STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF DUKE ENERGY INDIANA, LLC FOR APPROVAL OF AN ADVANCED METER OPT-OUT TARIFF, RIDER N0. 59 STANDARD CONTRACT	))))	**CAUSE NO. 44963**

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR'S SUBMISSION OF ADDITIONAL PUBLIC COMMENTS RECEIVED AFTER PREFILING DEADLINE

The Indiana Office of Utility Consumer Counselor ("OUCC"), by counsel, hereby submits the attached additional public comments received after the OUCC prefiled its testimony in this Cause. The OUCC respectfully requests that the Commission consider these additional public comments along with others previously filed in this Cause.

Respectfully submitted,

Karol H. Krohn, Atty. No. 5566-82
Deputy Consumer Counselor
Direct: 317-233-3235
kkrohn@oucc.in.gov

CERTIFICATE OF SERVICE

This is to certify that a copy of the foregoing ***Indiana Office of Utility Consumer Counselor's Submission of Additional Public Comments Received after Prefiling Deadline*** has been served upon the following counsel of record in the captioned proceeding by electronic service, on November 17, 2017.

Casey M. Holsapple
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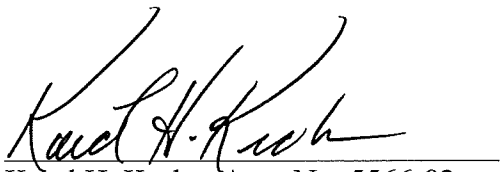

Karol H. Krohn, Atty. No. 5566-82
Deputy Consumer Counselor

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Comments on Indiana Utility Regulatory Commission Cause Number 44963

I urge the Commission to deny the request of Duke Energy Indiana to impose a tariff on opt-out customers. There are valid reasons to opt out, and I feel the requested fees are excessive. The reason my husband and I want to opt out is that some people experience harmful health effects from exposure to the electromagnetic radiation from advanced metering infrastructure (AMI), and we want to be protected from that as much as we can.

Ability to Opt Out

After my husband and I received the post card from Duke Energy, I called the telephone number listed on it. I spoke to a Duke Energy staff person who handles opt out requests and I said we want to opt out because of concerns about the effect of smart meters on human health. He told me that he can include us "on hold" for opt-out at this time. He explained that after approval is given by the Commission, that Duke Energy will mail a letter to us, and we would be given the opportunity to officially opt-out at that time. He said the charge for opting out would be $28.59 per month. He did not mention the one-time charge that is included in Duke Energy Indiana's (DEI) request for approval of Rider No. 59.

I then told him that we live in a retirement community in Bloomington, and that our home is part of a townhouse. Immediately outside our side wall (outside the kitchen) is not only our electric meter, but also 8 other electric meters belonging to the neighbors in our townhouse. I asked how we could protect ourselves from the effects of those meters. He told me each of those Duke Energy customers would have to contact the company and request to opt out. Since that conversation with him, we have not contacted the neighbors about it, because the quoted monthly charge for opting-out would be a substantial disincentive to many people: many would not consider opting out for that reason.

Since I called Duke Energy, 8 new digital meters for our neighbors have been installed outside our home. The meters are located on the back wall of the neighboring home, which is perpendicular to our side wall. The nine meters (8 new plus our meter) are placed in three rows and three columns. The nearest edge of the closest meters are 4 inches from the exterior wall of our home, and the furthest edge of the furthest meters are 32 inches from our home. The new meters look the same as is pictured in "Petitioner's Exhibit 1, Direct Testimony of Justin C. Brown Filed July 7, 2017", on page 6, except that instead of indicating opting-out status, the meter screen of each meter displays various numbers or letters and numbers, which change frequently. The meter for our home appears to be the same analog meter that we have had, a Westinghouse brand.

Thus while we have the ability to opt out of the new meter system, we have no control over the other 8 meters that are located as close as our meter. My husband and I live close to the source of the electromagnetic radiation, and we can reduce it only 11 % (1/9) by opting out on our meter. This situation applies to residents of apartment buildings, condominiums and townhouses who opt out and live close to the meters. It also applies to opt-out customers who live in single-family residences that are situated close to other residences. Is there any solution in this situation since we want to protect ourselves from close exposure to the electromagnetic radiation of the new meters?

Type of Meter Used for Opt-Out Customers

We would very much like to keep the current analog meter in place. Duke Energy Indiana plans to install the type of meter they choose for opt-out customers. The plan listed in "Petitioner's Exhibit 1" (mentioned above) to install AMI meters and have them turned off in "Opt Out" mode still leaves the

possibility for electromagnetic radiation of some amount to be emitted, and for the meters to be turned on without direction of the customer to do that.

Safety of the AMI Meter and the Impact on Human Health

In "Petitioner's Exhibit 3, Rebuttal Testimony of Justin C. Brown Filed October 31, 2017," page 8, Mr. Brown states, " The FCC sets minimum guidelines for safe human exposure for all wireless communications devices sold in the United States and the meters being deployed by the Company comply with those FCC guidelines." He then says that no party has testified that there are any health issues/security issues with the AMI meters being deployed.

I have read about "smart" meters in Wise Traditions, a quarterly publication of the Weston A. Price Foundation.. The article "Smart Meters – not so Smart", by Amy Worthington, dated January 19, 2015, is available on-line at www.westonaprice.org (search for "smart meters"). Worthington says "... the FCC and others' guidelines are not actually meant to protect our health. In fact, they are only meant to protect from acute tissue heating and electrical shock over several minutes. They are not meant to protect humans from the long-term, non-thermal levels of microwave radiation emitted by devices such as smart meters. In fact, there are no true governmental safety standards that govern smart meters."

No public health study has been conducted to assess the long-term effects on human health of exposure to electromagnetic radiation from "smart" meters, according to Worthington. She says "medical literature is now loaded with peer-reviewed studies about the non-thermal biological effects of exposure to EMR...(including) DNA damage, abnormal genetic and hormonal changes, sperm damage, pregnancy complications, degradation of immunity, ...and certain types of cancers." She discusses other impacts on health as well. There is evidence that when humans are exposed to smart meters in close proximity, there are physiological changes in their bodies whether they experience symptoms or not. She says "The American Academy of Environmental Medicine...has proposed a moratorium on 'smart' meters as an 'issue of the highest importance.'"

This as well as other sources I have read indicate there is sound basis for opting-out due to concerns about the effect of smart meters on health.

The Requested Opt-out Tariff

I have the following observations on the request of DEI for approval of an opt-out tariff:

1) In "Petitioner's Exhibit 3, Rebuttal Testimony of Justin C. Brown Filed October 31, 2017," page 9, a range of approved fees for AMI opt-out tariffs are provided. "The fees ...seem to generally range from $75 setup charge and $10 per month (Pacific Gas and Electric) to $298 one-time fee with a $26.69 monthly charge for ONCOR." DEI's requested monthly fee of $28.59 per month exceeds the implied top of the range of $26.69 per month.
2) 90 % of the IT costs for opt-out customers are amortized over 5 years, and this amounts to approximately $7.00 per month per customer. I would expect the monthly charge to be reduced after the end of the five-year period; however, I see nothing in the request to the Commission that the monthly charge will be reduced after 5 years to reflect the fully-amortized expenses.
3) Monthly meter reading expenses for all customers are already included in the current monthly billing to all customers, and that rate will not change. In "Petitioner's Exhibit 4, Rebuttal Testimony of Jeffrey R. Bailey Filed October 31, 2017," page 3, Mr. Bailey

said, "The amount embedded in rates for residential meter reading is $0.54 per customer. As a point of compromise, the Company is willing to deduct such costs embedded in rates from the calculated monthly AMI opt-out charges to avoid any perception of double recovery." What happens to the savings realized from not reading the meters monthly for customers who do not opt out?

I suggest the savings from no longer reading the meters monthly for those customers be applied to reduce or eliminate the requested tariff. In Petitioner's Exhibit 1-A (JCB), page 3 of 3, Note 1 says the total number of customers is 836,000. A 0.1% opt out rate is assumed, yielding 836 customers expected to opt out. Since the amount embedded in the monthly base rate pertaining to meter readings is $0.54/customer/month, the total monthly expense of meter reading is calculated to be approximately $451,440 ($0.54 X 836,000 customers). The requested monthly fee for opt-out customers is $28.59. If twice the number of projected customers actually opt out as were projected by DEI, their monthly fees would amount to approximately $47,800 ($28.59 X 2 X 836 opt-out customers). Thus the savings realized by DEI ($451,440 minus the expense to continue reading meters for opt-out customers) can be applied to eliminate the proposed tariff. In fact, the savings can eliminate the proposed tariff even if many more customers opt-out.

Recommended Action by the Commission

I urge the Indiana Utility Regulatory Commission to deny the request of Duke Energy Indiana for approval to impose tariffs on opt-out customers. The high requested fees and the fact that the Company provided no notice to customers of an opportunity to opt-out indicate to me that the Company seeks to minimize the number of customers who opt out. I feel the fee for opting-out, if there is any fee, needs to be fair.

I appreciate this opportunity to give my comments on this subject, for consideration by the Commission.

Thank you to Duke Energy for considering these comments and for providing reliable electrical service.

Carol A. Peacock
911 Juniper Place
Bloomington IN 47408

November 6, 2017

Swinger, Anthony

From: noreply@formstack.com
Sent: Wednesday, October 25, 2017 2:55 PM
To: UCC Consumer Info
Subject: OUCC_Contact_2361

Formstack Submission For: OUCC_Contact_2361

Submitted at 10/25/17 2:54 PM

Title:	Dr.
Name:	Lynn Struve
Email:	lynn.struve@gmail.com
Address:	602 E Moss Creek Court Bloomington, IN 47401
Telephone (Best number to reach you between 8:00 am and 4:30 pm, Eastern Time, Monday through Friday)::	(812) 334-2590
Type of phone::	Mobile
If you do not have telephone service,:	
If providing comments on a specific case, please indicate the cause number and/or name of utility::	Duke Energy Smart Meters

Your Comments::	I am increasingly concerned about scientific findings that growing exposure to electromagnetic fields (EMFs) is adversely affecting people's health. A couple months ago Duke Energy installed new meters on all the homes in my neighborhood. Only now have I learned that they are "smart meters," one of the prime sources of EMFs in homes. I called Duke to request that this type of meter be removed from my house, but was told that there currently is no possibility of "opting out" of the smart-meter conversion--at least not until the IURC decides on the issue after a Nov. 17 hearing. Allow me to encourage the IURC to require that Duke allow customers to protect themselves from needless exposure to EMFs by opting out of smart meters, and that Duke remove these meters, upon customer request, where they already have been installed. The evidence is substantial that concentrations of EMFs, such as those surrounding smart meters, are very harmful to many people and somewhat harmful to everyone.

STATE of INDIANA

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101 WEST WASHINGTON STREET, SUITE 1500 EAST
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PETITION OF DUKE ENERGY INDIANA, LLC FOR APPROVAL OF AN ADVANCED METER OPT-OUT TARIFF, STANDARD CONTRACT RIDER NO. 59) **CAUSE NO. 44963**

You are hereby notified that on this date the Indiana Utility Regulatory Commission has caused the following Entry to be made:

Please be advised that, on October 31, 2017, Chairman James D. Atterholt received correspondence from James Janulis that addresses matters currently pending in this proceeding. The entire text of the email is attached to this Docket Entry. Disclosure of this written communication is being tendered to the record pursuant to 170 IAC 1-1.5-6.

IT IS SO ORDERED.

David E. Ziegner, Commissioner

Loraine L. Seyfried, Chief Administrative Law Judge

November 9, 2017

Date

>
> -----Original Message-----
> From: James Janulis [mailto:j-pop1234@att.net]
> Sent: Tuesday, October 31, 2017 12:56 PM
> To: Atterholt, James <JAtterholt@urc.IN.gov>
> Subject: Re: I wanted to reach you directly regarding issues with
> Smart Meters (New Message)
>
> **** This is an EXTERNAL email. Exercise caution. DO NOT open
> attachments or click links from unknown senders or unexpected email.
> ****
>
> Dear Mr. Atterholt,
>
> This is a brief further statement as a personal update.
> I think you will find it most interesting.
> Also a short under five minutes video by Stan McDonald which is posted YouTube.I sincerely hope that time will allow to review this video... and my brief statement.
>
> My previous comments and letter/article as you mentioned to me have been entered into the official record for review.
>
> Here is my updated brief comments in summary.
>
> Scientific measurements with an RF or EMF gagger meter have repeatedly
> been proven to show... That Smart Meters emit very unsafe levels of
> radiation actually damaging the DNA of humans
>
> One new health concern I have personally is Tinnitus, the on-going ringing in the ears effect. Smart Meters have been proven to create Tinnitus.
>
> I can personally report that I am a now afflicted with Tinnitus from Smart Meters deployment in my neighborhood/home division in Fishers. The Ashwood Division was changed out to Smart Meters by Duke Energy recently.
>
> From walks around my division and viewing from the sidewalks only I can report that all homes have been changed to Smart Meters. At the very same time that was done was when I was experiencing around the clock Tinnitus. I continue to experience it to the present. It varies in its sound levels of annoyance and sound.
>
> Once in a blue moon I would have a little ringing in the ears.
> I think most people experience this occasionally. That is not what I am talking about.
> This is always present when I am at home. When I leave the area to work, etc.
> It is gone at once. Now I know Smart Meters are everywhere. I can only state I am not experiencing it once leaving home and out of the division area.
> As I drove down 131st coming home last night it began to occur noticeably at the corner of 131st St. and Cumberland.
>

> I am reminding that scientific proof has shown a number of serious illnesses by Smart Meters exposure... Such as Brain Tumors, Heart Attacks skin rashes and more. Now I ask is this worth the price of having one? The Smart Meter has been proven not to save customers/consumers any money on their bills. In fact the majority, most people see their bills go up. So what is going on? Why do this? The Smart Meter has no benifits to the consumer/customer. Not one beifit! Duke Engergy can only quote hersay or in-house so-called research. Are we going to leave it all the energy companies. I hope not. Why would they want to save customers money on their bill. The are a corporation with stock holders.
> They must show increased profits... and this is how they are doing it.
> It is a hoax, a fraud... and in my opionon crimanal activity.
>
> Not only should there be a opt-out for a Smart Meter. Not only should one be able to have the analog meter placed back. Both at no cost to the consumer whatsoever. A moratorium to stop the deployment of more Smart Meters should take place immediately. This is an untested product. Are unknowing customers agreeing to be a partispant in radioactiving exposure to find out if it is safe or not... It appears this is exactly what is happening.
>
> For health, safety and privacy reasons thatthese Smart Meters are guilty of causing... stop anymore from being deployed now please.
>
> Scientific research by expert scientists, doctors and knowledgeable investigative reporters have revealed these concerns are factual.
> Its in thousands of pages on the Internet. Its in many videos by those
> who are considered very knowledgable or experts. Its in books and
> reaserach that Smart Meter radiation exposure is dangerious to not
> only human and animal life... Also plant life too
>
> Key: Duke Energy can not show any third party research or investigaton that is not funded by their company or other energy companies worldwide that proves these serious and life treating concerns are untrue.
>
> I believe the burden of proof should be with Duke Energy to prove they are truly safe. No way can they prove that... because they are not. Mostly customers have trusted Duke Energy to act on their better interests. Nothing could be further from the truth. This simply is no longer true or factual with the deployment of Smart Meters. In my opinion, this is actually a dangerious weapon. Its technology was invented by the military if you were not aware of this? To be used as a weapon to confuse the enemy. Point and fire type weapon that effectually disorients the enemy. This is from my research and came from an expert who lectures on the subject of the dangers of ER and EMP radiation.
>
> It is fact that many people are negatively effected and are highly sensitive to Electromatic Radiation Exposure. It is devastating to them. No one escapes this kind of radiation posining that can happen quickly or over time with being exposured to Smart Meter transmissions. Duke says they are only transmiting a few minutes a day. This is completely untrue!
>
> This November 17th meeting with Duke Energy will be one of the most important meetings of the I.U.R.C. ever had in its history most likely.
> I hope the consumers, customers, people will be protected by its outcome.
>
> All of this protest to Smart Meters sounds extreme. I assure you it is not.

>
> I truly appreciate your interest in my comments!
>
> Thank you!
>
> Sincerely,
>
> James Janulis
>
> I hope every decision maker on the committee can read this statement and review this short video. Its all true.
>
> https://www.youtube.com/watch?v=Oik1agilam4
> Short video by Stan McDonald

STATE of INDIANA

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PETITION OF DUKE ENERGY INDIANA, LLC FOR APPROVAL OF AN ADVANCED METER OPT-OUT TARIFF, STANDARD CONTRACT RIDER NO. 59) **CAUSE NO. 44963**

You are hereby notified that on this date the Indiana Utility Regulatory Commission has caused the following Entry to be made:

Please be advised that, on October 11, 2017, Chairman James D. Atterholt received correspondence from Todd Butler that addresses matters currently pending in this proceeding. The entire text of the email is attached to this Docket Entry. Disclosure of this written communication is being tendered to the record pursuant to 170 IAC 1-1.5-6.

IT IS SO ORDERED.

David E. Ziegner, Commissioner

Loraine L. Seyfried, Chief Administrative Law Judge

October 12, 2017

Date

From: Todd Butler [mailto:Todd@butlerinsurance.in]
Sent: Wednesday, October 11, 2017 8:41 AM
To: Atterholt, James <JAtterholt@urc.IN.gov>
Cc: Ziegner, David <DZiegner@urc.IN.gov>; Seyfried, Loraine <lseyfried@urc.IN.gov>
Subject: RE: Smart Meters

Jim,
Below is additional info for you and your staff to research. As an Honest Godly Man and Chairman of the IURC, you are now in a position that may impact "everyone's" health including you, Brenda and your boys here in Indiana!!!

This is not fiction but rather a nasty product using human's as their Ginny pigs! My Medical Doctor friend sees patients daily that are negatively impacted by our Energy Companies and especially these Smart Meters! We as consumers should have the absolute right to opt out if we so warrant!

I am praying that you and your staff are able to stop what 99% or more Americans are unaware of how harmful these Smart Meters are to their health.

What would be really interesting is to go visit "all" of the higher ups at Duke to see how many of them truly have Smart Meters on their homes!

I know you can't comment but I will forward you info as I am able. Please just confirm you received.

Thanks for all you are doing,
Todd

Todd, Sorry to hear this news. I have a few concerns about you personally.....and close proximity to a smart meter for an extended period of time....A friend got so depressed when a smart meter was placed on the wall of her home (she didn't know it was there) that she was suicidal for 6 weeks. When she saw the smart meter she got very aggressive about getting it removed and her depression lifted once it was removed. Another issue is RF's ability to increase proliferation and neurotoxicity of yeast in our body. Dr Klinghardt has some info.- a you tube on this. It's also important to be aware of placement on nearby buildings. I have bought smart meter guards for 8 neighbors (available via link on emfhealthy.com website) BEST SOLUTION for many reasons including health and fire hazard is NO Smart Meter. BUT smartmeterguard is next best option. I was put on "delayed installation list" BUT I reacted strongly to all my neighbors getting a smart meter. After 2 years of fighting the California Public Utility Commission (CPUC) we won an opt out option which we pay for- $75 for removal (even if you don't have one...) and $10 per month for 3 years. Extortion....

Good Resources for you are:

Website: EMFsafetynetwork (see FAQ)
Articles: bioinitiative.org (see "Summary for the Public")

American Academy of Environmental Medicine (has a couple of letters pertaining to health effects-AND recommends NO smart meters on schools or homes because of all the cases of severe reactions to smart meters)
You Tube: Toril Jelter MD + Health Effects of Non-Ionizing Radiation in Children (EMF Summit Mountainview CA. 10/10/15) case discussed about a boy that couldn't sleep because of SM placement outside his bedroom wall. After SM removal he could sleep again. Night time is when our immune system resets and repairs...decreasing likelihood of cancer.

Also the National Toxicology Program is finding RF stimulates tumors and cancer within 2 years of exposure to cell phones-another form of non-ionizing radiation. The rest of the results will be released later this year or next year.

I think this is a good start. I can also introduce you to the head of Stop Smart Meters in California IF you need more. Good luck! Remember we live in a democracy....a country with freedom of speech and all that.

From: Todd Butler [mailto:Todd@butlerinsurance.in]
Sent: Wednesday, October 11, 2017 8:44 AM
To: Atterholt, James <JAtterholt@urc.IN.gov>
Cc: Ziegner, David <DZiegner@urc.IN.gov>; Seyfried, Loraine <lseyfried@urc.IN.gov>
Subject: Smart Meters II

Todd, You may also use my open letter to FCC with cases pertaining to smart meters available at WiFi in Schools and/or google Toril Jelter + Letter to FCC

Some more links below.

--
Best Regards,
Dr. Jelter
MDI Wellness Center
www.mdiwellness.com
325 N Wiget Ln #130
Walnut Creek, CA 94598 USA
Ph 925 935 5425
Think Wellness! Spread Wellness!!
Link for MDI Event Calendar: http://mdicalendar.pageurl.net

From: Atterholt, James
Sent: Wednesday, October 11, 2017 11:31 AM
To: Todd Butler <Todd@butlerinsurance.in>
Cc: Ziegner, David <DZiegner@urc.IN.gov>; Seyfried, Loraine <lseyfried@urc.IN.gov>
Subject: RE: Smart Meters III

I did receive the e-mails and they will be made part of the official record. The hearing for this case has been set for November 17th.

Jim

James D. Atterholt
Chairman - Indiana Utility Regulatory Commission
101 West Washington Street, Suite 1500E
Indianapolis, Indiana 46204
Cell Phone: (317)448-6202
Executive Assistant – Brittany Webb: (317) 232-2703
Executive Office Line: (317) 232-2845

From: Todd Butler [mailto:Todd@butlerinsurance.in]
Sent: Wednesday, October 11, 2017 8:46 AM
To: Atterholt, James <JAtterholt@urc.IN.gov>
Cc: Ziegner, David <DZiegner@urc.IN.gov>; Seyfried, Loraine <lseyfried@urc.IN.gov>
Subject: Smart Meters III

Jim,
Did you receive all 3 emails?

Can you give a time frame for this case?

Thanks, Todd

Subject: You Tube

CPUC + Smart Meter Testimony
Peevy tries to stop smart meter testimony

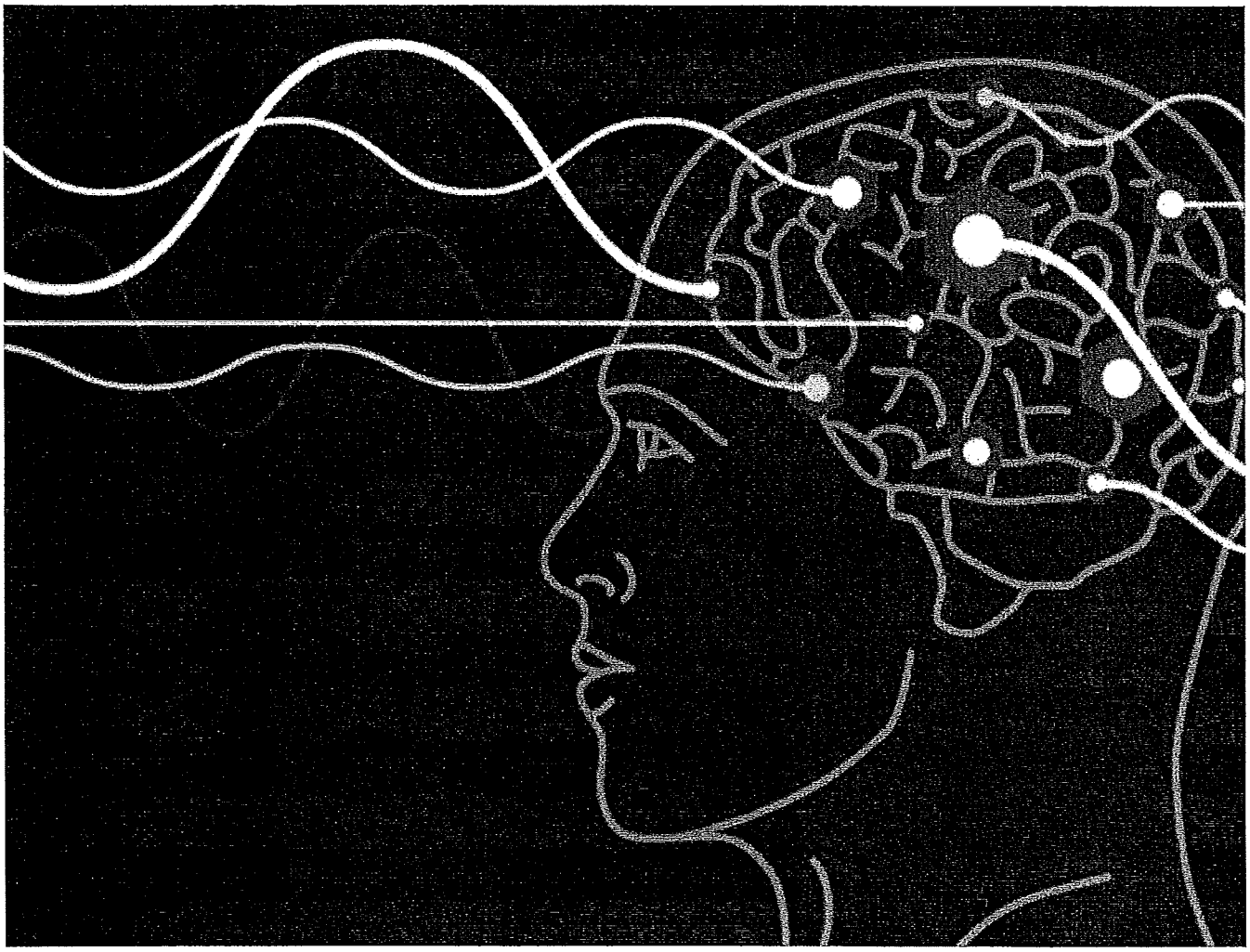
--

Best Regards,
Dr. Jelter
MDI Wellness Center
www.mdiwellness.com
325 N Wiget Ln #130
Walnut Creek, CA 94598 USA
Ph 925 935 5425
Think Wellness! Spread Wellness!!
Link for MDI Event Calendar: http://mdicalendar.pageurl.net

http://www.naturalblaze.com/2016/01/environmental-refugees-electromagnetic-hypersensitivity-ehs-sufferers.html

Environmental Refugees: Electromagnetic Hypersensitivity (EHS) Sufferers

Posted on January 28, 2016Natural Living



By Catherine J. Frompovich

The State of Maine Public Utility Commission recently received what it thinks is the ultimate verdict in the issue of electromagnetic hypersensitivity (EHS) when the Maine Supreme Judicial

Court agreed with the PUC that utility companies' smart meters are safe and not harmful to human health and safety.

Perhaps the judge who rendered that decision ought to reconsider what's going on regarding EHS, especially at the United Nations and their conference where EHS issues were discussed.

Dr Yael Stein, MD, Department of Anesthesiology and Critical Care Medicine, Hebrew University – Hadassah Medical Center, Jerusalem, Israel, gave an 83 slide presentation titled "Environmental Refugees" wherein Dr Stein pointed out key factors that need to be addressed in the modern age of microwave technology that super saturates humans with EMFs and RFs from cell phones and towers, Wi-Fi, utility companies' AMI smart meters, smart phones, routers, monitors, etc. and other electronics that can send and receive data, information, voice, photographs, etc.

Dr Stein's comprehensive presentation was before the UNESCO 10th World Conference on Bioethics, Medical Ethics and Health Law held January 6 to 8, 2015 in Jerusalem, Israel. [1]

One very prominent classification regarding EHS, pointed out by Dr Stein, is that in Sweden, *electromagnetic hypersensitivity (EHS) officially is recognized as a functional impairment and not regarded as a disease!* Furthermore, there's a published peer-review paper, "Electrohypersensitivity: state-of-the-art of a functional impairment" [2] wherein Sweden's position on EHS is discussed. The Abstract for that paper states:

EHS is characterized by a variety of non-specific symptoms that differ from individual to individual. The symptoms are certainly real and can vary widely in their severity. Whatever the cause, EHS can be a disabling problem for the affected individual.

Source: Dr Yael Stein, MD, Slide 67 of 83 / UNESCO 10th Word Conference on Bioethics, Medical Ethics and Health Law

Presented at the Corporate Interference with Science and Health: Fracking, Food and Wireless, Scandinavia House, New York City, March 13 & 14, 2013.

RADIATION FROM WIRELESS TECHNOLOGY AFFECTS THE BLOOD, THE HEART AND THE AUTONOMIC NERVOUS SYSTEM.

Magda Havas, BSc, PhD

Environmental & Resource Studies, Trent University, Peterborough, ON, K9J 7B8, Canada, mhavas@trentu.ca, www.magdahavas.com

ABSTRACT

Exposure to electrosmog generated by electric, electronic, and wireless technology is accelerating to the point that a portion of the population is experiencing adverse reactions when they are exposed. The symptoms of *electrohypersensitivity* (EHS)–best described as *rapid aging syndrome* (RAS)–experienced by adults and children resemble symptoms experienced by radar operators in the 1940s-1960s and are well described in the literature. An increasingly common response includes clumping (rouleau formation) of red blood cells; heart palpitations; pain or pressure in the chest accompanied by anxiety; and an up regulation of the sympathetic nervous system coincident with a down regulation of the parasympathetic nervous system typical of the "fight or flight" response. Provocation studies presented in this publication demonstrate that the response to electrosmog is physiological and not psychosomatic. Those who experience prolonged and severe EHS may develop psychological problems as a consequence of their inability to work, their limited ability to travel in our highly technological environment and to the social stigma that their symptoms are imagined rather than real.

KEY WORDS: electrosmog, radio frequency radiation, Wi-Fi, rouleau, tachycardia, Wolff-Parkinson-White Syndrome

INTRODUCTION

Our exposure to devices using electricity and emitting electromagnetic fields (EMF) and electromagnetic radiation (EMR) has been increasing ever since Edison invented the incandescent light bulb and Tesla/Marconi transmitted radio frequency radiation. Radio, television, computers, cell phones and their accompanying cell phone antennas, cordless phones, wireless routers (Wi-Fi), wireless baby monitors, wireless games, and smart meters are increasing our exposure to radio frequency radiation and especially to microwave radiation (300 MHz to 300 GHz).

As an example of the proliferation of this technology, in 2002 access to Wi-Fi was limited but by 2012 access was virtually ubiquitous in the U.S. (Fig. 1). We have citywide Wi-Fi in some communities; Wi-Fi at work, at home; in school, universities and hospitals; in restaurants and coffee shops; on public transit, at airports and on an increasing number of airplanes. As a society we seem to be insatiable for wireless technology and the connectivity it affords.

However, there is a downside to this technology that has received relatively little attention in North America, namely radiation's harmful effects, which fall into three categories–cancer, reproductive problems and electrohypersensitivity. This paper is restricted to the later, electrohypersensitvity or EHS.

ELECTROHYPERSENSITIVITY

Just as some people have multiple chemical sensitivity (MCS) or react to pollen, mould, and certain types of food, a growing population is becoming "sensitive" to electromagnetic radiation.

The flood analogy can be used to explain electromagnetic exposure and subsequent sensitivity. Low levels of water have little or no effect and as the water level rises, those who are short and become submerged and are poor swimmers are going to be adversely affected long before those who are taller and not yet submerged or are good swimmers (Fig. 2).

Santini et al. (2002) published a study documenting symptoms of EHS among those who lived at various distances from a cell phone antenna. People who lived closest to the antennas experienced the following symptoms more often than those who lived further away: fatigue, sleep disturbance, headaches, feeling of discomfort, difficulty concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular problems, dizziness, loss of appetite, movement difficulties, and nausea (Fig. 3). Many of these symptoms predominate with age so I prefer to call this *rapid aging syndrome*. The difference between real aging and *rapid aging syndrome* experience by those who are electrically hypersensitive, is that when these people go into an electromagnetically clean environment many of their symptoms diminish or disappear. Obviously, this does not happen with real aging.

We are experiencing an emerging health crisis that is contributing to chronic ill health and is promoting the sale of pain medication; sleep medication; antidepressants and anti-anxiety medication; uppers and downers to moderate energy level and mood; and drugs like Ritalin for those with attention deficit hyperactivity disorder (ADD and ADHD).

In 2006, Hallberg and Oberfeld documented the increasing prevalence of EHS. Fig. 4 clearly shows that self-perceived EHS is on the rise. According to the authors, by 2017 50% of the population is going to be complaining of this illness.

A conservative estimate of those who have severe symptoms is 3% of the population. Another 35% population experience mild to moderate symptoms of EHS when exposed to electrosmog (Havas and Olstad 2008). Based on these percentages the cumulative number of people adversely affected in Canada, the U.S. and Europe are 25 million people with severe sensitivity (electrohypersensitivity) and another 300 million with mild to moderate sensitivity (electrosensitivity). People in this latter group can function in an electrosmog environment but may develop headaches or have difficulty sleeping and are living a life compromised by

increasingly poor health as a consequence of their exposure (Fig. 5).

This information may be shocking to those who are unaware of the research in this area. Their reaction is often, "If this were true **they** would have told us." The fact is that international groups of scientists and medical doctors have been telling us for decades that the current guidelines for electromagnetic radiation are insufficient to protect public health and these experts have been asking policy makers to reduce guidelines based on more than four decades of scientific research. These experts make these statements through appeals and resolutions that are ignored by governments and policy makers and seldom appear on the evening news. Table 1 provides a list of some of these resolutions and appeals.

The World Health Organization (WHO) held an international workshop on electrosensitivity in Prague in 2004 and they defined EHS as follows:

> *". . . a phenomenon where individuals experience* ***adverse health effects*** *while using or being in the vicinity of devices emanating* ***electric, magnetic,*** *or* ***electromagnetic fields*** *(EMFs)."*
>
> *" . . . EHS is a* ***real*** *and sometimes a* ***debilitating*** *problem for the affected persons . . . Their exposures are generally several orders of magnitude* ***under*** *the limits in* ***internationally accepted standards****."*

Based on this definition what role should the WHO and other leading health authorities play in helping these sensitive individual? Some would advocate–at the very least–lower exposure limits and possibly places where the radiation is not allowed, similar to smoke-free environments. Instead, the WHO recommended that this *illness* be referred to as *idiopathic illness*, which basically means we don't know the cause. By refusing to acknowledge the cause the WHO undermines the need to act for them and for any other governing body. We do know the immediate cause and that is electrosmog exposure. What we don't know is why some people are more sensitive than others and what conditions created or caused the initial onset of this sensitivity.

Some of the pre-existing conditions that may sensitize a person to electrosmog include physical or electrical trauma to the central nervous system; presence of toxic chemicals in the body including metals, especially mercury, and organic neurotoxins; biological insults to the body such as Lyme disease; a compromised (lupus), underdeveloped (children) or heavily challenged (stressed) immune system.

In contrast to the WHO, the Austrian Medical Association (2012) came out with guidelines to help doctors diagnose and treat those who suffer from EHS. In this document they recognize that there is a rise in stress-related illness and that electrosmog may play a role. They even provide a temporary code (Z58.4, exposure to radiation) under the International Classification of Diseases (ICD-10) to be used for *EMF syndrome*, which is their term for *electrohypersensitivity*.

A small group of psychologists considers EHS to be entirely a psychological illness rather than a physiological response to electrosmog (Rubin et al. 2005). Many of the

papers reviewed by Rubin et al. are based on flawed assumptions of how people with EHS respond to exposure and as such lead to flawed conclusions. However, it is clear that those who suffer from EHS and are no longer able to live a "normal" life and who are not supported by their family, friends and physicians also suffer from stress leading to psychological problems including depression and anxiety disorders. Where we disagree about EHS is that I believe the physiological response precedes the psychological problem.

In this paper examples of the effects electrosmog has on the blood, on the heart, and on the autonomic nervous system are provided indicating that electrohypersensitivity is a physiological response to electromagnetic pollution. The only legitimate use of the term "idiopathic" (i.e. disease or disorder that has no known cause) is in reference to the initial trigger than initiated the electromagnetic sensitivity. In some cases, with good medical investigation, this also can be surmised.

ELECTROSMOG AFFECTS THE BLOOD

Healthy blood consists of erythrocytes, red blood cells, that are round and float freely in the plasma. Cardiologist Dr. Stephen Sinatra says that healthy blood should have the consistency of red wine. Instead, what he finds in his practice is that blood increasingly has the consistency of ketchup.

Figure 6 shows live blood (blood without any chemicals added to it) in an electromagnetically clean environment (A); the same blood after person spoke on a cordless phone for 10 minutes (B); and after person used a wired computer for 70 minutes (C). The erythrocytes are sticking together and resemble a stack of coins. This is known as rouleau formation and indicates unhealthy blood.

With rouleau formation the surface area of the red blood cells is significantly reduced and the release of nutrients and the removal of waste products is compromised. Symptoms may include headaches, difficulty concentrating, dizziness, nausea, heart and blood pressure problems as well as cold, numbness or tingling sensation in the extremities (hands and feet).

The good news is that live blood analysis may be a useful diagnostic for EHS. Monitoring how quickly the blood clumps and how quickly it recovers following exposure may be a good indicator of the degree of sensitivity.

ELECTROSMOG AFFECTS THE HEART AND THE AUTONOMIC NERVOUS SYSTEM

Some people who are electrically hypersensitive complain of pain or pressure in the chest area, heart palpitations and/or an irregular heartbeat, accompanied by feelings of anxiety that develop rapidly. The symptoms resemble a heart attack and thus contribute to even more anxiety.

To test the effect of electrosmog on the heart Havas et al. (2010) designed a simple experiment where subjects were exposed to electromagnetic radiation generated by the base of a cordless phone. This was a double-blind study with randomized real and sham exposure. A cordless phone base station was selected as the source of exposure since the base emits a constant beacon signal when it is plugged into an electrical outlet. The beacon signal in this case was a pulsed 2.4 GHz frequency, the same frequency used in Wi-Fi.

In the original study (Havas et al. 2010), 25 subjects from Colorado were tested and while most subjects did not react adversely to the radiation from the cordless phone base station (see Fig. 7, Subject A), a few did react with either tachycardia (rapid heart rate) or arrhythmia (irregular heart rate) (Fig. 7, Subject B). The reaction was often immediate and coincided with exposure to the radiation. When the radiation ceased, the heart returned to normal.

Two examples of responsive subjects are provided. The heart rate of Subject B increased from a resting 68 beats per minute (bpm) to a rapid 122 bpm during exposure, fell to 66 bpm as soon as the radiation stopped, and increased to 129 bpm when it resumed. This reaction occurred while the subject was resting in a supine position and was unaware of when s/he was or was not exposed.

During exposure to the radiation from the cordless phone base station, subject C (Fig. 8) had a slight increase in heart rate (65 to 86 bpm), an irregular heartbeat, as well as changes in the response of the sympathetic (SNS) and parasympathetic (PNS) nervous system. This up regulation of the SNS and down regulation of the PNS is an example of the "fight or flight" response indicating physiological stress. During periods of this type of stress the body redirects most of the blood and energy from the internal organs to the arms and legs to prepare the organism for fighting or fleeing a stressful situation. Intermittent exposure may not cause a problem but if the exposure is continuous and long-term, the immune system of the body will be compromised and the body will not be able to repair itself resulting in symptoms that are commonly experienced by those who are electrically hypersensitive. This inability to heal is what then accelerates the symptoms of aging (i.e. rapid aging syndrome).

The level of radiation in this experiment was well below international guidelines. Subjects were exposed to 3 $\mu W/cm^2$ or 0.3% of the guidelines recommended by ICNIRP, the FCC, and Health Canada for 2.4 GHz frequencies. According to these organizations harmful biological effects do not occur below these thermal guidelines. Both the blood results and the heart results from these provocation experiments indicate otherwise, i.e. that biological effects, which can have serious health implications, do occur at levels well below current thermal guidelines.

The cordless phone provocation study has since been repeated for a larger group of subjects and shows similar results (Havas and Marrongelle 2013).

Some suggested that the radiation from the cordless phone was interfering with the technology rather than the heart. If this were the case then 100% of the subjects would have had similar results since the electromagnetic interference (EMI) would have been consistent rather than highly variable and individualistic. Additional testing of higher levels of radiation at the sensor did not affect the HRV of a subject who was non-responsive to the original levels. Had it been EMI then higher levels of exposure should have had a greater response, but this was not the case.

One subject (52-year old male) told us he normally experienced a delayed reaction to electrosmog exposure so we monitored him for 30 minutes post-exposure and observed the delayed response during a period of no exposure. The response included periods of short-term and intermittent irregularity in the R-R interval (HRV) as well as episodic down regulation of both the SNS and the PNS, which were both low to begin with (Havas and Marrongelle 2013). The normally low heart rate 53 to 55 beats per minute began to increase slightly (61 bpm) 25 minutes post-exposure.

WI-FI IN SCHOOLS AFFECTS STUDENT HEALTH

Students in schools with Wi-Fi are complaining of headaches, difficulty concentrating, weakness, and heart palpitations prompting their parents to take them to their family doctor and to their pediatric cardiologist to determine the nature of their problem.

In one Ontario school district, several students complained of heart problems. A 6-year old girl had a "musical heart." She experienced headaches and dizziness only at school. A 12-year old boy had tachycardia (rapid heart rate). A 12-year old girl experienced nausea, vomiting, no fever, insomnia, blurred vision, and tachycardia only at school. A 13-year old boy, had a pounding heart, insomnia, and headaches. His family moved to a different school district and his symptoms disappeared.

In the same area four students had sudden cardiac arrests (SCA) during exercise class within a two-year period. Two of these students were resuscitated. The annual rate for SCA among young people in Canada is approximately seven per year; hence four in a small community is unusual.

According to Cardiologist Stephen Sinatra (2011), Wolff-Parkinson-White (WPW) Syndrome, which is a disorder of the conduction system of the heart, is present in 1 out of 700 students. In a school district with 50,000 students as many as 70 may have this generally undiagnosed condition. When students with WPW syndrome are exercising and are exposed to microwave radiation the combined stress on the heart can lead to supraventricular tachycardia, creating the "perfect storm".

In response to this disturbing situation, schools are installing defibrillators! What they should also be doing is trying to determine what is causing sudden cardiac arrest and why students are complaining of headaches and heart palpitations at school. A key question that needs to be asked is, "What role does radio frequency radiation from a school's Wi-Fi system and from nearby cell phone base stations play in these symptoms?"

The effects of microwave radiation on the heart have been known for decades (Cleary 1969). In a 1969 Symposium on the Biological Effects and Health Implications of Microwave Radiation, the authors clearly state that, "In the interest of occupational hygiene . . . researchers have recommended that cardiovascular abnormalities be used as screening criteria to exclude people from occupations involving radio-frequency exposures." Perhaps students need to be screened at school to ensure that they do not have an underlying heart condition that may be exacerbated with Wi-Fi microwave exposure.

Out of hospital sudden cardiac arrest among young people, according to Drezner et al. (2008), is on the rise in the U.S., although doctors do not know the reason. The increasing exposure to electrosmog may be to blame for at least part of this increase. More research is urgently needed in this area.

Children are much more sensitive to environmental toxins than are adults and as such require stricter guidelines for exposure. To date at least nine countries have issued warnings that children should limit their use of cell phones. These countries include: the United Kingdom, 2000; Germany, 2007; France, 2008; Russia, 2008; India, 2008; Belgium, 2008; Finland, 2009; the U.S. (FCC), 2009; and Health Canada, 2012. The same warning should be issued for children exposed to wireless games and Wi-Fi routers based on the amount of time students are exposed to these emitters.

Wi-Fi routers emit a beacon signal that is continuous as long as the device is activated. In other words, you do not have to be connected to the Internet to be exposed to the radiation generated by the wireless router. When information is either uploaded or download, the radiation levels increase both at the router and at the computer. The same is true for cordless phones and wireless baby monitors. Voice activated baby monitors and cordless phones that radiate only when in use are available in Europe but are not currently available in North America.

HISTORIC RESEARCH ON MICROWAVE ILLNESS RESEMBLES CURRENT RESEARCH ON ELECTROHYPERSENSITIVITY

The information provided in this paper is not new. Reviews as far back as 1969 summarized the effects of microwave radiation and identified many of the same symptoms. Dodge (1969) reviewed the Soviet and Eastern European literature and reported that microwave radiation affects the central nervous system; the autonomic nervous system (as shown here); neurohumoral systems; endocrine glands and functions; eye and ocular function; blood and hematopoietic system (as shown here) and miscellaneous organs.

Dodge (1969) identified general subjective complaints resulting from exposure to electromagnetic radiation (Table 2) that are similar to the symptoms experienced by those who live near cell phone base stations (Fig. 3). The major difference is that Dodge was reviewing symptoms for men who were occupationally exposed whereas Santini was

documenting symptoms for those who lived near cell phone antennas and were exposed to radiation in their own homes and as such were unable to avoid exposure.

Glaser (1972) reviewed the literature on the biological effects of microwave radiation and provided more than 2000 references in 1972. While many of these studies were conducted at levels above existing guidelines, we are getting similar results at levels of microwave radiation that are well below these guidelines.

Most revealing are the "psychophysiologic disorders" based on human behavioral studies. These disorders include the following and are similar to those reported by Santini et al. (2002): neurasthenia (general "bad" feeling), depression, impotence, anxiety, lack of concentration, hypochondria, dizziness, hallucinations, sleepiness, insomnia, increased irritability, decreased appetite, loss of memory, scalp sensations, increased fatigability, chest pain, and tremor of the hands.

Both Glaser and Dodge worked for the U.S. Navy and had access to information that was later declassified. In one limited edition (only 15 copies were produced) document (Pollack and Healer 1967), Herbert Pollack, M.D. and his co-authored, Janet Healer, recommended that guidelines in the U.S. be reduced from 10,000 microW/cm^2 to those used in the Soviet Union (10 microW/cm^2). Little attention was paid to this recommendation. Years later power density guidelines in the U.S. were reduced from 10,000 to 1,000 microW/cm^2 although this was still based on thermal effects.

WHERE DO WE GO FROM HERE?

If we do nothing about guidelines and allow Wi-Fi to be installed in schools; allow WiMax to come into neighborhoods as part of the 4G network; allow wireless smart meters to be installed on homes; and fail to regulate the technology in a way that minimizes microwave exposure then many more people are likely to become ill and some will die (Fig. 9).

If we choose to minimize exposure by establishing biologically based guidelines rather than the current thermal guidelines; by encouraging wired Internet access in schools, universities, hospitals, workplaces and homes; by installing wired smart meters; and by establishing radio frequency-free zones for those who are highly sensitive than we can reverse much of the damage that has been inflicted (Fig. 9).

The choice is ours and the real question is, "Do we have the foresight and courage to make the right decision or will we require a health tsunami before we act?"

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Table 1. Appeals and Resolutions from International Groups of Scientists and Medical Doctors.

Resolution/Group	Country	Year	Link
Salzburg Resolution	Austria	2000	www.land-sbg.gv.at/celltower
Catania Resolution	Italy	2002	www.emrpolicy.org/faq/catania.pdf
Freiburger Appeal	Germany	2002	www.mastsanity.org/doctors-appeals.html
Prague Conference	World Health Organization	2004	http://www.who.int/peh-emf/meetings/hypersensitivity_prague2004/en/
Irish Doctors' Environmental Association	Ireland	2005	www.ideaireland.org
Helsinki Appeal	Finland	2005	www.emrpolicy.org/headlines/helsinki_appeal_05.pdf
Benevento Resolution	Italy	2006	http://www.icems.eu/docs/Benevento Resolution_REVISED_march2008.pdf
BioInitiative Report	U.S.	2007 & 2012	www.bioinitiative.org
Venice Appeal	Italy	2008	http://www.icems.eu/resolution.htm
Porto Alegre	Brazil	2009	http://www.icems.eu/docs/resolutions/Porto_Alegre_Resolution.pdf
International Doctors Appeal	Germany	2012	http://www.icems.eu/resolution.htm
Seletun	Norway	2011	http://iemfa.org/index.php/publications/seletun-resolution

Table 2. Subjective symptoms associated with radio frequency and microwave radiation.

General subjective complaints resulting from exposure to electromagnetic radiation (Dodge 1969)	Symptoms experienced "very often" by those who live within 300 m of a cell phone base station (Santini et al. 2002)
Similar Symptoms	
pain in head and eyes	headaches, visual disruptions
weakness, weariness & dizziness	dizziness, fatigue
depression, antisocial tendencies, general irritability	depression, irritability
impairment of memory & general mental function	memory loss
adenoma and inability to make decisions	difficulty concentrating
chest pain & heart palpitation	cardiovascular
dyspepsia, epigastric pain, and loss of appetite	loss of appetite
sensitivity of mechanical stimulation & dermagraphism	skin problems
Different Symptoms	
lacrimation	irritability
hypochondria, sense of fear & general tension	nausea
inhibition of sex life (male)	movement difficulties
sour scalp sensations and hair loss	hearing disruption
trembling of eyelids, tongue, & fingers	sleep disturbance
asthma	feeling of discomfort
brittle fingernails	

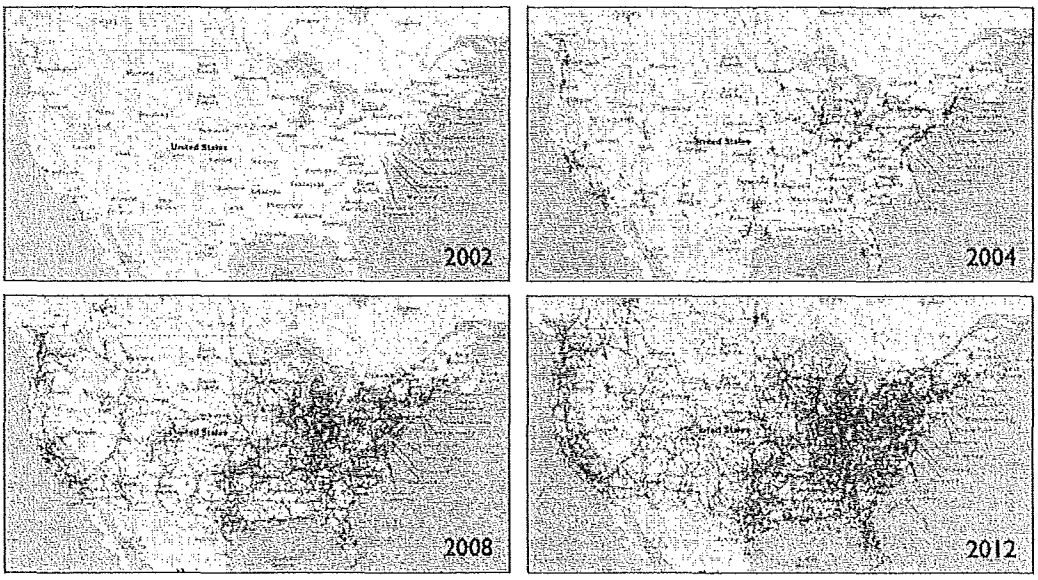

Figure 1. Wi-Fi networks in the U.S. from 2002 to 2012 (source wigel.net).

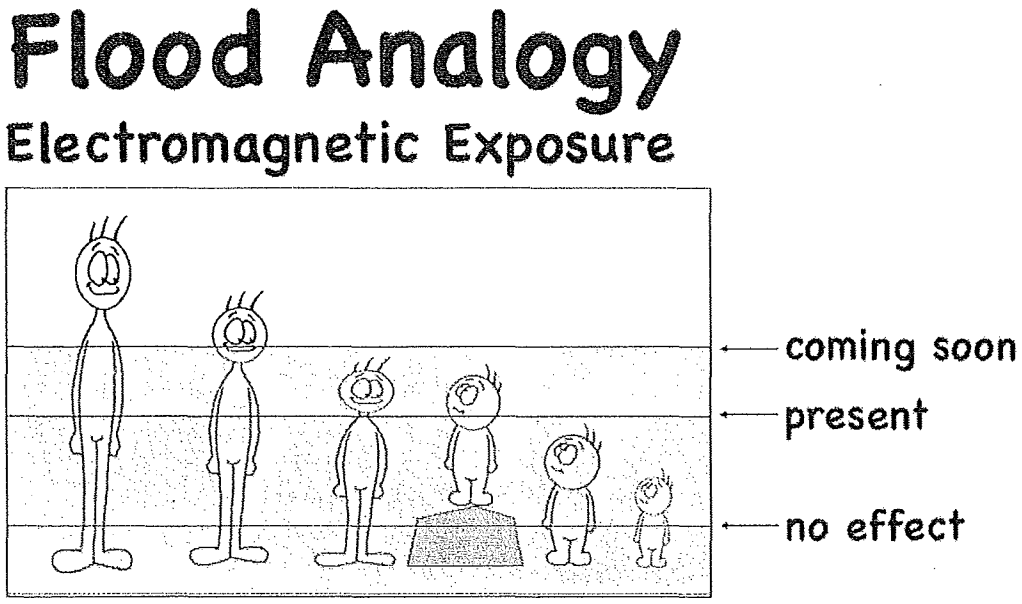

Figure 2. Electrosmog exposure and electrohypersensitivity based on the flood analogy.

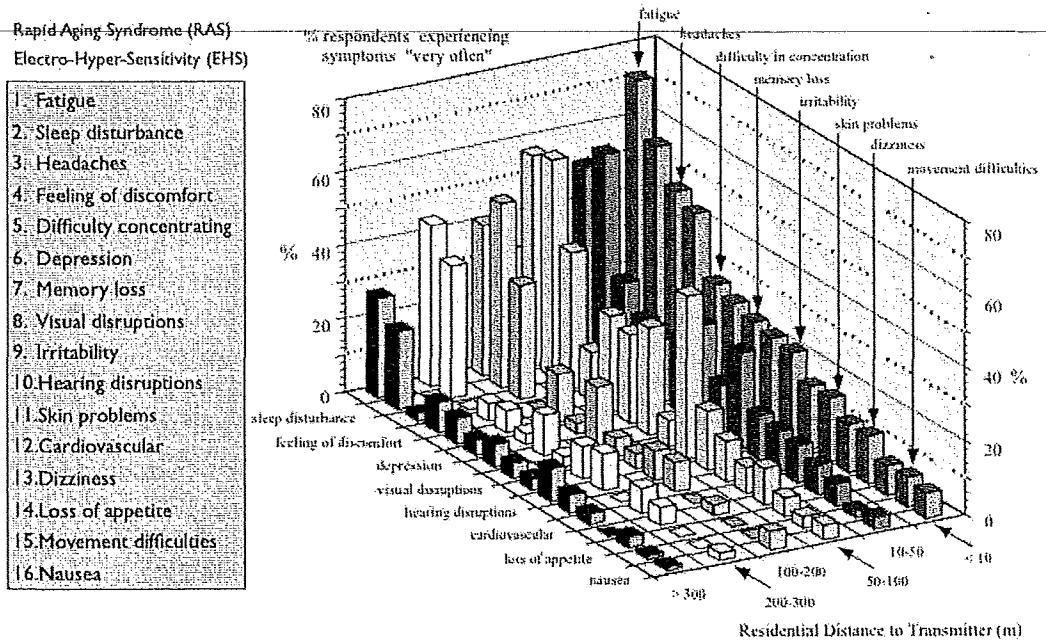

Figure 3. Symptoms experienced by people in the vicinity of cellular phone base stations (based on Santini et al. 2002).

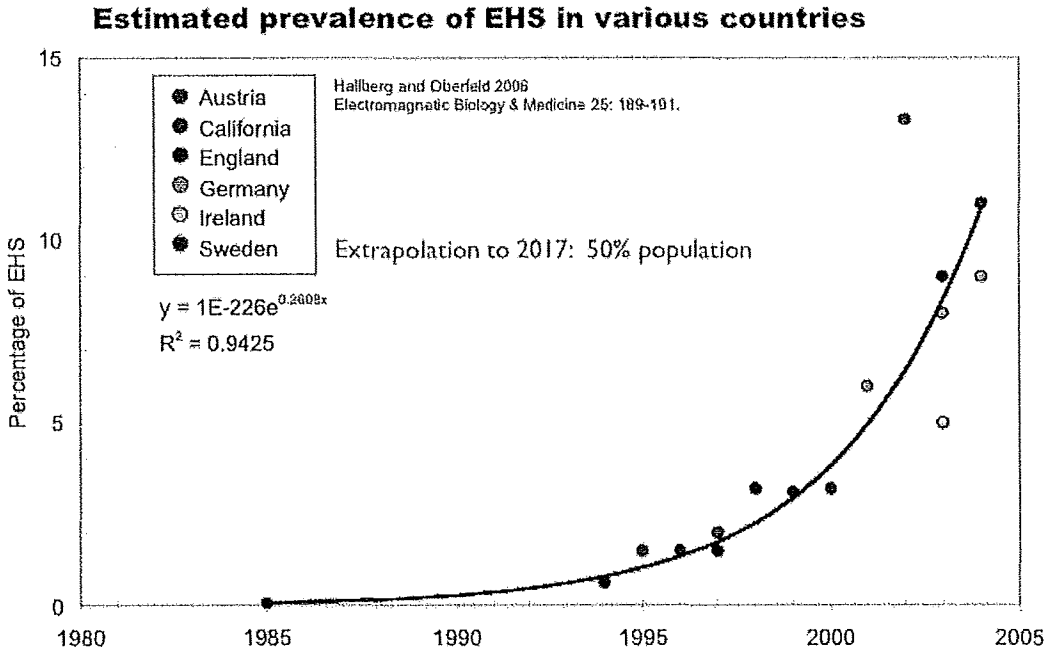

Figure 4. Estimated prevalence of self-proclaimed electrohypersensitivity (EHS) in various countries (based on Hallberg and Oberfeld 2006).

Estimated Prevalence of Electrohypersensitivity

	Population	Severe (3%)	Moderate (35%)
Canada	33 million	1 million	10 million
U.S.	312 million	9 million	110 million
E.U.	500 million	15 million	175 million

. . . Electrohypersensitivity Symptoms . . .

Figure 5. Estimated prevalence of electrohypersensitivity (EHS) based on severity of symptoms.

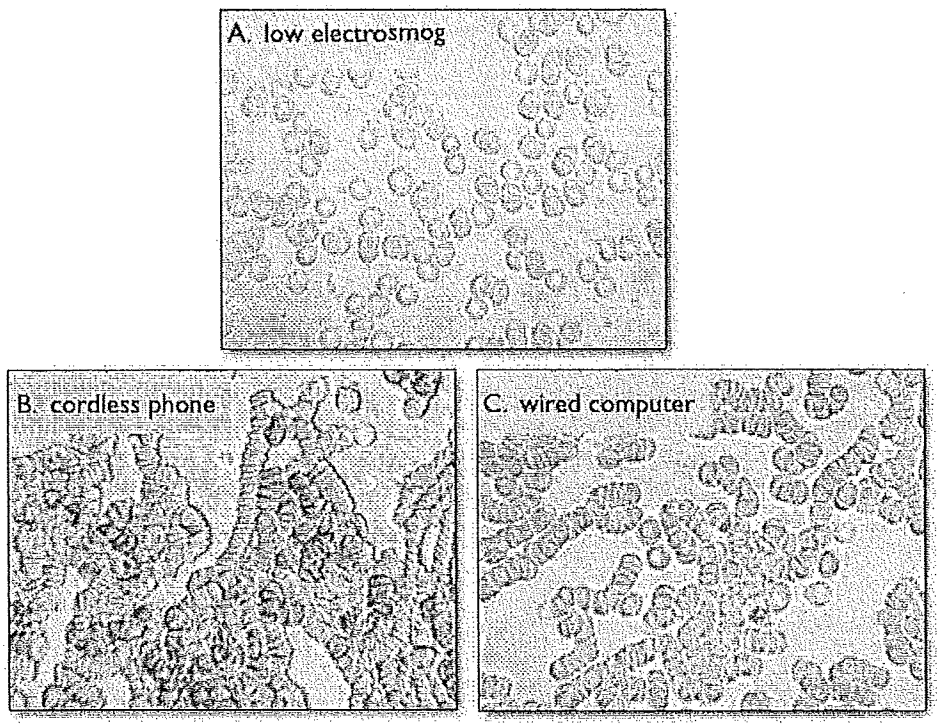

Figure 6. Live blood cells in a low electrosmog environment (A); after using a cordless phone for 10 minutes (B); and after using a wired computer for 70 minutes (C).

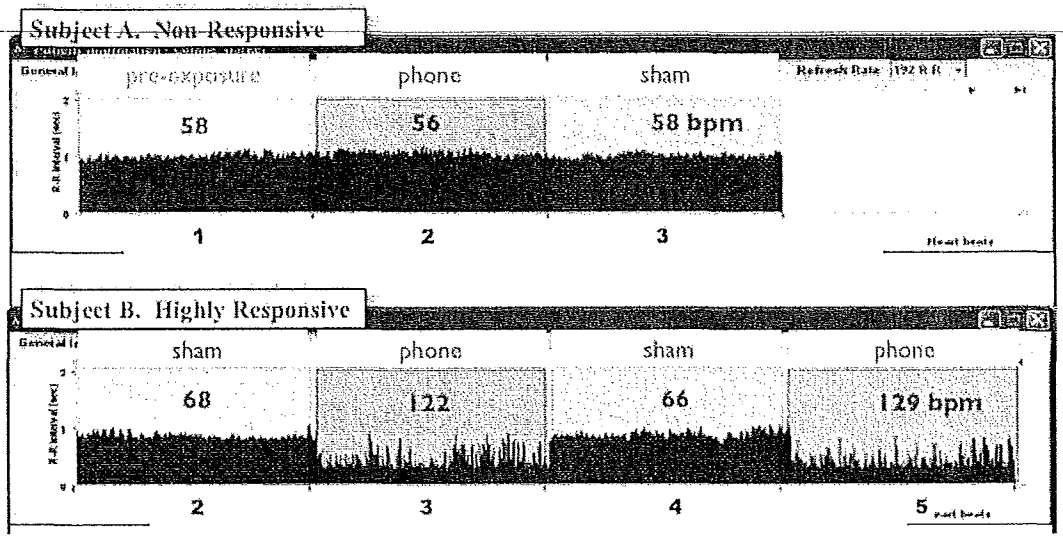

Figure 7. Rhythmograph of heart rate variability during provocation with digital 2.4 GHz cordless phone and sham exposure.

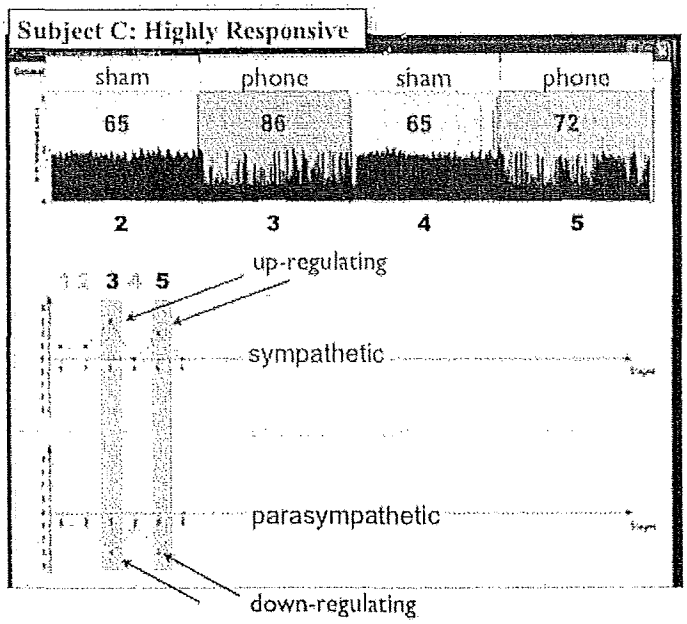

Figure 8. Rhythmograph of heart rate variability and functioning of the sympathetic and parasympathetic nervous system during provocation with digital 2.4 GHz cordless phone and sham exposure.

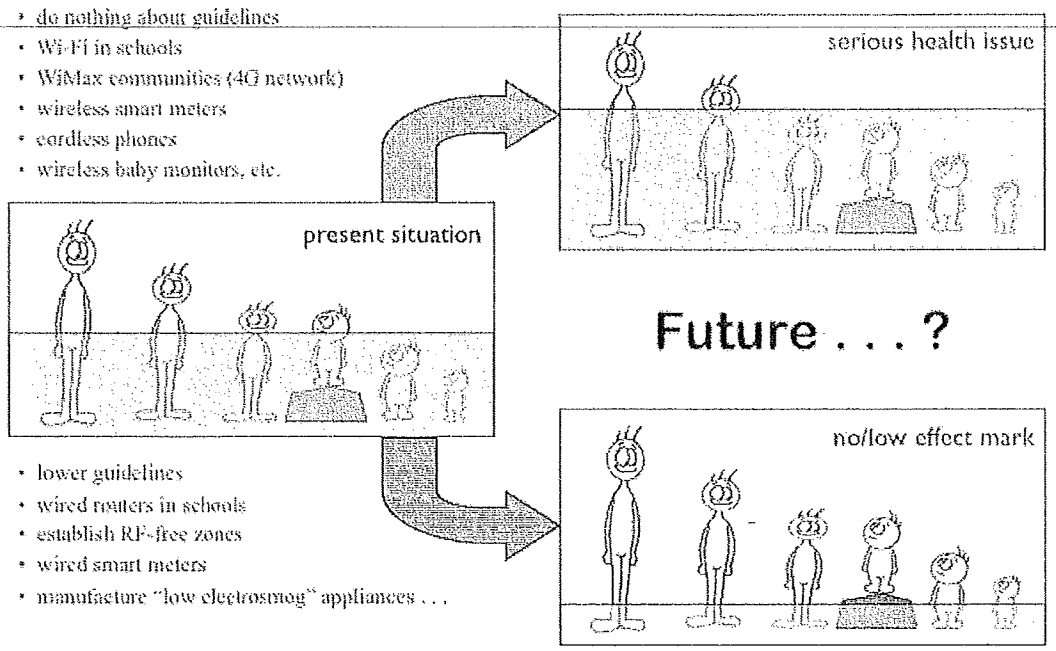

Figure 9. Two future health scenarios based on the steps we take or fail to take to reduce electrosmog exposure.

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CASE REPORT

Exacerbation of demyelinating syndrome after exposure to wireless modem with public hotspot

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ABSTRACT

In August 2003, 48-year-old JS of Colorado, USA, a fitness therapist and sports nutritionist, contracted neuroinvasive West Nile virus which left her with disabilities due to spinal axonal damage.

In August 2014, she suddenly developed symptoms very much like her acute West Nile infection 11 years ago, including focal seizures, ataxia, vertigo and headaches. Her blood count looked normal so there was no obvious infection. What struck her as odd was that when she left her apartment for any length of time, the symptoms stopped. She found out that a new type of wireless modem, enabled for both personal use and functioning as a public hotspot designed to reach up to 100 m, had been installed in the flat under hers.

Her neighbor replaced the modem with a router without the hotspot feature. After that, the seizures stopped immediately, and the other symptoms faded gradually, after which she was fine and again could sleep well. Later, when another activated hotspot was installed in an adjacent flat, JS once again noticed symptoms.

A possible association between electrohypersensitivity, myelin integrity and exposure to low-intensity radiofrequency electromagnetic fields (RF-EMF) typical in the modern world has recently been proposed. Since the West Nile virus attacks both the nerve cells and the glial ones, one explanation to the above observed case effects is that the initial virus attack and the wireless modem's RF-EMF affect the nervous system through the very same, or similar, avenues, and maybe both via the oligodendrocytes.

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KEYWORDS
Beacon signal; electrohypersensitivity; hotspot; myelin; neurodegenerative disease; radiofrequency exposure; strobe effect; WiFi

Background

In August 2003, 48-year-old JS of Colorado, USA, a fitness therapist and sports nutritionist contracted neuroinvasive West Nile virus which left her with disabilities due to axonal damage in the cervical and thoracic spine. Laboratory tests at the time confirmed anti-myelin antibodies and anti-ganglioside antibodies. The subsequent damage led to focal seizures, headaches, ataxia, paresthesia and vision problems which gradually improved over the subsequent 2 years. She worked hard to overcome many of the effects of her illness, but still had to be very careful about attracting any form of inflammation and is still officially disabled. She could no longer live in her home because she had to have wheelchair access. It took a couple of moves to find an ideal living situation, but she was eventually able to secure a third-floor unit in a handicapped accessible senior complex (55+) where she lived happily since then.

The only regular medications she takes are replacement thyroxine, steady since 1982. She never takes non-steroidal anti-inflammatory drugs (NSAIDs) or aspirin.

In August 2014, she suddenly developed symptoms very much like her acute West Nile infection 11 years ago, including focal seizures, ataxia, vertigo and headaches. Her blood count looked normal so there was no obvious infection, but she was losing sensation in her face, neck and torso. What struck her as odd was that when she left her apartment for any length of time, the symptoms stopped. It took some investigating, but she found out that a new type of wireless modem had been installed in the unit under hers. She herself used a cell phone, a wireless router and a computer and had no problems with those products. However, she found out that this new wireless modem was enabled for both personal use and functioned as a public hotspot designed to reach up to 100 m, but was just feet below her floor.

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Because of the severity of the reaction, she asked her neighbor if he would be willing to turn off his modem at night so that she could sleep without seizures preventing this. He was very concerned and turned off the modem completely and replaced it with a router that was compatible with the service in question but that did not have the hotspot feature. After that, the seizures stopped immediately, and the other symptoms faded gradually, after which she was fine.

Nine weeks later, on 7 November, the symptoms started again. It took some weeks to locate the source. Finally, she found out that another of these modems had been installed, this time across the hall from her unit. On 10 December, the owner disabled the hotspot component. JS found she was able to sleep in her bedroom for the first time in weeks with none of the symptoms.

From before the episodes occurred, JS has kept her mobile phone WiFi disabled while at home. The day after she began having symptoms in August, she had temporarily enabled the WiFi feature while out shopping and when she came home that day, a pop-up appeared informing her she was in a free Xfinity WiFi zone. She checked the connections and saw the new router name and signal strength on the list. Since a new tenant had just moved in below her, she asked him if he had had a new modem installed, which he confirmed. Because her own wireless modem had not been a problem, she did a search online and found out about the new marketing plan that Comcast was implementing using customers' personal modems to provide 1 h of free hotspot use along with advertisements encouraging users to sign up for their own account.

There are still strong signals in her unit from four modems, but none of them are hotspots, and do not cause her problems. There are also signals of the sort with hotspots from the far end of the building that have not caused JS any problems at the time of writing. Their pop-ups do not appear on her phone unless she walks along the corridor toward them.

There have been suggestions that the functional impairment electrohypersensitivity is psychosomatic (Landgrebe et al., 2008). This may be the case in some instances; however JS has never been diagnosed with or treated for depression, anxiety or related disorders, and the symptoms appeared well before she identified a source that, repeatedly, appeared correlated.

Clinical

On 8 September 2014, JS revealed changes in her memory B cells (IgD+/CD27+ low; IgD-/CD27+ low; IgD +/CD27– high), and in 19 November 2014, she was tested high for IL-4 (in a TH1/TH2 Panel Test). IL-4 is an inflammatory cytokine consistent with upregulated mast cell response. From such single tests it is, of course, very difficult to draw any conclusions; the blood test may merely be showing random alterations due to having had the West Nile virus poliomyelitis. But, it could also be due to the influence of electromagnetic field exposures (cf. Johansson (Johansson, 2009), including them affecting the mast cells.

Reported fluctuations in response

JS noticed differences in symptoms according to the time of day/night and the distance from the router with the public hotspot, and whether or not the hotspot component was activated or disabled. Distance from, and activation of, the router was generally only ascertained after experiencing symptoms. This was done using a mobile phone application that graphs wireless connections when JS experienced symptoms.

When there was an activated hotspot in an adjacent unit, JS noticed symptoms. This occurred prior to knowing one was there and recurred when a new one was installed nearby without her knowledge.

On getting out of bed in the morning, she often experienced temporary vertigo, tinnitus and allergy symptoms like those of severe hayfever. Other common symptoms were headache, difficulty concentrating, poor fine motor control, impaired short-term memory and pain in the facial bones, especially the malar bone (cheeks) and mandible (jaw) including the roots of the teeth. There were no sinus infections or colds during the weeks the hotspots were active.

If she left the house for a while, mental symptoms diminished. Other daytime symptoms included numbness, tingling and difficulty breathing and swallowing and were also more pronounced after exertion. Other physical symptoms of ringing in ears and dizziness also diminished when leaving the house temporarily, but the November/December exposure was considerably longer and the numbness and other typical demyelination symptoms persisted for a while when out of the house.

In the evening, her appetite was much increased and she craved sweet food, which was not usual for her. She became sleepy at the usual time, settling down between 10.30 pm and 11 pm and could fall asleep, all as normal.

However, within 1–2 h, she routinely woke suddenly having had very vivid, disturbing dreams and with a pounding heartbeat. This was usually followed by a seizure, sometimes focal, where one part of her body (primarily right arm) would be shaking. Other times, her whole body was shaking. After a seizure, she slept

fitfully, unless she moved to sleep on the couch in another room. There, JS found she could fall asleep quite quickly and sleep through the rest of the night.

This type of seizure was documented as occurring twice during auditory evoked potential tests about 10 years ago. JS was told that she was having a seizure, but that it was related to the gray matter, not white matter part of the brain and therefore was not well defined on the electroencephalogram. Those seizures ceased within 2 years after contracting West Nile virus. This may indicate that the seizures were not epileptic, but due to myelin loss (Yarnykh et al., 2015).

After the recurrence of symptoms recently, JS discovered which neighbor had a WiFi system with public hotspot. The unit was diagonally across the hall which made the area with the modem just 20–30 feet from her bedroom, but about 50–60 feet from her living room (plus an additional wall), both of which would weaken the signal somewhat.

There was some sign of adaptation for some symptoms. The first time symptoms appeared in August 2014 the hotspot was only on for about 3 days. JS had very acute symptoms, and as soon as it was disabled they went away. The most recent exposure was over 4 weeks. During that time, she had the same acute symptoms and elevated morning fasting blood sugar levels (up 25% from usual to 100 mg/dL), but the neurological symptoms did seem to reduce with time. During the 4-week exposure, there was a fight or flight reaction for the first 2–3 weeks, which then turned into fatigue and apathy with little accomplished during the day. The day after the hotspot was disabled JS could focus on an activity for 4 h and felt much calmer. Her morning fasting blood sugar was back to normal 2 weeks later.

JS notices no effects from the private WiFi component once the hotspot component is disabled.

Relevant wireless protocols and operating frequencies

The symptoms outlined above have reportedly been experienced in relation to the public hotspot component of Comcast's Xfinity Gateway WiFi service, which is supported by Technicolor.

Depending upon the model, it can operate on either IEEE 802.11a/b/g protocols (Comcast, 2012) simultaneously, or IEEE 802.11b/g/n protocols. These protocols specify characteristics of the beacon signal which is transmitted typically over 1 ms of each 100 ms leading to a 10.24 Hz pulse with 1% of the time taken by the beacon; other pulse durations are sometimes used. The beacon signal continues as long as the router is turned on. When in use, the resulting duty signal increases the percentage of time the router is transmitting. All transmissions are at full power. The beacon signal contains all necessary information about the network to enable those within range to use the service. 802.11b and g are 2.4 GHz protocols, while 802.11a operates in a 5 GHz bandwidth. The most recent protocol, 802.11n, operates at either 2.4 GHz or in the 5 GHz bandwidth and has a greater range than the other three. Meter testing indicated the public hotspots near JS's apartment were functioning on 2.4 GHz. Reportedly, the Gateway contains two antennas, one of which is secured for the use of the paying customer and the other is available as a public hotspot (Hayes, 2014). The hotspot antenna almost certainly has a considerably higher transmit power as this would be needed to increase the effective transmit range for users in the area. WiFi signal range depends on several protocol factors including transmit power and transfer rate. Intensity falls away quickly with distance. Walls and vegetation reflect and absorb some of the signal, but do not block it. The 802.11b and 802.11g protocols fitted with standard antennae have a range of approximately 250 feet (76 m) (National Instruments, 2013), while that of 803.11n can be double of that (Belanger, 2007).

Measurements of the electric field and the power density were taken in the hallway, but are not presented as we were unable to determine the distance to the routers. JS declined a request to ask the residents as they are elderly and she did not want to worry them.

Signal strength (dBm) does not correlate well with her experienced symptoms. For instance, an Xfinity hotspot signal strength as low as −58 dBm,[1] equal to 0.002 μW, triggers the reported responses in JS, while other signal sources such as a mobile phone by the head and other WiFi signals prompt no symptoms, even with much higher exposures.

Discussion

A recent paper (Redmayne and Johansson, 2014) has pointed to a possible association between electrohypersensitivity, myelin integrity and exposure to low-intensity RF-EMF typical in the modern world. Overall, evidence from in vivo and in vitro and epidemiological studies suggests an association between RF-EMF exposure and either myelin deterioration which weakens neuronal transmission resulting in loss of muscle function, or a direct impact on neuronal conduction, which may result in the neuron hyperactivity, paresthesias and severe pain which are sometimes characteristic of electrohypersensitivity.

Since the West Nile virus attacks both the nerve cells and the glial ones, one explanation to the above observed case effects is that the initial virus attack and the wireless modem's RF-EMF affect the nervous

system through the very same, or similar, avenues, and maybe both via the oligodendrocytes.

The trigger of effect in this case is hard to identify as full details of the transmit protocol are not available and the provider has not responded to queries on hotspot specifications.

JS does not have EHS responses to signals other than this hotspot one, even though this RF-EMF exposure intensity from several meters away will be considerably lower than that from using her own mobile phone or computer. Although it appears the strength of the exposure is one determining factor, characteristics of the signal that differ from those from her own regularly used equipment are likely to be involved. This could be the beacon interval, if this is different than those generally encountered (e.g. if the hotspot had an interval of 200 ms it would result in a 5 Hz pulse). However, an audio recording of the beacon signal indicates this does not appear to be the case.

A second factor that may be a trigger is the pulse width of the beacon signal (on time). If this is longer than the standard 1 ms, the body may "notice" and respond to the extended duration of each 10.24 Hz pulse more readily. As an illustration, it is easier to see a line of dashes that take up 3% of the line than a row of dots that take up 1% of the line. Another possible explanation is an additional pattern or stroboscopic effect, or double intensity set up by the simultaneous transmission of the private and public hotspots.

A high transmit power from the hotspot would have little effect on the average power of the beacon signal since it only occupies a small proportion of the transmission. But the beacon along with another component, such as a 10.24 Hz frequency, could conceivably stimulate or trigger certain biophysiological responses, such as seizures in some people.

This explanation fits the scenario as transmit power decreases rapidly with distance and JS finds the symptoms only appear within a certain radius of the hotspot. If the pulse of the beacon signal component is the trigger, we put forward a hypothesis that the responses may be similar to those experienced by some people in response to strobe lighting, to which responses are highly individual and occur in 1 in approximately 4000 people (Harding, 1994).

In this case, a distance of at least 30 m from an enabled Xfinity hotspot is the only reliable identified variable needed for no symptoms to appear.

This case raises some concern for those in the population with currently well-managed demyelinating diseases such as multiple sclerosis. Technologies based on various artificial electromagnetic fields, such as microwaves, are increasing incrementally and public health infrastructure that could ameliorate harm remains inadequate. It will be a fundamental task to investigate the scientific background to our case observations, but they strongly indicate that emissions from these new wireless modems could cause physical harm for those susceptible to that type of radiation.

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Declaration of interest

The study had no other involvement from these or other companies.

The authors have had no writing/editorial assistance in preparing the paper, although confirmation was sought from JS and her doctor regarding the accuracy of the details of the reporting and minor amendments made accordingly. Mary Redmayne is a member of the Stds. Australia technical committee TE-007.

Note

1. Cornet ED 78S meter, margin of error +/–3.5 dBm.

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Guideline of the Austrian Medical Association (ÖÄK) for the diagnosis and treatment of EMF-related health problems and illnesses (EMF syndrome)

Consensus paper of the Austrian Medical Association's EMF Working Group (ÖÄK AG-EMF)

Adopted at the meeting of environmental medicine officers of the Regional Medical Association´s and the Austrian Medical Association on 3rd March 2012 in Vienna.

Introduction

There has been a sharp rise in unspecific, often stress-associated health problems that increasingly present physicians with the challenge of complex differential diagnosis. A cause that has been accorded little attention so far is increasing electrosmog exposure at home, at work and during leisure activities, occurring in addition to chronic stress in personal and working life. It correlates with an overall situation of chronic stress that can lead to burnout.

How can physicians respond to this development?

The Austrian Medical Association has developed a guideline for differential diagnosis and potential treatment of unspecific stress-related health problems associated with electrosmog. Its core element is a patient questionnaire consisting of a general assessment of stress symptoms and a specific assessment of electrosmog exposure.

The guideline is intended as an aid in diagnosing and treating EMF-related health problems.

Background

Many people are increasingly exposed, to various degrees, to a combination of low and high frequency electric fields (EF), magnetic fields (MF) and electromagnetic fields (EMF) of different signal patterns, intensities and technical applications for varying periods of time, colloquially referred to as electrosmog.

Physicians are often confronted with unspecific complaints without clearly identifiable causes (Huss and Röösli 2006). It has been suspected that environmental conditions such as increasing exposure of the population to radio waves, emanating e.g. from cordless phones, mobile phone base stations, cell phones, GPRS, UMTS, data cards for laptop and notebook computers and wireless LAN (WLAN), but also exposure to electric and magnetic fields emanating from power lines, devices and equipment, may play a causal role (Blake Levitt and Lai 2010). For the medical profession, this raises new challenges in diagnosis and treatment. A central issue for

the causal attribution of symptoms is the assessment of variation in health problems depending on time and location, which is particularly relevant for environmental causes such as EMF exposure.

Austria is currently rolling out the fourth generation of mobile telephony (LTE), as well as smart metering (for electricity, gas and water consumption), resulting in additional EMF exposure of the population.

New radio technologies and applications have been introduced without certainty about their health effects, raising new challenges for medicine. For instance, the issues of so-called non-thermal effects and potential long-term effects of low-dose exposure were hardly investigated at all prior to introduction. Some patients suspect a link between EMF exposure and their health problems. Moreover, physicians are increasingly confronted with health problems with unidentified causes. Pursuing an evidence-based treatment strategy in this context is a challenge for differential diagnosis.

In Austria, there are no democratically legitimized limits to protect the general population from EMF exposure. The recommendations of the WHO, compiled by the International Commission on Non-Ionizing Radiation Protection (ICNIRP 1998), are based on a thermal model. These recommendations were adopted by the EU in its Council Recommendation of 1999 (EU-Ratsempfehlung 1999) and by Austria in its pre-standard ÖVE/ÖNORM E 8850:2006 02 01 (ÖNORM 2006) without taking into account long-term non-thermal effects.

In August 2007, the BioInitiative, an international group of experts, published a comprehensive report calling for preventive measures against EMF exposure based on the scientific evidence available (BioInitiative 2007). Consequently, the European Environment Agency compared electrosmog to other environmental hazards such as asbestos or benzene (EEA 2007).

In April 2009, a resolution of the European Parliament called for a review of the EMF limits in the EU Council Recommendation of 1999, which was based on the guidelines of the ICNIRP, with reference to the BioInitiative Report (EU Parliament 2009).

In May 2011, the Parliamentary Assembly of the Council of Europe adopted the report "The potential dangers of electromagnetic fields and their effect on the environment" (PACE 2011). The report calls for a number of measures to protect humans and the environment, especially from high-frequency electromagnetic fields. One of the recommendations is to "take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours".

Also in May 2011, a group of experts at the International Agency for Research on Cancer, an agency of the WHO, classified radiofrequency electromagnetic fields as possibly carcinogenic (Group 2B) for humans (IARC 2011).

A representative telephone survey (n=2048, age >14 years) carried out in 2004 in Switzerland yielded a frequency of 5% (95% CI 4-6%) for a self-attributed "diagnosis" of electrosensitivity (Schreier et al. 2006).

In another survey carried out in Switzerland, in 2001, 394 respondents attributed specific health problems to EMF exposure. Among others, the following symptoms were reported as occurring frequently: sleep problems (58%), headaches (41%), nervousness (19%), fatigue (18%) and difficulty concentrating (16%). The respondents listed mobile phone base stations (74%), cell phones (36%), cordless phones (29%) and high-voltage lines (27%) as causes. Two thirds of respondents had taken measures to reduce their symptoms, the most frequent measure being to avoid exposure. Remarkably, only 13% had consulted their physicians (Röösli et al. 2004).

While a 2006 study by Regel et al. described no exposure effects, two provocation studies on exposure of "electrosensitive" individuals and control subjects to mobile phone base station signals (GSM, UMTS or both) found a significant decline in well-being after UMTS exposure in the individuals reporting sensitivity (Zwamborn et al. 2003, Eltiti et al. 2007). Analysis of the data available on exposure of people living near mobile phone base stations has yielded clear indications of adverse health effects (Santini et al. 2002, Navarro et al. 2003, Hutter et al. 2006, Abdel-Rassoul et al. 2007, Blettner et al. 2008).

Based on the scientific literature on interactions of EMF with biological systems, several mechanisms of interaction are possible. A plausible mechanism at the intracellular and intercellular level, for instance, is interaction via the formation of free radicals or oxidative and nitrosative stress (Friedmann et al. 2007, Simkó 2007, Pall 2007, Bedard and Krause 2007, Pacher et al. 2007, Desai et al. 2009). It centres on the increased formation of peroxynitrite ($ONOO^-$) from a reaction of nitrogen monoxide (NO) with superoxide ($O2^-$). Due to its relatively long half-life, peroxynitrite damages a large number of essential metabolic processes and cell components.

This approach can serve as a plausible explanation of many of the health problems, symptoms and their progression observed in the context of EMF exposure. There are increasing indications that EMF syndrome (EMFS) should be counted among multi-system disorders (Pall 2007) such as Chronic Fatigue Syndrome (CFS), Multiple Chemical Sensitivity (MCS), fibromyalgia (FM) and Post Traumatic Stress Disorder (PTSD).

In Sweden, EMF syndrome is designated as electrohypersensitivity (EHS), considered a physical impairment and recognized as a disability. With reference to UN Resolution 48/96, Annex, of 20 December 1993 (UN 1993), local governments grant support to individuals with EHS. Employees with EHS have a right to support from their employers so as to enable them to work despite this impairment. Some hospitals in Sweden provide rooms with low EMF exposure.

The Austrian Medical Association considers it its duty and its mission to provide members of the medical profession with a compilation of the current state of the scientific and political debate from a medical perspective and with specific recommendations for action in this first guideline. The guideline can only be improved by suggestions, criticism and amendments. Due to the rapid development of various technologies, the recommendations need to be adapted on an ongoing basis. We therefore invite all medical professionals to send contributions to the next edition of the guideline to the following email address: post@aerztekammer.at

What to keep in mind when dealing with patients and EMF

In the case of unspecific health problems (see patient questionnaire) for which no clearly identifiable cause can be found, EMF exposure should in principle be taken into consideration as a potential cause, especially if the patient suspects that it may be the cause.

How to proceed if EMF-related health problems are suspected

The recommended approach to diagnosis and treatment is intended as an aid and should, of course, be modified as each individual case requires.

1. History of health problems and EMF exposure
2. Examination and findings
3. Measurement of EMF exposure
4. Prevention or reduction of EMF exposure
5. Diagnosis
6. Treatment

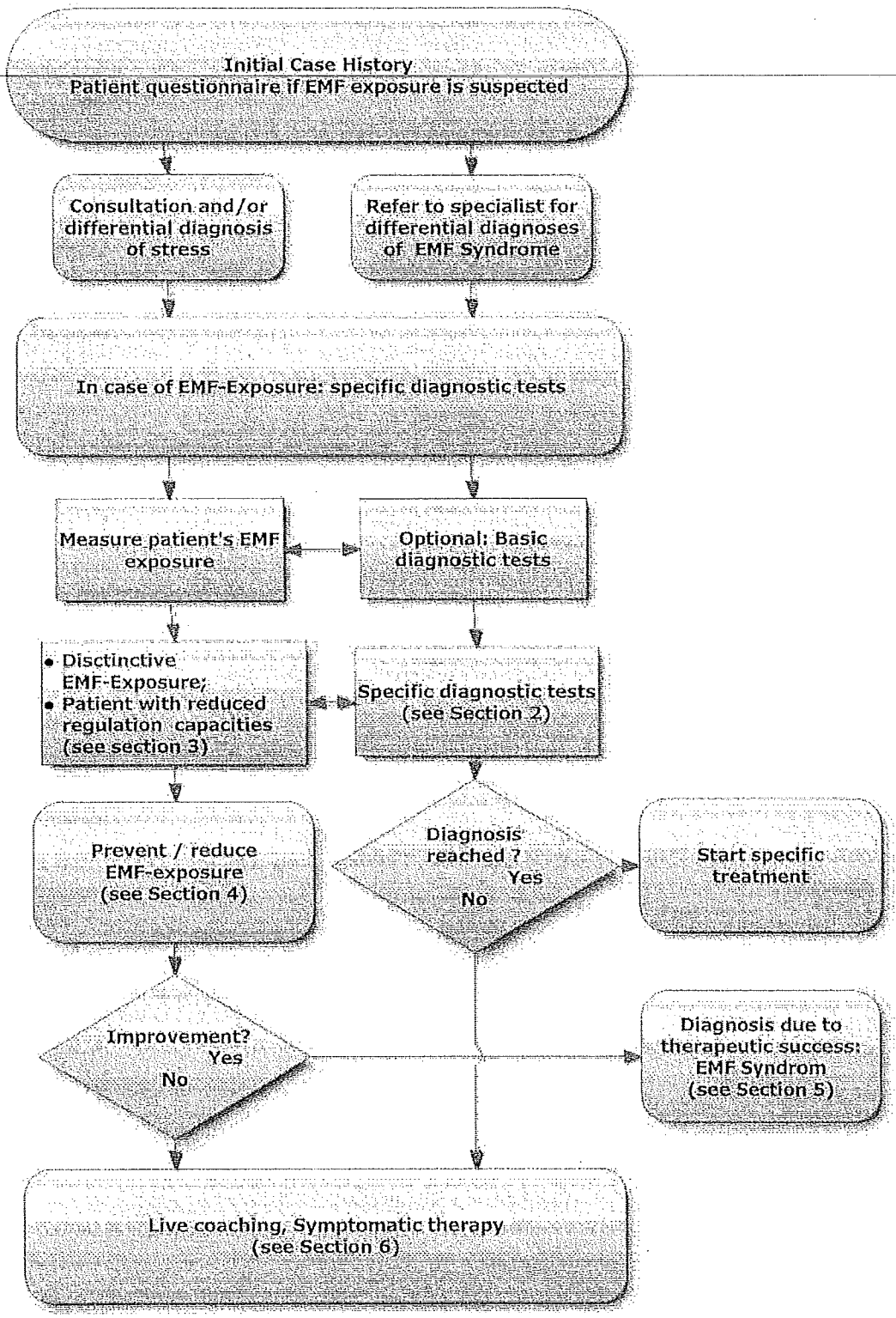

Fig. 1: Flow chart for diagnosing EMF-related health problems

1. History of health problems and EMF exposure

A **patient questionnaire** to facilitate a systematic history of health problems and EMF exposure, compiled by the Austrian Medical Association's EMF Working Group, is available for download at: www.aerztekammer.at/referate Umweltmedizin.

The patient questionnaire consists of three sections:

a) List of symptoms
b) Variation of health problems depending on time and location
c) Assessment of EMF exposure

a) List of symptoms

The list of symptoms in the patient questionnaire serves to systematically quantify stress-related health problems regardless of their causes. It also includes questions on when the health problems first occurred. Most EMF-related symptoms fall within the scope of so-called stress-related health problems, e.g. sleep problems, fatigue, exhaustion, lack of energy, restlessness, heart palpitations, blood pressure problems, muscle and joint pain, headaches, depression, difficulty concentrating, forgetfulness, anxiety, urinary urgency, anomia, dizziness, tinnitus and sensations of pressure in the head and the ears.

The health problems may range in severity from benign, temporary symptoms, such as slight headaches or paraesthesia in the head when using a cell phone, to severe, debilitating symptoms that drastically impair physical and mental health.

b) Variation of health problems depending on time and location

The answers to questions on when and where the health problems occur or recede, and when and where the symptoms increase or are particularly evident, provide indications as to whether the health problems may be related to specific times and locations. They must be interpreted in the context of the patient's living conditions and circumstances.

c) Assessment of EMF exposure

Regardless of whether or not the patient suspects EMF exposure as a cause, these questions should be used to assess the kind of exposure that exists. It is important to note that only certain types of EMF exposure can be assessed by means of the questionnaire, such as use of cell phones and cordless phones. Detection of other types of EMF exposure, e.g. due to high frequency transmitter sites or the electric or magnetic fields of power lines, generally requires measurements (see section 3: Measurement of EMF exposure). In principle, questions should be asked to assess EMF exposure at home and at work, keeping in mind that the degree of EMF exposure may vary at different times.

2. Examination and findings

There are no findings specific to EMF, which makes diagnosis and differential diagnosis a considerable challenge. A method that has proven useful is to use stress-

associated findings for diagnosis and follow-up and to evaluate them synoptically. Basic diagnostic tests should be carried out as a first step, followed by measurements of EMF exposure as a second step. Only then can specific diagnostic tests be considered.

Cardiovascular system

Basic diagnostic tests

- Blood pressure and heart rate (in all cases resting heart rate in the morning while still in bed), including self-monitoring, possibly several times a day, e.g. at different places and with journaling of subjective well-being for a week.

Specific diagnostic tests

- 24-hour blood pressure monitoring (absence of night-time decline)
- 24-hour ECG (heart rhythm diagnosis)
- 24-hour heart rate variability HRV (autonomous nervous system diagnosis)

Laboratory tests

Basic diagnostic tests

- Early morning urine
  - Adrenaline
  - Noradrenaline
  - Noradrenaline/adrenaline quotient
  - Dopamine
  - Serotonin
- Early morning urine
  - 6-OH melatonin sulphate
- Saliva
  - Cortisol (8 am, 12 am and 8 pm)
- Blood
  - Blood count and differential blood count
  - Fasting blood glucose and postprandial blood glucose
  - HBA1c
  - TSH

Additional diagnostic tests – specific individual parameters depending on symptoms

- Late morning urine
  - Histamine, glycine
  - Gamma-aminobutyric acid GABA
  - Glutamate
- Saliva
  - Alpha amylase A (10 am)
  - Dehydroepiandrosterone DHEA (8 am and 8 pm)
- Blood
  - Homocysteine
  - Intracellular ATP

- Intracellular glutathione (redox balance)
- Malondialdehyde (lipid peroxidation)
- 8-hydroxydeoxyguanosine (DNA oxidation)
- Interferon-gamma (IFNg)
- Interleukin-1 (IL-1)
- Interleukin-6 (IL-6)
- Interleukin-10 (IL-10)
- Tumour necrosis factor alpha (TNFa)
- NF-kappaB
- Vitamin B2 (FAD and riboflavin) (whole blood)
- Vitamin B6 (whole blood)
- Vitamin D
- Ubichinon (Q 10)
- Selenium (whole blood)
- Zinc (whole blood)
- Magnesium (whole blood)
- Differential lipid profile

3. Measurement of EMF exposure[1]

In general, a wide variety of forms of EMF exposure (e.g. from cordless phones, wireless internet access, electrical installations and electrical devices in the building, mobile phone base stations, radio and TV transmitters, high-voltage lines or transformer stations) may be the root causes of health problems.

EMF measurements should be planned and carried out by specially trained and experienced measurement engineers.
See e.g. http://www.salzburg.gv.at/adressen_elektrosmog.htm.

After the measurements have been commissioned by the patient and carried out, the results should be discussed with the attending physician or a physician familiar with the issue.

The measurements should be carried out in accordance with relevant standards, e.g. the guidelines of the Professional Association of German Building Biologists (VDB-Richtlinien). In addition to the readings, the measurement report should include suggestions for a potential reduction of exposure.

Basic measurements

Low-frequency alternating magnetic fields

Isotropic magnetic field sensor (for all spatial axes) in the frequency range from 5 Hz to 2 kHz, e.g. near the bed, near the desk with source identification (short-term orientation measurement); in addition, long-term measurements e.g. during the night can be useful.

Low-frequency alternating electric fields

[1] EMF measurements are not covered by statutory health insurance.

Isolated isotropic electric field sensor (for all spatial axes) in the frequency range from 5 Hz to 2 kHz, e.g. near the bed, near the desk with source identification.

High-frequency electromagnetic radiation

Broadband measurements and/or band-selective measurements of common frequencies in the high frequency range, e.g. GSM base stations (900 and 1800 MHz), DECT base stations (1900 MHz), UMTS (2100 MHz), WLAN (2450 and 5000 MHz), possibly WiMAX (3400-3600 MHz), LTE (2500-2700 MHz), within a defined measurement space such as the head and torso area on the bed, or the desk chair, with source identification (e.g. acoustic diagnosis); identification of maximum reading; peak detector.

Additional measurements

High-frequency electromagnetic radiation

Frequency-selective measurements (individual frequencies) of common frequencies in the high frequency range, within a defined measurement space such as the head and torso area on the bed, or the desk chair, with source identification; identification of maximum reading; peak detector. The measurements should be adapted to each individual case, e.g. to account for short-wave transmitters, radar, "dirty power" and other high frequency sources.

Benchmarks

The following aspects should be taken into account when evaluating the readings in each case: duration of exposure, exposure during the night or the day, multiple exposure to different EMF sources, additional exposure to noise, chemicals etc., patient's individual regulation capacity status. Based on epidemiological studies (BioInitiative 2007, Kundi and Hutter 2009) and measurements relevant in practice (Standard of Building Biology Testing Methods, SBM 2008), the Austrian Medical Association 's EMF Working Group has recommended preliminary benchmarks.

Irrespective of the ICNIRP recommendations for acute effects, the following benchmarks apply to regular exposure of more than four hours per day.

High-frequency electromagnetic radiation (as power flow density)

- ≥1000 µW/m² (≥1 mW/m²) — very far above normal
- 10-1000 µW/m² (0.01-1 mW/m²) — far above normal
- 1-10 µW/m² (0.001-0.01 mW/m²) — slightly above normal
- ≤1 µW/m² (≤0.001 mW/m²) — within normal limits

The benchmarks listed are intended to be applied to individual types of radiation, e.g. GSM, UMTS, WiMAX, TETRA, radio, TV, DECT or WLAN, and refer to peak levels. The benchmarks do not apply to radar, which must be evaluated separately. Highly critical types of radiation, such as periodic signals (mobile telephony, DECT, WLAN, digital broadcasting...), should be critically evaluated, especially if levels are far above normal, while less critical types, such as non-pulsed or non-periodic signals (USW, shortwave, medium and long wave, analogue broadcasting), may be considered more leniently.

Low-frequency alternating magnetic fields

- ≥400 nT (≥0.4 µT) — very far above normal
- 100-400 nT (0.1-0.4 µT) — far above normal

- 20-100 nT (0.02-0.1 μT) slightly above normal
- ≤20 nT (≤0.02 μT) within normal limits

The benchmarks are intended to be applied to the range up to and around 50 Hz; higher frequencies and distinct harmonics should be more critically evaluated. Mains current (50 Hz) and traction current (16.7 Hz) should be assessed separately. Long-term measurements should be carried out – also and especially during the night – if intense and frequent field variations occur over time; in such cases, evaluation should be based on the arithmetic mean over the period of exposure.

Low-frequency alternating electric fields

- ≥10 V/m very far above normal
- 1.5-10 V/m far above normal
- 0.3-1.5 V/m slightly above normal
- ≤0.3 V/m within normal limits

The benchmarks (potential-free measurement) are intended to be applied to the range up to and around 50 Hz; higher frequencies and distinct harmonics should be more critically evaluated.

4. Prevention or reduction of EMF exposure

Preventing or reducing EMF exposure after consultation of a measurement engineer is advantageous for several reasons:

a) to prevent and reduce risks to the individual and to public health,
b) to treat the causes of EMF syndrome and
c) to aid in identifying any links to health problems.

There are numerous potential causes for EMF exposure above normal limits, and this guideline can only give a few examples. Further information can be found, for instance, in the building biology checklist "Gebäudecheckliste Baubiologie" (Land Salzburg and VDB 2009) as well as in the information folder on electrosmog (Land Salzburg 2009), which also lists contact data of measurement engineers, sources for measurement devices and materials to reduce exposure. In most cases, it will be necessary to consult an experienced measurement engineer.

Based on documented cases, it is useful to recommend that patients take certain measures (also as preventive measures) to eliminate or reduce EMF exposure, which may lead to an alleviation of health problems within days or weeks. Such measures include the following:

- Disconnecting (unplugging) the power supply of all DECT cordless phones – the use of "classical" cord phones is recommended instead.
- Disconnecting (unplugging) the power supply of all WLAN access points or WLAN routers. (NB: Many LAN routers now come equipped with additional WLAN.)
- Disconnecting the power supply in the bedroom (switching off the fuse) while sleeping. – NB: The benefits should be weighed against the potential risk of accidents and the use of a flashlight should be recommended.
- Disconnecting the power supply to all non-essential electric circuits, possibly in the entire flat or building. NB: See note above.
- Moving the bed or desk to a different place with lower exposure, such as another room or floor; in case of external high frequency sources, rooms facing away from the source should be chosen.
- Discontinuing use of certain appliances and lamps.

- Retrofitting the electrical wiring of the building to reduce residual current and equalising current (installation of a residual current device RCD).

We also recommend following the 10 medical rules for cell phone use published by the Vienna Medical Association :
http://www2.aekwien.at/media/Plakat_Handy.pdf.

5. Diagnosis

A diagnosis of EMF syndrome will largely be based on a comprehensive case history, focusing in particular on correlations between health problems and times and places of EMF exposure, as well as the progression of symptoms over time. In addition, measurements of EMF exposure and the results of additional diagnostic tests (laboratory tests, cardiovascular system) serve to support the diagnosis. Moreover, all other potential causes should be excluded as far as possible.

We recommend that the code Z58.4 (Exposure to radiation) under the International Classification of Diseases (ICD-10) be used for EMF syndrome for the time being.

6. Treatment

The primary method of treatment should consist in the prevention or reduction of EMF exposure, taking care to reduce or eliminate all sources of EMF if possible. Many examples have shown that such measures can prove effective.

Since sufficient EMF reduction is not possible in all cases, other measures can and must be considered. These include not only keeping additional exposure to a minimum, but also enhancing and increasing resistance to EMF. In some cases, positive effects of holistic medicine treatments have been reported.

We take it as given that appropriate treatment will be initiated after diagnosis if the patient presents manifest illness. Regardless of such treatment, the above-mentioned measures to reduce exposure should also be taken.

There is increasing evidence that a main effect of EMF on patients is the reduction of oxidative and nitrosative regulation capacity. This hypothesis also explains observations of changing EMF sensitivity and the large number of symptoms reported in the context of EMF exposure. From the current perspective, it appears useful to recommend a treatment approach such as those gaining ground for multi-system disorders, with the aim of minimizing adverse peroxynitrite effects.

In summary, the following treatment measures appear advantageous, depending on the individual case:

a) **Reduction of exposure** to electric and magnetic fields and high frequency electromagnetic waves.
For more information see e.g. the information folder on electrosmog at www.salzburg.gv.at/infomappe-elektrosmog.pdf.

b) **Lifestyle coaching** (exercise, nutrition, addictive substances, sleeping habits etc.) and stress reduction measures (reduction of general stress and work stress), as well as methods to increase stress resistance (autogenic training, yoga, progressive muscle relaxation, breathing techniques, meditation, tai chi, qui gong).

c) **Holistic treatments** such as anti-oxidative and anti-nitrosative therapies, trace elements, vitamins, amino acids.

d) **Treatment of symptoms** until the causes have been identified and eliminated.

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Download of guidelines and patient questionnaire and contact to the Austrian Medical Association :
www.aerztekammer.at/referate Umweltmedizin

Patient questionnaire

Last name, first name, Mr/Ms .....

Place, date .....

a) List of symptoms

How often have you experienced the following health problems in the past 30 days? Please mark the appropriate box in every line.

Symptoms	Never	Rarely	Sometimes	Often	Very often	If yes, since when (month/year)
Anxiety	☐	☐	☐	☐	☐	/
Tightness in chest	☐	☐	☐	☐	☐	/
Depression	☐	☐	☐	☐	☐	/
Difficulty concentrating	☐	☐	☐	☐	☐	/
Restlessness, tension	☐	☐	☐	☐	☐	/
Hyperactivity	☐	☐	☐	☐	☐	/
Irritability	☐	☐	☐	☐	☐	/
Exhaustion	☐	☐	☐	☐	☐	/
Fatigue	☐	☐	☐	☐	☐	/
Anomia (difficulty finding words)	☐	☐	☐	☐	☐	/
Forgetfulness	☐	☐	☐	☐	☐	/
Headaches	☐	☐	☐	☐	☐	/
Dizziness	☐	☐	☐	☐	☐	/
Sleep problems	☐	☐	☐	☐	☐	/
Noise sensitivity	☐	☐	☐	☐	☐	/
Sensation of pressure in the ears	☐	☐	☐	☐	☐	/
Ear noises, tinnitus	☐	☐	☐	☐	☐	/
Burning sensation in the eyes	☐	☐	☐	☐	☐	/
Nervous bladder, urinary urgency	☐	☐	☐	☐	☐	/
Heart palpitations	☐	☐	☐	☐	☐	/
Blood pressure problems	☐	☐	☐	☐	☐	/
Muscle tension	☐	☐	☐	☐	☐	/
Joint pain	☐	☐	☐	☐	☐	/
Skin conditions	☐	☐	☐	☐	☐	/
Other (please state)	☐	☐	☐	☐	☐	/
Other (please state)	☐	☐	☐	☐	☐	/

b) Variation of health problems depending on time and location

Which health problems do you perceive to be the most severe?	
Since when have you been experiencing these health problems?	
At what times do the health problems occur?	
Is there a place where the health problems increase or are particularly severe? (e.g. at work, at home)	
Is there a place where the health problems recede or disappear altogether? (e.g. at work, at home, other places, at the home of a friend, on holiday, at your weekend home, in the woods)	
Do you have an explanation for these health problems?	
Are you experiencing stress, e.g. due to changes in your personal life or at work?	
Please list any environmental assessments made, measurements or measures taken up to now.	
Please list any environmental medicine diagnoses and treatments given up to now.	
Other	

c) Assessment of EMF exposure at home and at work

1. Do you use a cell phone at home or at work?

How long have you been using it (years/months)? _____
How much do you use it to make calls per day (hours/minutes)? _____
Have you noticed any relation to your health problems?

_____

2. Do you have a cordless phone (DECT base station) at home (H) or at work (W)?

How long have you had it (years/months)? _____
How much do you use it to make calls per day (hours/minutes)? _____
Have you noticed any relation to your health problems?

_____

3. Do you use wireless internet access (WLAN, WiMAX, UMTS) at home (H) or at work (W)?

If yes, how long have you been using it (years/months)? _____
How much do you use it per day (hours/minutes)? _____
Have you noticed any relation to your health problems?

_____

4. Do you use energy-efficient light bulbs in your immediate vicinity (desk lamp, dining table lamp, reading lamp, bedside lamp) at home (H) or at work (W)?

If yes, how long have you been using them (years/months)? _____
For how long are you exposed to them per day (hours/minutes)? _____
Have you noticed any relation to your health problems?

_____

5. Is there a cell tower (mobile phone base station) near your home (H) or your workplace (W)?

If yes, how long has it been there (years/months)? _____
At what distance is it from your home/workplace? _____
Have you noticed any relation to your health problems?

_____

6. Are there any power lines, transformer stations or railway lines near your home (H) or your workplace (W)?

If yes, for how long are you exposed to them per day (hours/minutes)? _____
Have you noticed any relation to your health problems?

_____

6. Do you use Bluetooth devices in your car?

If yes, how long have you been using them? _____
Have you noticed any relation to your health problems?

_____