higher, i.e. 4.49 W/kg, then comes the number of a boy of 10 years & finally comes the number of an adult. So, children are much more vulnerable to the NIR, although they are forced to indulged in the usage of wireless devices by several means, with the name of advancement.

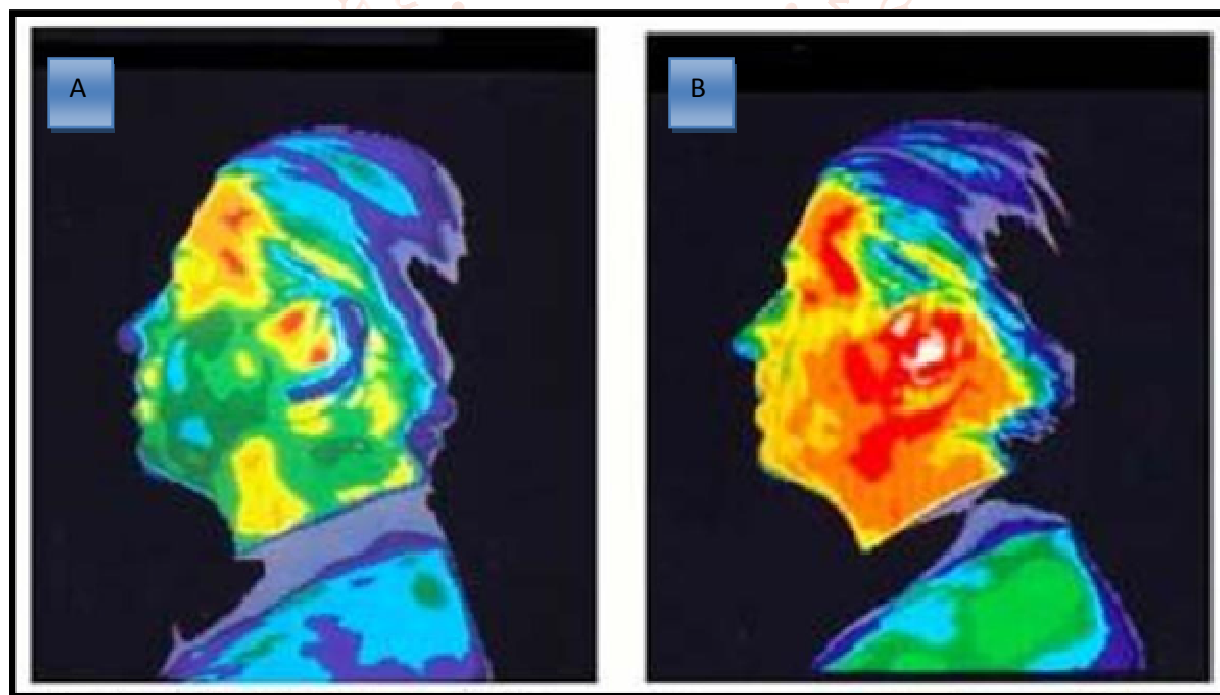


Chart-13 Picture-A is demonstrating a person who is not exposed to NIR. Picture-B is demonstrating a person who is exposed to the NIR for 1.25 minute.

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