

Why Fi?: Is Wireless Communication Hazardous to Your Health?

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We are exposed to increasing levels of microwave electromagnetic radiation from many devices which offer convenience and speed. We are not only addicted to it we depend on it. But what do we know of the health and environmental effects of this enlarging wireless web we are in? What should you tell your patients?

For sure there has been a good deal of controversy about health effects of cell phones, cordless phones, smart meters, cell towers and any number of wireless devices constantly and silently sending information through the air. Because of the escalating microwave radiofrequency exposure from many sources throughout the world there is a broad concern that wireless communication is or will be a significant public health issue.

Biologic and Human Health Studies Show Reason for Concern

While 3 decades of literature have shown biologic effects on a cellular level until recently there were no long term studies that indicated an increase in cancer in humans. A sufficient amount of research now exists to suggest there is reason for concern about long term and probably short term adverse health effects from this technology although some conflict still exists. Many scientists throughout the world have been calling for a reevaluation of the international standards for EMF as they are not protective of human health. **The current RF-EMF standards are based solely on heat effects of the microwave radiation on tissue and not the biological effects seen in the laboratory at levels more than a hundred times lower than what is allowed.**

Although more studies are underway, recent research on the microwave frequencies from cell phones and cell phone towers has demonstrated biological non thermal effects including leakage of the blood brain barrier, genetic damage with single and double stranded DNA breaks, disruption of intracellular communication, abnormal protein synthesis, and alternation of DNA expression. Epidemiological studies have demonstrated an increase in brain tumors, with long term use. Neurobehavioral effects from EMF have been reported to include memory loss, tinnitus, headaches, hearing loss and insomnia.

The Electromagnetic Spectrum

Electromagnetic Waves

Electromagnetic waves are a form of energy that consists of vibrating electric and magnetic fields. Electric fields are produced by forces of electric charges, and magnetic fields are produced when electric charges are in motion. When an appliance is plugged in, an electric field is produced around the appliance; when the

appliance is turned on and the electrical current is flowing, a magnetic field is added. When the appliance is unplugged the electric field remains at the outlet and there is no electric or magnetic field around the wiring or appliance.

Common sources of electromagnetic radiation

The main natural source of electromagnetic radiation is the sun. Natural electromagnetic energy (i.e., sunlight) is necessary for photosynthesis in plants. Man-made sources, however, account for most of the electromagnetic radiation in our environment. With the proliferation of new technological devices in our home and workplace we are all exposed to electromagnetic radiation daily. Everyday household electrical devices such as hairdryers, electrical ovens, fluorescent lights, microwave ovens, stereos, mobile phones, and computers and the transmitters that support these items emit electrical and magnetic fields of varying intensities.

ELF, RF and Microwaves

The electromagnetic spectrum extends from non-ionizing, extremely low frequencies **ELF** (long wavelength) used for electrical power line distribution with 50-60 HZ (oscillations of 50-60 times/second) and found in home appliances and electrical wiring; to radio and communication frequencies **RF** for radio, TV, cell phones, microwave ovens, satellite TV and wireless networks (1 KHz through 2500 MHz and now to 300 GHz which produce wave oscillations billions of times per second); to short wavelength ionizing high **gamma radiation** at the opposite end of the frequency spectrum (UV light, X-rays and radioactive sources).

Radio frequency waves (RF) are usually defined as those in the range 30 kHz to 300 GHz. Microwaves are a subset of radio waves typically between 300 MHz to 300 GHz. The electromagnetic spectrum is also divided into ionizing and non-ionizing bands based on how the wave interacts with biological tissue. Ionization involves removal of electrons from their normal positions in atoms and molecules, damaging tissues including DNA. Although ELF is a non-ionizing form of radiation the International Agency for Research on Cancer (IARC) has classified the extremely low-frequency (ELF) electromagnetic fields (EMF) as "possible carcinogenic" based on the reported effects. There is of yet no such classification with non-ionizing radiofrequency (RF) although some research supports this.

Evolution in a Low RF World

We evolved in an environment largely of a magnetic nature and a low radiofrequency (RF) world with little ELF-EMF. The sun's rays provide us with visible light and UV light but our fragile ozone layer protected us from most of its lethal ionizing rays. Microwaves were for the first time produced by humans in 1886 when radio waves were broadcasted and received. Until then, microwaves had only existed as a part of the cosmic background radiation. By utilizing microwaves in telegraph communication, radars, television and above all, in the modern mobile phone technology, mankind is today exposed to microwaves at magnitudes far greater than the original background radiation since the birth of universe. (Nittby 2009)

What Frequencies Are We Exposed To with cell phones?

GSM stands for Global System for Mobile communication, which is the most widely used in Europe and many parts of the world. GSM operates at either the 900 MHz or 1,800 MHz frequency band. The Universal Global Telecommunications System (UMTS) is a newer third generation system and emits wide-band microwave (MW) signals with multiple frequencies. It is also known as Broadband.

UMTS requires new base stations and new frequency allocations. It is called 3G.

UMTS may result in higher biological effects compared to GSM signal because of eventual "effective" frequencies within the wideband.

The Bioinitiative Report

In 2007 a group of international scientists, researchers and public health policy professionals completed a comprehensive public policy initiative to document what is known of the biological effects that occur at low intensity EMF exposures. This Bioinitiative Report looked at all the data both positive and negative regarding EMF's. After reviewing this extensive body of research there was a clear consensus that existing public safety limits are outdated and new standards were needed that are based on biological effects rather than the current thermal effects of microwave radiation we are exposed to. They also point out that many new wireless devices are exempt from wireless standards. The report also discusses the fact that while there is not 100% certainty with regards to some EMF effects there is sufficient evidence in order to take action to prevent public harm. The Bioinitiative Report seems at first daunting however the chapters are well referenced, detailed, balanced and readable. See, www.bioinitiative.org. Much more research has been done since that report.

Cell phones and Brain Cancer

Brain cancer, like other cancers, typically takes many years to develop and cell phones have only been used for 15-20 years. It is logical that earlier studies did not show any increase in brain tumors due to this latency period however newer studies indicate otherwise. Dr. Hardell, a well respected Swedish researcher, has looked at the long term human effects of the use of cell phones, cordless phones and their associated risk for acoustic neuromas, gliomas and astrocytomas. He has published many articles on this subject and has found a consistent pattern with increased risk in acoustic neuromas on the ipsilateral side with more than 10 years of use (Hardell 2007). A newer study published in Neuroepidemiology (Hardell 2010) showed an increase in malignant tumors as well. The highest risk was again for the same side the phone was used and for those using cell phones for more than 10 years. The risk increased with over 2,000 hours of cumulative use. In other research the highest risk was found in those using cell phones before the age of 20. **"We conclude that current standard for exposure to microwaves during mobile phone use is not safe for long-term exposure and needs to be revised."** (Hardell 2009)

Industry Versus Independent Research

A review of the literature on cell phones and brain cancer demonstrated that the older industry-funded Interphone research found no increase in brain tumors. All of the independent Swedish studies found a significant increase in brain tumors from cell phones and cordless phones. Morgan evaluated the flaws in the Interphone and Swedish studies. He found 11 flaws in the Interphone studies and 3 flaws in the Swedish study (Pathophysiology, Aug 2009).

The industry studies had selection bias, insufficient latency time, exclusion of young adults and children, rural areas with higher power levels not investigated, other sources of transmission excluded, exclusion of brain tumor types and funding bias. Both had flaws of exclusion of brain tumor cases due to death, tumors outside radiation plume considered exposed, and recall accuracy of phone use.

The latest Interphone update May 2010 did show a small increase in some types of brain cancers. No definite conclusions could be reached, however and there was a range of opinions on the panel with regards to the safety limits of cell phones.

Biological Effects from the Basic Science Literature

Many studies of microwave radiation have shown alteration of cellular processes with up regulation or down regulation of genes which encode proteins with diverse functions including neurotransmitter regulation, blood-brain barrier (BBB), and melatonin production (Belyaev et al., 2006), Leszczynski et al., 2002, 2004, 2006).

Zhao in 2007 evaluated changes of gene expression in rat neurons after exposure to the pulsed RF EMF at a frequency of 1800 MHz and SAR 2W/Kg. He found alterations in 34 genes that are associated with multiple cellular functions.

RF fields have been shown to activate a cellular stress response which is a protective mechanism characterized by stress protein synthesis. Stress proteins help damaged proteins refold to regain their conformations, and also act as "chaperones" for transporting cellular proteins to their destinations in cells. The stress response, by its very nature, shows that cells react to EMFs as potentially harmful. (Kültz 2005)(Shallom 2002)(Leszczynski 2002) (Weisbrot 2003)

Belyaev in 2006 exposed rat brain to 915MHz microwaves of global system for mobile communication (GSM) and found up regulation in 11 genes producing proteins including those affecting neurotransmitter regulation. Dozens of studies show similar effects. Not all genes are affected and the effects depend on biologic and EMF variables as well as research protocols. The evidence however indicates that clinically relevant EMF radiation from wireless devices affects biologic systems.

EMF and Oxidative Stress

Oxidative stress has been shown in the myocardium of rats exposed to cell phone radiation. (Ozguner 2005). A review of immunologic effects revealed EMFs to disturb immune function through stimulation of various allergic and inflammatory responses, as well as effects on tissue repair processes. Johannson in 2009 summarizes; **"These and the EMF effects on other biological processes (e.g. DNA damage, neurological effects, etc.) are now widely reported to occur at exposure levels significantly below most current national and international safety limits.** Obviously, biologically based exposure standards are needed to

prevent disruption of normal body processes and potential adverse health effects of chronic exposure.”

This topic has become so important that a special issue of Pathophysiology August 2009 was published on Electromagnetic Fields (EMF) available on line at

www.sciencedirect.com

Cell Phones and the Blood Brain Barrier

The blood brain barrier helps maintain a highly stable extracellular environment necessary for accurate synaptic transmission and protects nervous tissue from injury. A number of studies on blood brain barrier effects do show leakage can occur with certain frequencies and power of EMF. Salford in 1994 studied the biological effects of electromagnetic fields on the blood-brain barrier (BBB) and found albumin leakage in animals exposed to 915 MHz microwaves versus controls. Schirmacher (2000) reported that an in vitro model demonstrated increased permeability of the blood brain barrier to sucrose with exposure to 1.8 GHz conforming to GSM standards compared to controls. Studies by Nittby in 2009 confirmed this effect and found albumin extravasation from the brain even after 7 days with a SAR as low as 0.12W/kg.

Brain Effects: Electrical Activity

Marino in 2009 analyzed the reports in which human brain electrical activity was compared between the presence and absence of radio-frequency and low-frequency electromagnetic fields (EMFs) from mobile phones, or between pre- and post-exposure to the EMFs. Of 55 reports, 37 claimed and 18 denied an EMF-induced effect on either the baseline electroencephalogram (EEG), or on cognitive processing of visual or auditory stimuli as reflected in changes in event-related potentials.

He states

“Overall, the doubt regarding the existence of reproducible mobile-phone EMFs on brain activity created by the reports appeared to legitimate the knowledge claims of the mobile-phone industry. However, it funded, partly or wholly, at least 87% of the reports. **From an analysis of their cognitive framework, the common use of disclaimers, the absence of information concerning conflicts of interest, and the industry’s donations to the principal EMF journal, we inferred that the doubt was manufactured by the industry.**”

DNA and Genotoxic Effects

A major concern of the adverse effect of EMF is as a carcinogen. As the majority of cancers are initiated by damage to a cell’s DNA many studies have looked at the potential for DNA breaks with EMF. Microwave frequencies used in wireless communications are not in the ionizing radiation segment of the EMF spectrum that we know to cause rapid and predictable DNA damage. Nevertheless, there are numerous studies that demonstrate single and even double stranded DNA damage. The mechanism is not yet completely understood but a likely explanation is **oxidative damage through the free radical pathway**. Free radicals kill cells by damaging macromolecules, such as DNA, protein and membranes. This leads to changes in cell function and death. Chemical toxins have a similar pathway of

damage. In this way microwave frequencies could act as a co-inductor of DNA damage rather than as a direct genotoxic agent. (Phillips 2009)
Several reports have indicated that electromagnetic fields (EMF) enhance free radical activity in cells. (Lai and Singh, 1997, 2004); Oral et al., 2006; Simko, 2007). Another mechanism of harm is to DNA repair. Belyaev in 2009 **found intracellular DNA repair mechanisms were inhibited by Broadband (UMTS)** and stated the effects “persisted up to 72 h following exposure of cells, even longer than the stress response following heat shock.” (Belyaev 2009 Bioelectromagnetics).

Senior Moments: Memory Effects of RF- EMF

Considering the frequent use of mobile phones studies have looked at their possible implications on cognitive functions. Nittby et al. in 2008 exposed rats to 2 hours per week for 55 weeks of 900 MHz GSM cell phone RF-EMF. They then evaluated cognitive function and found, GSM exposed rats had impaired memory for objects and their temporal order of presentation, compared to sham exposed controls. They concluded **“Our results suggest significantly reduced memory functions in rats after GSM microwave exposure.”**

An analysis of neurobehavioral affects of GSM mobile phones by Barth in 2008 showed a small impact on human attention and memory.

Acute and Chronic Neurologic Symptoms from EMF

In Egypt a study of inhabitants near the first **cell pone tower** in the district showed a significant increase in **reported headaches, memory changes, dizziness, tremors, and sleep disturbance.** They conclude “Inhabitants living nearby mobile phone base stations are at risk for developing neuropsychiatric problems and some changes in the performance of neurobehavioral functions.” (Abdel-Rassoul G 2007).

Bortkiewicz in 2004 found people living in the vicinity of base stations reported similar complaints in addition to irritability, depression, blurred vision, concentration difficulties, nausea and lack of appetite. The interesting thing was that this association was observed in both those who linked their complaints with the presence of the base station and those who did not notice such a relation.

Hutter in 2009 studied the association between **tinnitus and mobile phone use.** While tinnitus can be associated with loud noise, earphones, diseases and disorders of the ear, and vascular pathologies, there are few known risk factors for tinnitus apart from these conditions. There has been anecdotal evidence of a link between mobile phone use and tinnitus, but so far there have been no systematic investigations into this possible association. Hutter looked at 100 consecutive patients presenting with tinnitus in an individually matched case-control study. The risk estimate was significantly elevated for prolonged use (≥ 4 years) of a mobile phone. Children and adults are already at risk of hearing loss and tinnitus from high noise levels and earphones and headphones which are on the rise as well. (Vogel 2009)

Affects on Sperm have Implications For Infertility

Scientists looking at the effects of mobile phone microwave frequencies on sperm have found that the morphometry and sperm binding is affected. Falzone used 900MHz and a SAR of 2.0 to examine these effects and concluded, “These results could indicate a significant effect of RF-EMF on sperm fertilization potential.” (Falzone, 2010).

Agarwal reported in Sterility and Fertility journal in 2009 the effects of one hour of cell phone RF-EMF on sperm. He found a significant decrease in sperm motility and viability. He concluded that radiofrequency electromagnetic waves emitted from cell phones may lead to oxidative stress in human semen and cautioned against men putting their cell phones in trouser pockets.

SAR Levels on Cell Phones

Remember how older cell phones used to make your ear warm if you were on the phone a while? Well newer phones are less likely to do that due to Specific Absorption Rate (SAR) limits. Cell phones and some other wireless communication devices are regulated by the FCC according to their emissions, which depend on the amount of power absorbed into the body. SAR is a way of measuring the quantity of radio frequency (RF) energy that is absorbed by the body. For a phone to pass FCC certification and be sold in the United States, its maximum SAR level must be less than 1.6 watts per kilogram within 1 gram of tissue for the head. The limit for absorption of radiofrequency radiation is limited to 0.08W/kg for whole body exposure set by the American National Standards Institute (ANSI), National Council on Radiation Protection and Measurements (NCRP) and the Institute of Electrical and Electronics Engineers (IEEE), the worlds largest technical organization.

Children's Brains are more Vulnerable: SAR level

Children's brains are immature and continue to develop important learning connections until their early 20's. In addition children's skulls are thinner, absorb more radiation and studies suggest are more prone to radiation damage. (Wart 2005, 2008) (Ghandi 1996) Because of this some scientists argue that for children there needs to be a margin of safety for SAR levels. According to the Pew Internet and American Life Project in 2008, 71 percent of American children between 12 and 17 years old, owned cell phones. More than half use the device daily.

Health Ministers and authorities in **France, India, Israel, Russia and the U.K** recommend limiting use of the cell phone in teenagers and children to emergency use only. In June 2010 **San Francisco** became the first U.S. jurisdiction to respond to increased concerns over possible links between cellphone use and cancer, adopting a city ordinance requiring retailers to post the radiation levels of mobile phones (Washington Post June 22, 2010). This was adopted as a consumer disclosure policy. In June 2008 **India banned advertisements** of pregnant women and children in mobile phone ads as a precaution.

Switzerland, Italy, and Russia with More Stringent SAR Limits

Although the NCRP, ANSI and the IEEE recommend levels set by thermal standards some countries in the world have established new, low-intensity based exposure standards that do not rely on heating. **Emerging scientific evidence on the biologic effects of RF has encouraged some countries to reduce the RF limits to levels that are hundreds of times lower than US standards.** In the cell phone frequency range of 800 MHz to 900 MHz. the levels range from 10 microwatts per centimeter squared in Italy and Russia to 4.2 microwatts per centimeter squared in Switzerland. The United States and Canada limit such exposures to only 580

microwatts per centimeter squared. According to Belyaev 2007 **“Numerous data on the NT (non thermal) MW (microwave) effects clearly indicate that the SAR-concept alone cannot underlie the safety guidelines for chronic exposures to MW from mobile communication and other approaches are needed.”**

Cell Phone Towers

In 1973 the first call was made from a cell phone. In 1982 the FCC authorized the first commercial cellular service in the US. In 1987 there were 1 million subscribers and in 2008 there were about 270 million. At last count there are an estimated 245,000 registered cell towers in the USA (CTIA- Wireless Association data). It is expected to double in the next 5 years. Each cell company (T-mobile, Verizon, Nextel, Sprint) owns these towers. There is no publicly available database of all individual cell site locations. The FCC does not require cell phone towers to be registered.

Cell towers are only a small subset of wireless towers as many more towers are unregistered. The towers may be listed with the private owner and not listed with a specific carrier. In addition there are smaller “microcell” towers which are located in cities every other block and 10 to 20 feet above ground that are used to improve coverage where buildings exist that may interfere with transmission although the microwave frequencies can pass through most structures easily. These microcells transmit similar radiofrequencies and are no less risky. Of particular concern is the cumulative radiation exposure from this wide variety of sources.

Several studies have show an increased risk of cancer as well as other neurobehavioral effects on those living near cell phone towers. (Abdel-Rassoul G 2007) (Bortkiewicz 2004) (Khurana 2005). It appears the most hazardous is within 1300 feet of the tower. This may be dependent on how many carriers are on the tower and other factors. Many jurisdictions are so concerned they are beginning to limit cell phone tower placements.

Knesset, a city in Israel banned placing towers on residential buildings in 2007. Taiwan in 2007 removed 1500 cell towers from residential areas and schools, as the NCC had been urged by lawmakers to “strongly intervene” in efforts to cut the number of base stations by at least half, since the coverage rate of existing MPBS’s is more than five times the amount that Taiwan actually needs. They stated, “Residential neighborhoods and schools must not be exposed to the risk of radiation emitted by the MPBS’s that could cause cancer, miscarriages and diseases of the nervous system.”

Proof or the Precautionary Principle?

European Union policy requires that the Precautionary Principle be the basis for environmental protection for the public. *“when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary*

Principle shifts the burden of proof from those suspecting a risk to those who discount it". Their perspective is that it is important to protect public health and take preventative action before certainty of harm is proven. If governments wait until there is absolute certainty and proof of harm then much damage to human health, the environment and the economy could occur. This has been seen with many environmental toxicants such as mercury, lead, tobacco, and chemical pollution.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) and Institute of Electrical and Electronics Engineers, Inc. (IEEE), National Council on Radiation Protection and Measurements (NCRP) in developing their recommendations for exposure standards require proof of adverse effect and risk before amending the exposure standards. The Precautionary Principle Treaty requires action to protect the public when a reasonable suspicion of risk exists.

Precautionary Principle Proponents

European Environment Agency: "There are many examples of the failure to use the precautionary principle in the past, which have resulted in serious and often irreversible damage to health and environments. Appropriate, precautionary and proportionate actions taken now to avoid plausible and potentially serious threats to health from EMF are likely to be seen as prudent and wise from future perspectives. We must remember that precaution is one of the principles of EU environmental policy," says Professor Jacqueline McGlade, Executive Director of the EEA. (EEA Report 2007)

The Austrian Medical Association recommended to the public in 2005 to use wired internet connections instead of Wi Fi.

Vienna Resolution: "The currently used national and international practiced strategy to determine limit values is extremely conservative, it urgently demands replacement by the precautionary principle, similar to strategies in many other sciences. The "Salzburg-model" showed, that neighbor involvement and a precautionary limit value of 1 mW/m² EMF-flux-density can be achieved even for the sum of all GSM frequencies without technically compromising the quality of the GSM net."

Salzburg Resolution(Austria): In 2000 the Salzburg, Austria Resolution was passed with regards to telecommunications base stations. They stated "**Presently the assessment of biological effects of exposures from base stations in the low-dose range is difficult but indispensable for protection of public health.** There is at present evidence of no threshold for adverse health effects. It is recommended for existing and new base stations to exploit all technical possibilities to ensure exposure is as low as achievable (ALATA-principle). In addition the protocol should include considerations on existing sources of HF-EMF exposure.

Benevento Resolution 2002 (Italy)

“More evidence has accumulated suggesting that there are adverse health effects from occupational and public exposures to electric, magnetic and electromagnetic fields, or EMF¹, at current exposure levels. What is needed, but not yet realized, is a comprehensive, independent and transparent examination of the evidence pointing to this emerging, potential public health issue. Resources for such an assessment are grossly inadequate despite the explosive growth of technologies for wireless communications as well as the huge ongoing investment in power transmission. ***There is evidence that present sources of funding bias the analysis and interpretation of research findings towards rejection of evidence of possible public health risks.***”

The Porto Alegre Resolution 2009: Co sponsored by the Brazilian Health Ministry and the International Commission for Electromagnetic Safety, May 18, 2009.

“ We agreed that the protection of health, well-being and the environment requires immediate adoption of the Precautionary Principle... for the establishment or modification of non-ionizing radiation exposure standards.

We recognize that, in Brazil as well as all over the world, where there has been an unprecedented explosion in the availability and use of non-ionizing electromagnetic fields for electrical and wireless communications technologies (mobile and cordless phones, WiFi and WIMAX networks, RFID, etc.), as well as major electrical grid and wireless broadband infrastructure changes, this assessment should inform risk management to take proper steps to protect the public from long- term, low-level exposure to extremely-low frequency as well as radiofrequency electromagnetic fields that have substantially increased in the ambient environment in recent years.

The exposure levels at which these effects have been observed are many times lower than the standards promulgated by the International Commission for Non-Ionizing radiation Protection (ICNIRP) and the IEEE's International Committee on Electromagnetic Safety (ICES). These standards are obsolete and were derived from biological effects of short-term high intensity exposures that cause health effects by temperature elevation and nerve excitation discovered decades ago.

We are deeply concerned that current uses of non-ionizing radiation for mobile phones, wireless computers and other technologies place at risk the health of children and teens, pregnant women, seniors and others who are most vulnerable due to age or disability, including a health condition known as electromagnetic hypersensitivity.

We strongly recommend these precautionary practices:

1. Children under the age of 16 should not use mobile phones and cordless phones, except for emergency calls;
2. The licensing and/or use of Wi-Fi, WIMAX, or any other forms of wireless communications technology, indoors or outdoor, shall preferably not include siting or signal transmission in residences, schools, day-care centers, senior centers, hospitals or any other buildings where people spend considerable time;
3. The licensing for siting and installation of infrastructure related to electrical power and wireless broadband telecommunications, particularly, cellular telephony,

Wi-Fi and WIMAX, should only be approved after open public hearings are held and approval granted with full consideration given to the need to apply the Precautionary Principle. Sensitive areas should be avoided to protect vulnerable populations;

4. Mankind shall be encouraged to continue to discover new means of harnessing non-ionizing electromagnetic energy, aiming at bringing benefits to society, through definition of new standards of human exposure, which are based on the biological realities of nature and not solely on the consideration of economic and technological needs.”

Who is Opting Out of WiFi?

Those opting out of WiFi are doing so for a variety of reasons, including public health protection, data security and better data retrieval with a wired connection.

The France National Library in Paris July 2008 placed a moratorium on WiFi in their 4 tower buildings for reasons of improved research quality with cabled connection as well as applying the Precautionary Principle due evidence of harm from WiFi.

Herouville St. Clair, Normandy France Schools in April 2009 all WiFi from primary schools was removed and the city may, after study, limit emissions from cell towers or remove the antennas.

Salzburg, Austria Schools: In 2005 the Public Health Department of Salzburg Austria Region adopted a policy of no WiFi or DECT phones in schools based on reports of sensitive people who develop symptoms of difficulty with concentration, memory problems, headaches, restlessness, etc.

Frankfurt Local Education Authority and the German Teachers Union banned WiFi in schools

Lakehead University, Ontario, Canada November 2009 policy states “There will be no WiFi connectivity provided in those areas of the University already served by hard wire connectivity until such time as the potential health effects have been scientifically rebutted or there are adequate protective measures that can be taken.”

Lawrence Livermore National Laboratory in California banned all wireless networks in 2002 , including the most prevalent, Wi-Fi, from its grounds due to "security vulnerabilities," according to USA Today 1/28/02

What To Tell Patients to Reduce EMF Exposure?

Because of the uncertainty in science regarding the minimum non ionizing radiation level below which no adverse health effects can occur, and the long latency for low dose exposure the Precautionary Approach is suggested and it is recommended that EMF human exposure be kept to a minimum. Here are a few suggestions.

Recommendations

* Children under 16 should not use cell phones or cordless phones except in an emergency

- * Use cables wherever possible. Advantages of cabled networks are speed (Wi-Fi is slower than wired networks), security (Wi-Fi is insecure – even with WEP or WPA encryption) and reliability (Wi-Fi is often known to drop connections).
- * If it is not possible to remove your wireless connections, it is advised that you take other precautions and do not sit in close proximity to a wireless router (keep it in an unoccupied room if possible)
- * Turn off any wireless devices at night time while you sleep, as these devices emit microwaves at all times, not just when the device is transmitting data. Plugging electrical cords into a surge protector works well with an easy on-off switch
- * Avoid using a wireless laptop on your lap for extended periods of time as it radiates cell phone levels of RF. Put it on a table.
- * Avoid cordless phones as the EMF is almost as strong as the cell phones. Land lines work very well.
- * Use speaker phone option for your cell phone as much as possible
- * Avoid wireless devices

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