



Position Paper
on
**ELECTROMAGNETIC HYPERSENSITIVITY
(IDIOPATHIC ENVIRONMENTAL INTOLERANCE
ATTRIBUTED TO ELECTROMAGNETIC FIELDS)**

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Position Paper on Electromagnetic Hypersensitivity



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Bad Science Watch is an independent consumer protection watchdog and science advocacy non-profit that provides analysis of dubious scientific claims to Canadians, our government, and the media, and advocates for the enforcement and strengthening of consumer protection regulation.

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Introduction

As our society has become increasingly technological, the production of artificial electromagnetic fields (EMF) has become ubiquitous. Today, sources of EMF permeate our lives, enabling life-changing technologies including artificial lighting, electric heat, radio, broadcast television, wireless cellular phone and data access, microwave ovens, computers, anti-theft devices, radar and, of course, WiFi. There are, however, people who believe that these electromagnetic fields are a health risk.

Research into the health consequences of artificial EM fields began in earnest with the proliferation of military and commercial aviation radar systems in the 1950s. Since then, considerable research has been conducted in an attempt to determine whether exposure to the expanding sources of EMF produce any health risks. More recently, public health concern has developed after some individuals have come forward claiming to be particularly sensitive to, and to suffer because of, EM fields. This concern has led to many rigorous, peer-reviewed, provocation studies that seek to determine whether these negative effects are, in fact, attributable to EMF. (Rubin, Nieto-Hernandez, & Wessely, 2010) Even more recently, WiFi networks have become a central technology implicated in this alleged electromagnetic hypersensitivity (EHS). Systematic reviews of the science, however, have consistently found no indication that these symptoms are causally related to the presence or absence of electromagnetic fields, and there is a growing scientific consensus that EM exposure is not responsible for these symptoms. (World Health Organization, 2006) (UK Health Protection Agency, 2012)

At the 2004 World Health Organization workshop on “electromagnetic hypersensitivity,” the working group proposed that the EHS designation be retired in favour of “idiopathic environmental intolerance attributed to electromagnetic fields” (IEI-EMF), because the EHS designation “implies that a causal relationship has been established between the reported symptoms and EMF” and no such causal relationship has been established. (Mild, Repacholi, van Deventer, & Ravazzani, 2004) Accordingly, this document will hereafter employ the IEI-EMF designation rather than EHS.

An **electromagnetic field (EMF)** is a physical field that affects the behaviour of charged particles in its vicinity. It is produced by the movement of electrically charged objects, and propagates in a wave-like fashion. Electromagnetic fields are produced naturally (the Earth and the Sun have natural EM fields) and artificially, both intentionally (microwaves to cook food, WiFi and radio for telecommunications) and as a by-product of technology.

Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) and **electromagnetic hypersensitivity (EHS)** are descriptive terms for nonspecific symptoms that are often attributed to weak radiofrequency electromagnetic fields (EMF). The symptoms associated with this syndrome vary from patient to patient, but often include fatigue, inability to sleep, headache, stress, muscle aches, and rashes.

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Further complicating public discussion of the health implications of EMF exposure is the confusion between ionizing radiation, which does cause damage to living tissue and can lead to radiation sickness, cancer, or death, and non-ionizing radiation, which does not typically have enough energy to disrupt molecular bonds and is not known to cause physiological changes in living tissue besides warming. The frequencies of EMF implicated in IEI-EMF are non-ionizing, and so are not known to cause any adverse effect on biological tissue at reasonable levels. High intensity exposure to non-ionizing radiation like EMF can cause damage in the form of heat burns, so technologies like WiFi are restricted well below levels that can cause measurable tissue warming in order to avoid adverse effects. (World Health Organization, 2006) Well established knowledge of the interaction between non-ionizing EMF and biological systems make it very unlikely that these fields have adverse health consequences. (UK Health Protection Agency, 2012) This means that proponents claiming IEI-EMF is caused by EM fields must first overturn a substantial, well-supported body of work in biology and physics. However, because many people are suffering from a host of nonspecific but very real and debilitating symptoms, and because it is increasingly common to attribute this illness to EMF, researchers have been compelled to conduct investigations into their illness, possible causes, and possible treatments.

The portion of the electromagnetic spectrum that extends from low-frequency through to the visible spectrum consists of **non-ionizing radiation**. Radiation at non-ionizing frequencies may be sufficiently power to cause thermal effects (vibrating molecules and causing substances to heat up), but is not powerful enough to strip electrons from molecules (creating ions) and break molecular bonds, thereby causing damage to biological systems. The radio, microwave, infrared, and visible spectra are made up of **non-ionizing** radiation, while the ultraviolet rays, x-rays, and gamma-rays are forms of ionizing radiation.

The literature investigating IEI-EMF is varied in terms of quality and informativeness. For instance, significant heterogeneity exists in the literature when it comes to identifying criteria for this syndrome, with the most common criterion being that the patient self-reports as “hypersensitive” to EMF. (Baliatsas, Van Kamp, Lebret, & Rubin, 2012) Loose and inconsistent criteria for assessing and defining IEI-EMF hinder researchers’ ability to study this syndrome and complicate the evaluation of results. It may also prove problematic for health care providers endeavouring to identify and manage patients. (Baliatsas, Van Kamp, Lebret, & Rubin, 2012) Furthermore, due to the potential nocebo effect, reviews must be careful to exclude studies without strict blinding in order to rule out results contaminated by the participants’ awareness of when they are being experimentally exposed to EMF and when they are not. Lastly, the statistical methodologies employed in these studies are expected to produce occasional false-positives, even if there is no effect whatsoever (typically 1 in 20 tests). This possibility becomes even more of an issue in studies with small sample sizes or poor experimental design. Regardless, the consistent finding is that IEI-EMF is not likely a direct result of EMF exposure, but is more likely to be a psychogenic response to the awareness of an EMF emitting de-

The **nocebo effect** describes the subjective (nonspecific) negative effects that a subject may experience that are not attributable to a medication intervention or invasive treatment. This effect is similar to the placebo effect, and can manifest after a subject receives an inert drug or intervention.

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vice. (Mild, Repacholi, van Deventer, & Ravazzani, 2004) (Rubin, Nieto-Hernandez, & Wessely, 2010) This finding is crucial, not just in terms of ruling out WiFi signals as environmental health hazards, but also in determining effective care for those suffering from IEI-EMF.

The goal of this position paper is to provide a short overview of the scientific consensus surrounding the health implications of exposure to WiFi technology, with emphasis on the claim that some individuals are particularly sensitive to the effects of the EMF. Unlike a systematic scientific review, the target audience of this document is non-experts in IEI-EMF: primarily those who are concerned about the health implications of WiFi technology and are looking for independent confirmation of the safety of WiFi, besides governmental health and industry organizations' reassurances. Here, Bad Science Watch intends to counter certain anti-WiFi groups' claims that governmental and industry organizations may be hiding serious science-based concerns. Bad Science Watch developed this position paper by acquiring and summarizing several of the largest scientific review publications on the topic, with the goal of providing a window into the overwhelming consistency of the results. Readers interested in a more detailed and complete review of the topic are encouraged to see the review papers discussed below.

Blind (or double blind) refers to experiments in which the subject (or both the subject and the researchers) are unaware of when the true stimulus is presented and when it is not. This prevents participants from altering their responses (either consciously or unconsciously) as a result of their awareness of the stimulus (see nocebo effect), rather than as a direct result of the presence of an actual EM field. Blinding is very important to reduce the impact that bias (often unintentional) on the part of the researchers or the subjects has on the outcome of the experiment.

Current State of the Research

Several comprehensive systematic reviews concerning the etiology of IEI-EMF have been conducted in the last decade. The studies reviewed typically take the form of double-blind, controlled provocation studies in which "hypersensitive" individuals are exposed either to a source of an EMF or an inactive control over several sessions. Reports from subjects about their symptom severity and experience allow the researcher to determine whether he or she experiences different symptoms or experiences depending on whether the EMF is switched on or off. These studies have not found any reliable and consistent evidence to suggest that people with IEI-EMF experience any unusual physiological reactions as a result of exposure to EMF, and that increased symptom severity does not correlate with the actual presence of EMF. (Rubin, Das Munshi, & Wessely, 2005) (Rubin, Nieto-Hernandez, & Wessely, 2010) (Rubin, Hillert, Nieto-Hernandez, Van Rongen, & Oftedal, 2011) Indeed, the majority of EHS individuals who claim to be able to perceive low-level radiofrequency EMF are not able to do so under double-blind conditions in a laboratory (Rösli, 2008).

None of the review papers that we found presented any convincing evidence that EM fields are causa-

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tive of IEI-EMF. Several of these reviews (Rössli, 2008) (Rubin, Nieto-Hernandez, & Wessely, 2010) concluded that the nocebo effect play a significant role in the onset of acute EHS symptoms.

This view is consistent with the findings of a 2006 systematic review of IEI-EMF treatments (Rubin, Das Munshi, & Wessely, 2006), which investigated several proposed treatments for those suffering from symptoms attributed to EMF exposure. EMF “shielding” and visual display unit (computer monitor) “filters” were tested, as were acupuncture, anti-oxidant supplementation, and cognitive behavioural therapy. Of these interventions, only cognitive behavioural therapy was shown to be more effective in treating symptoms of IEI-EMF than placebo (although the authors note that even this evidence is limited and of equivocal quality, suggesting that follow-up studies should be conducted before making clinical recommendations for cognitive behavioural therapy). This evidence is consistent with the hypothesis that IEI-EMF is a psychogenic disorder.

The majority of systematic reviews commented on the dearth of high quality research in studies investigating both the etiology and treatment of IEI-EMF. With so many studies that are unblinded, inappropriately randomized, have small numbers of participants, and have other methodological issues, researchers risk biasing their results based on their own or their subjects’ prior beliefs about causes of and treatments for IEI-EMF.

While the body of the literature suggests that the symptoms of IEI-EMF are not causally related to EMF exposure, we were able to find one literature review (Genuis & Lipp, 2012) that disagreed with this consensus. This article notes that upon exposure to EMF some patients were affected by non-specific signs and symptoms affecting multiple body systems. However, this review was not systematic: it provides no inclusion criteria for the papers it discusses and appears to take research correlating EHS to EMF at face value while dismissing research that finds no such relationship. Potential methodological problems are discussed only in the context of explaining away research findings that do not show a connection between EHS symptoms and EMF.

It’s important to note that with a large number of studies being conducted on this subject, a small number of statistically positive findings are to be expected (especially in studies with lower levels of methodological rigour) even if there is no causal relationship between EMF and IEI-EMF. Without proper inclusion criteria and analysis, the results of properly designed and executed studies can be overwhelmed by false positives generated by less careful research.

The Genuis and Lipp article comes close to invoking conspiracy to explain the preponderance of research dispelling the link between EMF and IEI-EMF: “[S]ome unscrupulous or uninformed scientists continue to serve and represent the vested interests that fund them... It has been suggested that perhaps some of the facts about EHS are being obfuscated and that ‘evidence’ has been manipulated to instill doubt and to impede public health regulation...” (Genuis & Lipp, 2012) The article goes on to note historical precedent for the vindication of controversial diagnoses; unfortunately, the fact that some initially contested

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conditions in medicine at large have, in time, become accepted medical diagnoses is of no value in determining the etiology of IEI-EMF. For every example of a maverick theory in medicine becoming vindicated, there are countless others lost to history.

Among the remaining review papers that we have located, those experiments which were of sufficiently high quality to meet the standards for inclusion in the reviews are consistent with the hypothesis that symptoms of IEI-EMF are not caused by exposure to electromagnetic fields and that the most effective treatments thus far identified do not involve reducing EMF exposure. (Ahlbom, Cardis, Green, Linet, Savitz, & Swerdlow, 2001) (Baliatsas, et al., 2011) (Nieto-Hernandez, Rubin, Cleare, Weinman, & Wessely, 2008) (Röösli & Hug, 2011) (Schröttner, Leitgeb, & Hillert, 2007) (Seitz, Stinner, Eikmann, Herr, & Röösli, 2005) These conclusions are consistent with public statements about the safety of low-level EMF exposure from the World Health Organization (2006), Health Canada (2011), the UK Health Protection Agency (2012), the International Commission on Non-Ionizing Radiation Protection (2009), the Swedish Council for Working Life and Social Research (2012), The Royal Society of Canada (2009), and the European Health Risk Assessment Network on Electromagnetic Fields Exposure (2012).

EHS Activism in Canada

There are a number of organizations in Canada lobbying for recognition of IEI-EMF and/or the health dangers of wireless technologies. These include: The Canadian Initiative to Stop Wireless Electric and Electromagnetic Pollution (WEEP), Citizens for Safe Technology, the EMR Health Alliance of BC, Stop SmartMeters BC, the Safe School Committee, Gulf Islanders for Safe Technology and the Québec Association in the Fight Against Atmospheric Pollution. In what they contend are attempts to educate the public, many of these organizations provide access only to research and information that support the EHS diagnosis and the dangers of EMF technology, misleading the public through exclusion. Furthermore, these groups tend to misrepresent or selectively quote the findings and conclusions of reputable organizations, such as the World Health Organization and Health Canada, misleading the public into believing that these trusted groups accept the link between EMF and IEI-EMF. For example, Dr. Riina Bray (medical director of the Environmental Health Clinic at Toronto's Women College Hospital) was recently quoted in *The Star*, saying "[T]here is a small fraction of the population who are hypersensitive [to EMF] and the WHO (World Health Organization) supports that phenomenon as being real." (Brennan, 2012) The activities of these lobby groups call for IEI-EMF research funds to be used to investigate a scientifically unsupported theory and encourage public fear of wireless technologies.

The tangible results of this misinformation are significant. Earlier this year, Toronto's Women's College Hospital became the first mainstream medical facility in Canada to endorse the link between EMF and IEI-EMF and begin treating patients specifically for EHS. Additionally, at least 12 elementary and middle schools across the country, including Wayside Academy in Peterborough, Ontario, Pretty River Academy

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in Collingwood, Ontario, and every elementary school in Saanich, British Columbia³, have yielded to pressure from these groups and removed WiFi networks from their classrooms. The Ontario English Catholic Teachers Association has also recommended that the WiFi networks in the 1,400-plus schools at which its 45,000 members teach should be disconnected and replaced with wired networks. This type of retrofitting is costly and limits network access for students and faculty to devices that natively support wired connections, preventing adoption of many newer devices like tablets and lightweight laptop computers.

Access to wireless networks is in the public interest. They provide unmatched access to information and communication capabilities, and do so in a way that does not discriminate based on wealth or privilege. Rejecting these technologies will impair Canadian's technological and intellectual leadership in the world, a status with important economic benefits.

Activists in Canada have generally not focused on promoting research either into identifying plausible alternative causes or comparing treatments, but rather on removing WiFi, SmartMeters, and other devices that they believe to be the inarguable cause of IEI-EMF. Several companies market products aimed at “protecting” customers from the putative harmful effects of EMF, including “shielding devices” for mobile phones and WiFi stations. These devices offer no demonstrated health benefit, but they may also impair the functioning of the device in question by interfering with radiofrequency communication, and are of significant cost to the consumer. The largest distributors of such products within Canada are EMF Solutions Canada (<http://www.emfsolutions.ca>), Safe Living Technologies Inc. (<http://www.safelivingtechnologies.ca>), Advanced Health Technologies (<http://www.earthcalm.ca>), and Sharp Deals/Hallegenic Health (<http://www.sharpdeals.ca>).

Connections between Activism, Research, and Commercial Interests

Bad Science Watch’s investigation of the major Canadian EHS activists was able to conclude that there exist at least two potential conflicts of interest, and was able to identify a number of questionable connections between activists, researchers, and individuals with commercial interests in the anti-WiFi movement.

The first potential conflict of interest that we were able to identify is with activist/entrepreneur Kevin Byrne, who not only runs the activist website DirtyElectricity.ca but is also the president of EMF Solutions Canada, the largest Canadian distributor of EMF home inspections and abatement equipment. Both of Mr. Byrne’s sites contain activist and commercial elements. While DirtyElectricity.ca is promoted

³ Since publication, we have received a clarification on the decision regarding WiFi in Saanich, BC by the Greater Victoria School District’s (GVSD), encompassing Victoria, Saanich and Oak Bay. Under pressure from anti-WiFi groups, the GVSD put a moratorium on all new WiFi installations in the district, so all high schools and most elementary schools still have wireless internet installations. Only new schools do not have WiFi.

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primarily as an activist site, it also includes information about specific commercial products sold by Byrne's company, EMF Solutions Canada. Similarly, the commercial site includes information about wireless technology that is similar to the activist website. This does not appear to be uncommon within the industry, however; most commercial websites that we investigated contain an activist component, while many activist websites contain information about products and services and even links to commercial sites.

The second potential conflict of interest we were able to identify is with entrepreneur/activist Rob Metzinger, president and founder of Safe Living Technologies Inc. Unlike Kevin Byrne, Mr. Metzinger does not himself run an activist website. Nevertheless, he is very much an activist, appearing on both CBC and CTV news, as well as speaking at an Oakville town hall meeting about cell phone tower microwave radiation, and advocating for stricter guidelines to Health Canada's Safety Code 6 (the exposure guidelines to radiofrequency electromagnetic energy). It should be noted that neither Kevin Byrne nor Rob Metzinger attempt to directly hide their commercial interests while serving as activists.

There are a number of researchers who are also activists. The most prominent, within Canada, is Dr. Magda Havas, an associate professor of environmental and resource studies at Trent University and the science advisor for The Canadian Initiative to Stop Wireless Electric and Electromagnetic Pollution (WEEP Initiative). Dr. Havas has developed a career denouncing the safety of low frequency electromagnetic radiation and advocating for the EHS designation. She presently operates a YouTube channel and a website (<http://www.magdahavas.com>) where she speaks about the dangers of WiFi networks and the link between RF and IEI-EMF, while promoting books and magazines sympathetic to her cause. She is also the co-author of a 2009 book entitled *Public Health SOS: The Shadow Side of the Wireless Revolution*.

In addition to her role with the WEEP Initiative, Dr. Havas also sits on the Council on Wireless Technology Impacts (CWTI) and the EMR Policy Institute (EMRPI) in the US; HESE and the EM Radiation Research Trust (EMRRT) in the UK; International Commission for Electromagnetic Safety (ICEMS) in the EU; and the Nationaal Platform Stralingsrisicos (NPS) in the Netherlands. Dr. Havas is also quite active with the media: appearing on a number of television news programs, occasionally alongside Kevin Byrne and Rob Metzinger. In 2010, Dr. Havas, ran the EMF and Health Workshop (a daylong, paid workshop) at which both Byrne and Metzinger were presenters.

Finally, we wanted to acknowledge the connection between Dr. Havas and David Stetzer. Stetzer is the president and founder of Stetzer Electric Inc, the manufacturer of the Graham/Stetzer EMF filter. In 2004 Havas and Stetzer presented a paper to World Health Organization Workshop on Electrical Hypersensitivity promoting the effectiveness of Graham/Stetzer filters with respect to alleviating the symptoms of IEI-EMF.

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Recommendations and Conclusions

We have been unable to identify any high quality reproducible evidence that any symptom of idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) is caused by exposure to non-ionizing electromagnetic radiation. Systematic reviews of both provocation studies and purported treatments for IEI-EMF support the conclusion that EMF is not the cause of the syndrome.

Despite the claims made by the authors of one review paper and the aforementioned anti-WiFi groups, Bad Science Watch was unable to locate any compelling evidence of legitimate scientific debate about WiFi induced illness, or the safety of low-level EMF exposure in general. While fringe groups continue to present flawed arguments and promote poorly designed experiments, the preponderance of research on the matter robustly dispels the connection between WiFi and IEI-EMF. For those tasked with making decisions about the inclusion of WiFi technology in their organization, school, or home, we can find no reason to ignore the advice of health organizations worldwide. The benefits of WiFi are numerous and varied, and there is no compelling evidence that any health effects arise as a result of this technology.

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