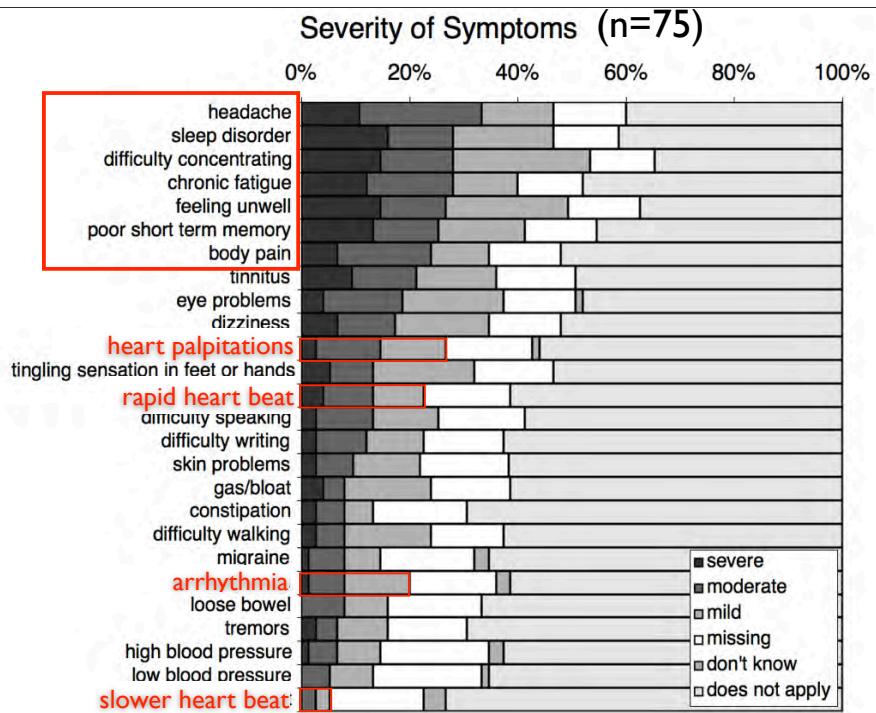


Heart Rate Variability (HRV) as a Diagnostic Tool in Electrohypersensitivity (EHS)

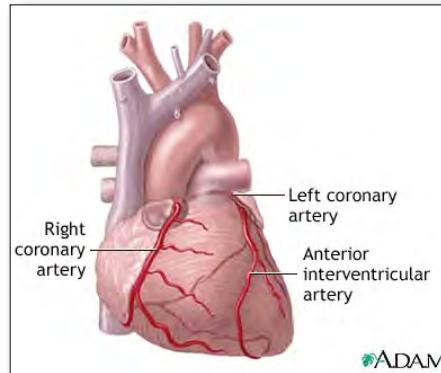


Dr. Magda Havas, BSc, PhD
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drmagdahavas@gmail.com
www.magdahavas.com



Electrohypersensitivity & Heart Problems

Heart



palpitations

arrhythmias

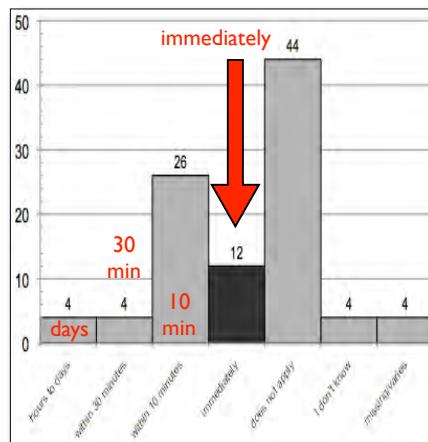
low or high blood pressure

pain or pressure in the chest

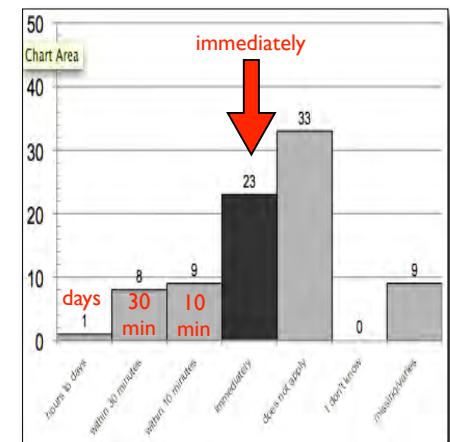
Self-proclaimed electrosensitivity of participants.

How quickly do you RESPOND?

First Study: (n=25)



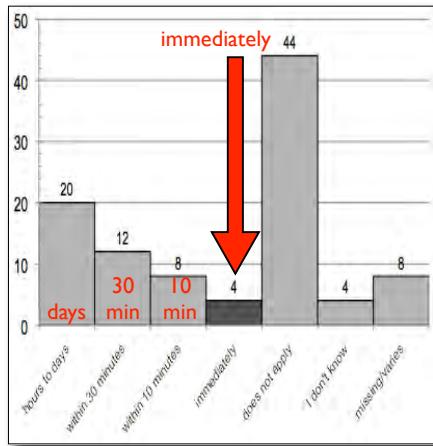
Second Study: (n=75)



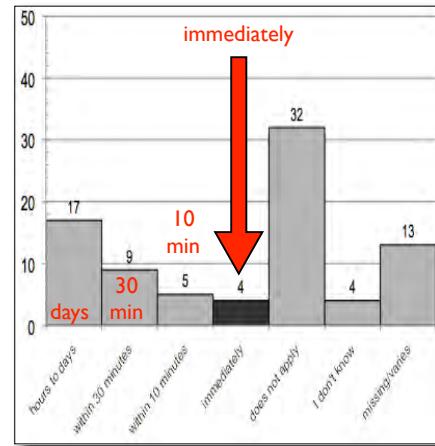
Self-proclaimed electrosensitivity of participants.

How quickly do you RECOVER?

First Study: (n=25)

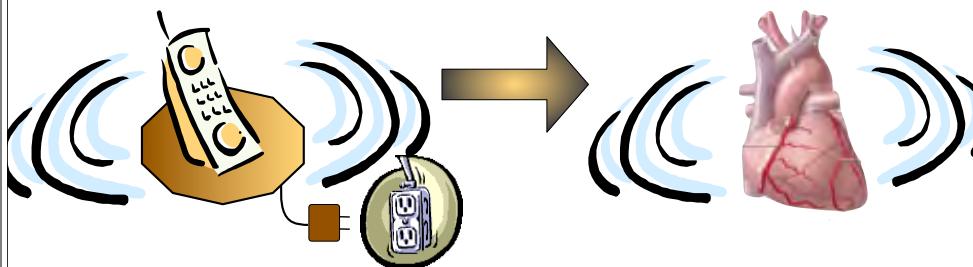


Second Study: (n=75)



"Proof of Concept" Provocation Study

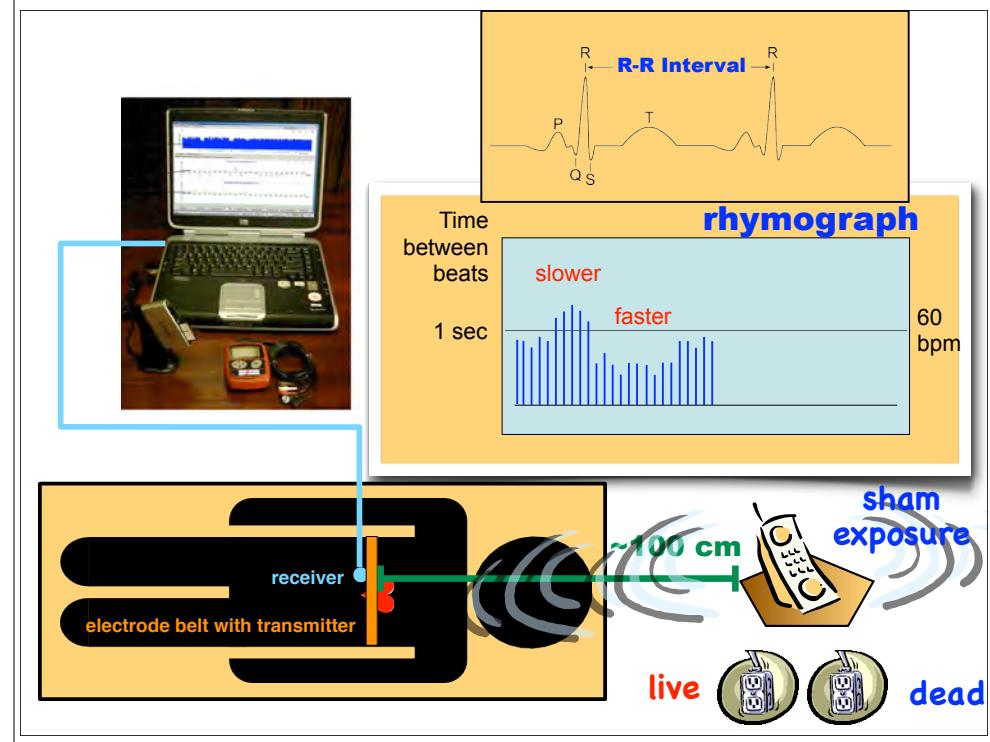
Do cordless phones affect the heart?



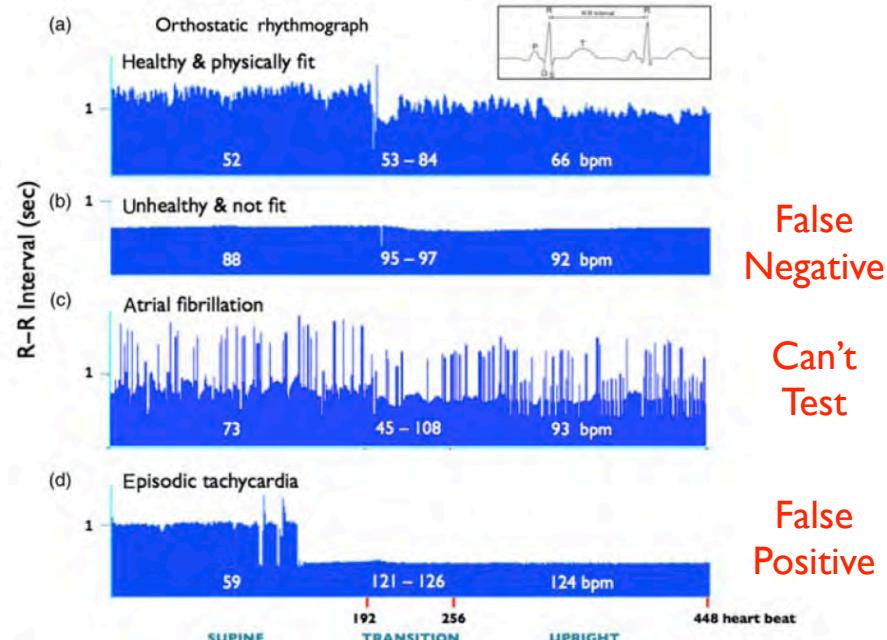
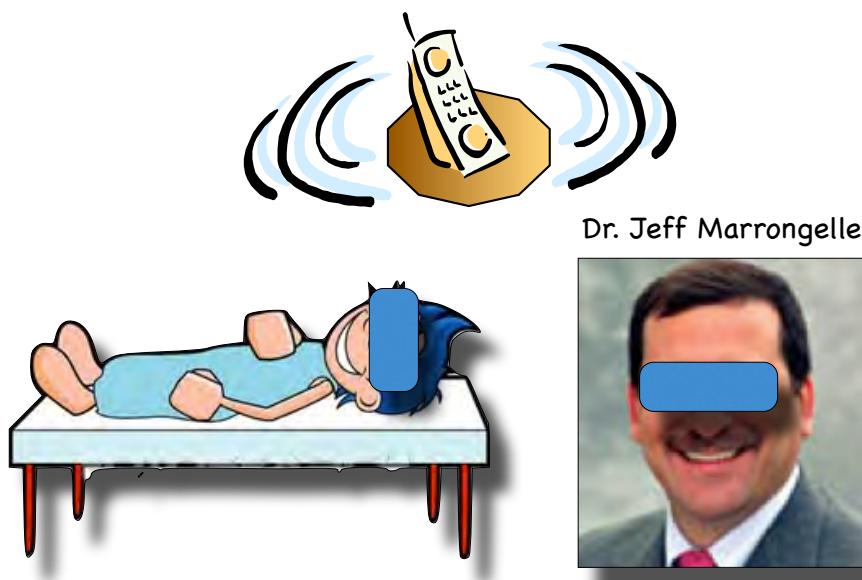
0.3%
frequency (GHz):
intensity (microW/cm²):

ICNIRP/US/Canadian
Guideline
2.4
1000 (540)

Cordless
Phone
2.4
3



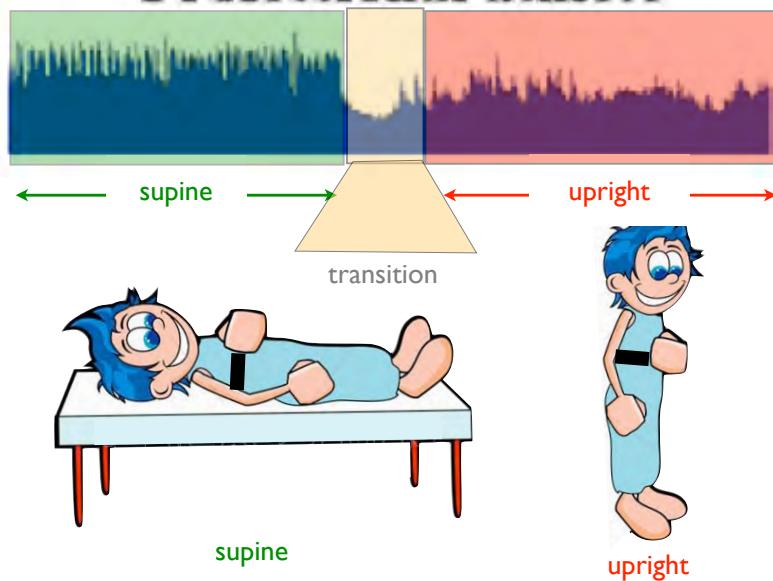
Double Blind Study



False Negative
Can't Test
False Positive

Orthostatic Test

Professional athlete



top athletes

fatigue

Graphical Representation of the Physical Fitness

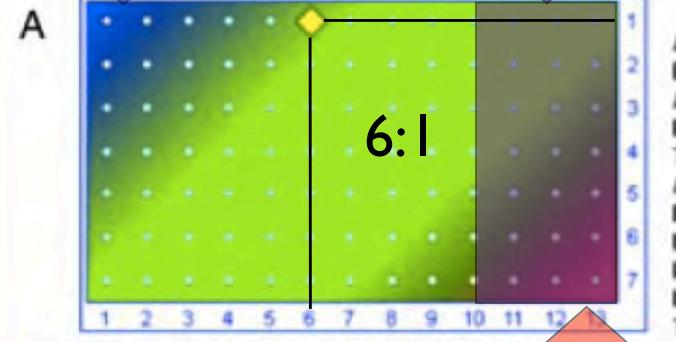


Figure 1. Examples of the Nerve Express orthostatic rhythmograph for different conditions.

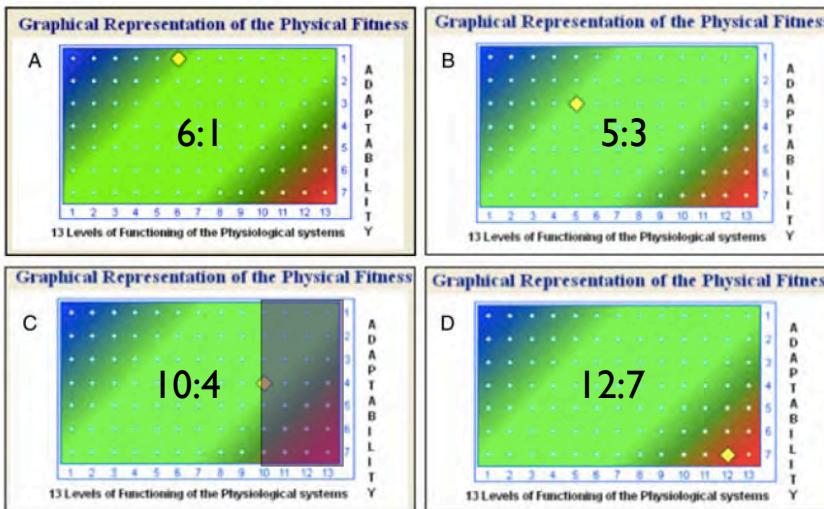
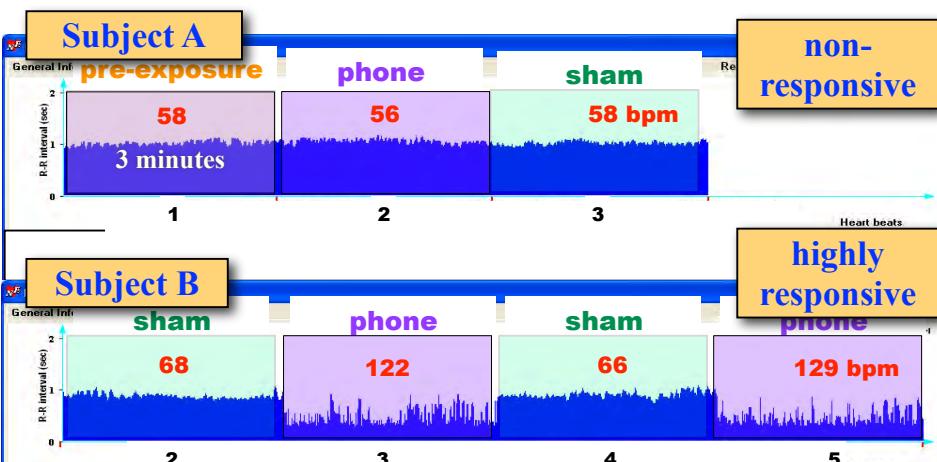


Figure 3. Physical fitness based on the orthostatic test. Fitness decreases as one approaches the lower right corner of the graph. A fitness score at and above 10 (horizontal axis) indicates fatigue. The relative fitness of the four examples decreases from A (6-1) to D (12-7).

Continuous monitoring of heart digital cordless phone provocation

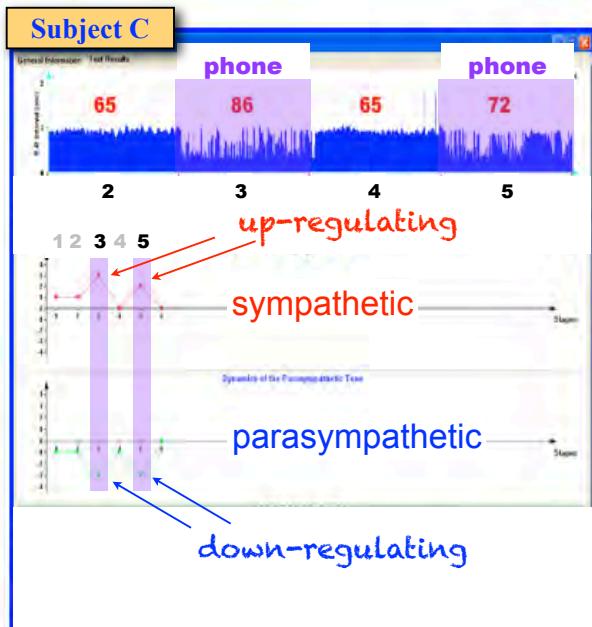


Tachycardia

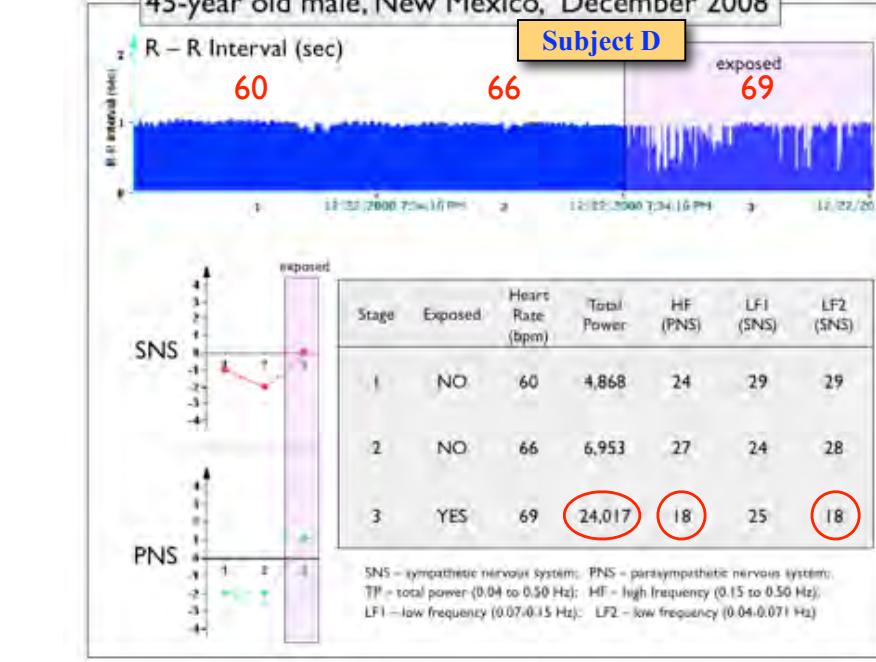
Real Time Monitoring Subject C: Reactive

Gender:	Female
Age:	56 years
Height:	5'6"
Weight:	156 lbs
Blood Type:	O+
Sitting HR:	66
Blood Pressure:	123-76
Blood Sugar:	5.0 mmol/L
Time Since Last Meal:	0.5 hr

"fight or flight"
stress response



45-year old male, New Mexico, December 2008



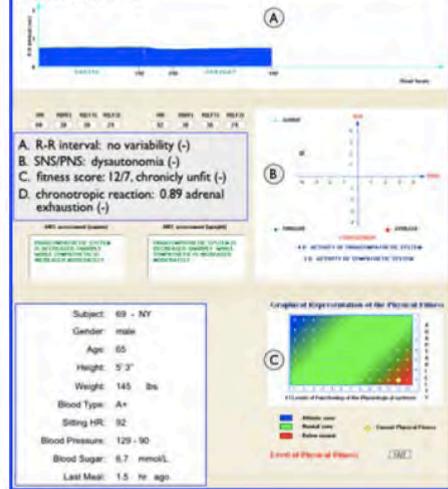
Is this person EHS?

False Negative Response

Can't tell due to adrenal exhaustion.

Non-reactive subject with dysautonomia & adrenal exhaustion: EHS unknown

Orthostatic Test



Provocation – Monitoring

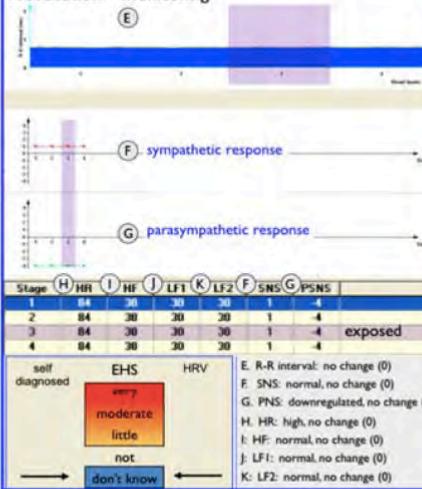
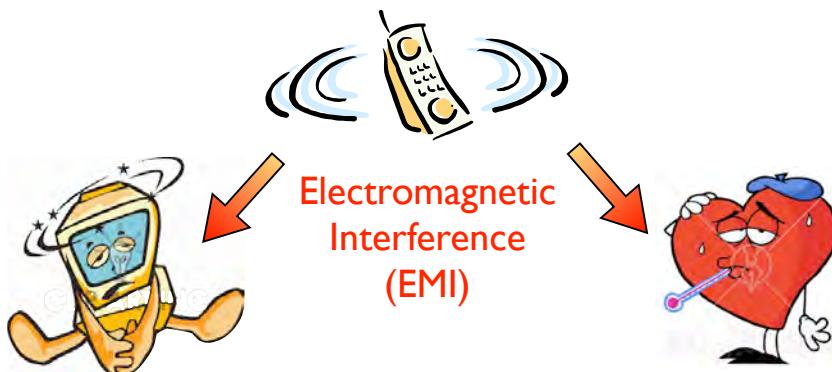


Figure 6. HRV parameters for a subject with dysautonomia and adrenal exhaustion who is not responding to any exposure. This subject's electrical hypersensitivity was classified as unknown due to adrenal exhaustion.

Subject E

Was the **radiation** from the **cordless phone** interfering with the **receiver** and giving a **false reading** or was it interfering with the **heart**?



Question:

Are the results **real** or are they an **artifact** due to **electromagnetic interference (EMI)**?

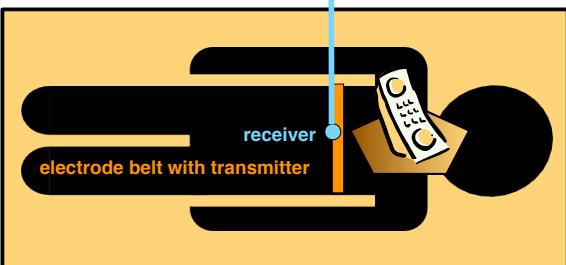
Test for Interference

Exposure Protocol

cordless phone & heart



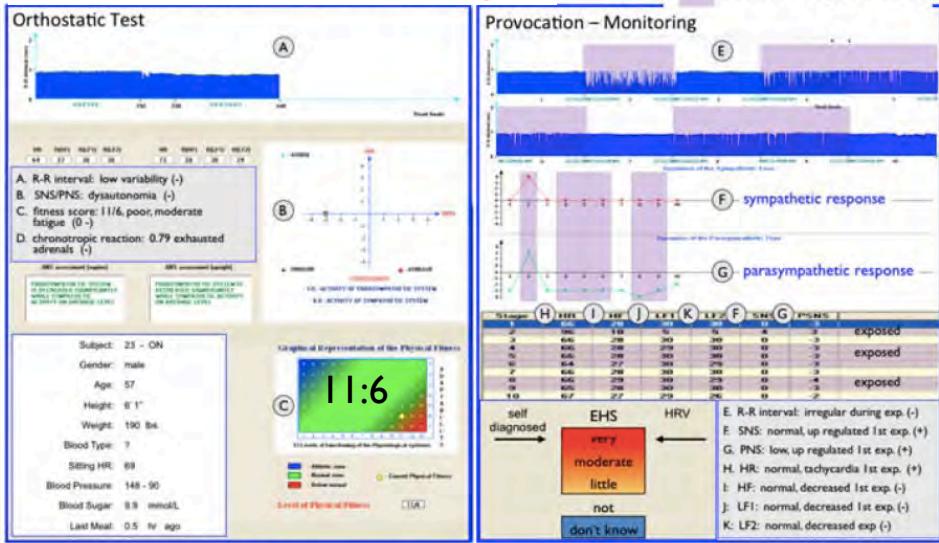
PHONE NEAR	DISTANCE from receiver (cm)	RADIATION at receiver ($\mu\text{W}/\text{cm}^2$)
HEAD	80 - 110	2 - 3
HEART	~ 5	100 - 200



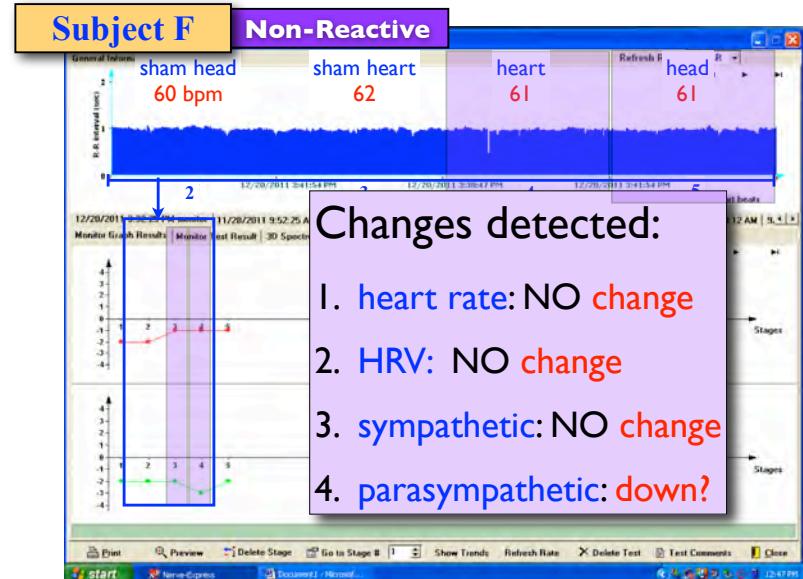
3

Subject G

Subject with moderate fatigue



Female-50s: HRV does not react to 2.4 GHz [December, 2011]

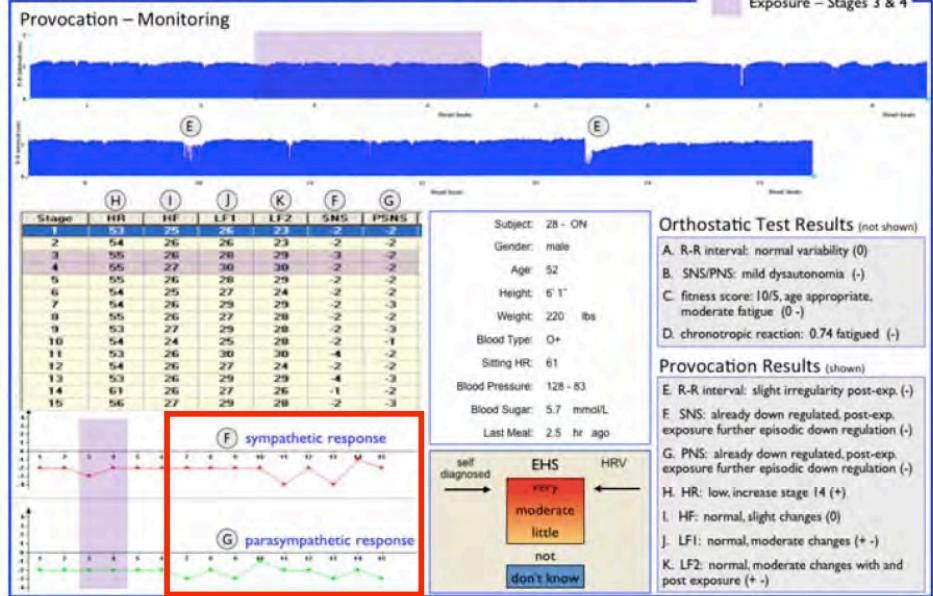


Changes detected:

1. heart rate: NO change
 2. HRV: NO change
 3. sympathetic: NO change
 4. parasympathetic: down?

Delayed Reaction

Delayed reaction, healthy subject with moderate fatigue: very EHS



Subject H

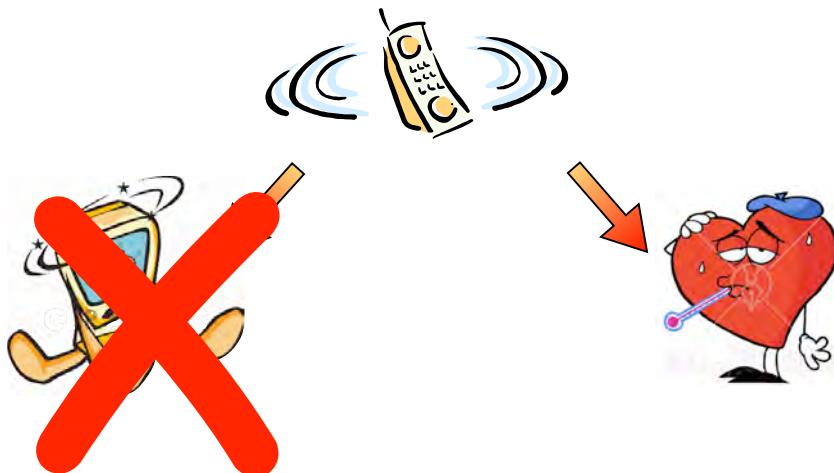
Orthostatic Test Results (not shown)

- A. R-R interval: normal variability (0)
 - B. SNS/PNS: mild dysautonomia (-)
 - C. fitness score: 10/5, age appropriate, moderate fatigue (0 -)
 - D. chronotropic reaction: 0.74 fatigued (-)

Provocation Results (shown)

- E. R-R interval: slight irregularity post-exp. (-)
 - F. SNS: already down regulated, post-exp.
exposure further episodic down regulation (-)
 - G. PNS: already down regulated, post-exp.
exposure further episodic down regulation (-)
 - H. HR: low, increase stage 14 (+)
 - I. HF: normal, slight changes (0)
 - J. LF1: normal, moderate changes (+ -)
 - K. LF2: normal, moderate changes with and
post exposure (+ -)

Interference?



Biological Effects and Health Implications of Microwave Radiation

Symposium Proceedings

Richmond, Virginia, September 17-19, 1969

Edited by
Stephen F. Cleary
Department of Biophysics
Virginia Commonwealth University

1969



sponsored by
MEDICAL COLLEGE OF VIRGINIA
Virginia Commonwealth University

In the interest of occupational hygiene . . . investigators have recommended that **cardio-vascular abnormalities** be used as screening criteria to exclude people from occupations involving **radio-frequency exposures**.

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 exposure.



Student with Heart Monitor

solution-defibrillators!

Mountain View School: Wi-Fi

1. 6-year old girl, "musical heart", headaches, dizziness only at school.
2. 12-year old boy, tachyarrhythmia.
3. 12-year old girl, nausea, vomiting, no fever, insomnia, blurred vision, tachycardia (only at school).
4. 13-year old boy, heart pounding, insomnia, headaches, moved & symptoms abated.

- in Simcoe County, 4 students experienced sudden cardiac arrest in the past school year (2 died)
- incidence of adolescent cardiac arrest is 40 x higher than the expected national average
- youngest child - 13 years old

Source: www.safeschool.ca

ICEMS: The International Commission for Electromagnetic Safety

NON-THERMAL EFFECTS AND MECHANISMS OF INTERACTION BETWEEN ELECTROMAGNETIC FIELDS AND LIVING MATTER

An ICEMS Monograph



RAMAZZINI INSTITUTE

Edited by
Livio Giuliani and Morando Soffritti

2010

Eur. J. Oncol. - Library Vol. 5

National Institute for the Study and Control of Cancer and Environmental Diseases "Benedettino Ramazzini"
Bologna, Italy
2010

Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system

Magda Havas, Jeffrey Marrongelle, Bernard Pollner, Elizabeth Kelley, Camilla R.G. Rees, and Lisa Tully

Abstract

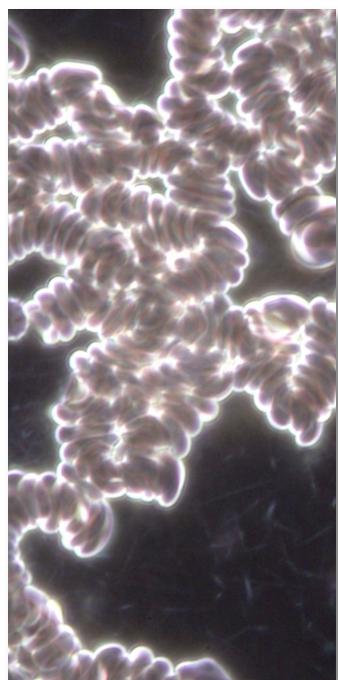
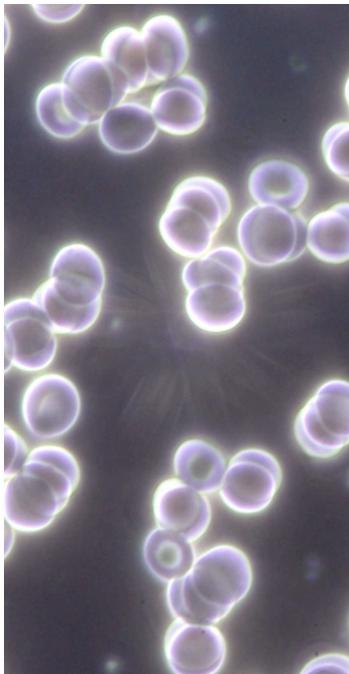
Aim: The effect of pulsed (100 Hz) microwave (MW) radiation on heart rate variability (HRV) was tested in a double blind study.

Materials and Methods: Twenty-five subjects in Colorado between the ages of 37 to 79 completed an electrosensitivity (EHS) questionnaire. After recording their orthostatic HRV, we did continuous real-time monitoring of HRV in a provocation study, where supine subjects were exposed for 3-minute intervals to radiation generated by a cordless phone at 2.4 GHz or to sham exposure.

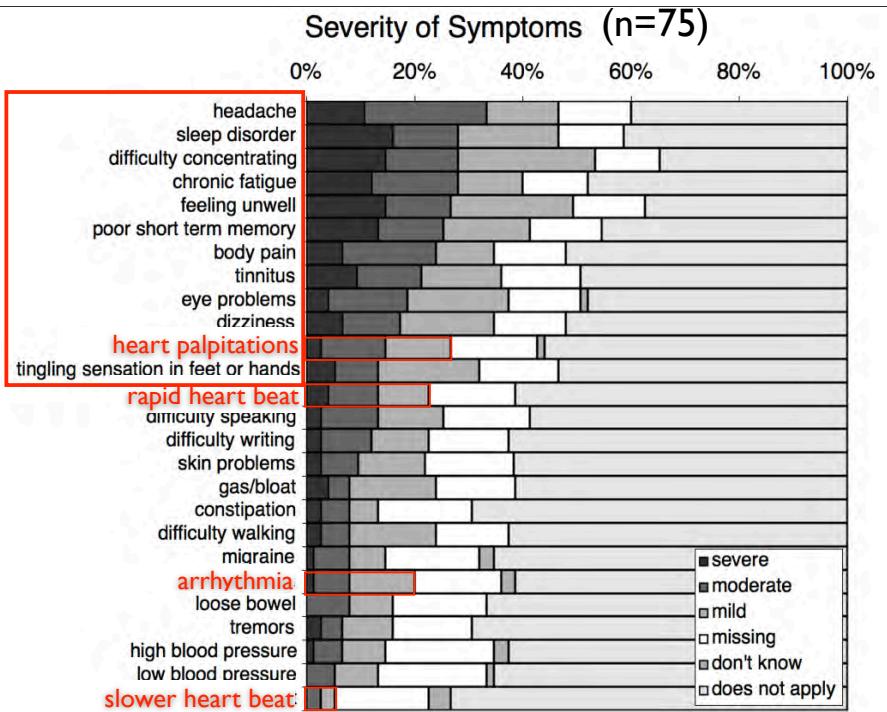
Results: Questionnaire: Based on self-assessments, participants classified themselves as extremely electrically sensitive (24%), moderately (16%), slightly (16%), not sensitive (8%) or with no opinion (36%) about their sensitivity. The top 10 symptoms experienced by those claiming to be sensitive include memory problems, difficulty concentrating, eye problems, sleep disorder, feeling unwell, headache, dizziness, tinnitus, chronic fatigue, and heart palpitations. The five most common objects allegedly causing sensitivity were fluorescent lights, antennas, cell phones, Wi-Fi, and cordless phones.

Provocation Experiment: Forty percent of the subjects experienced some changes in their HRV attributable to digitally pulsed (100 Hz) MW radiation. For some the response was extreme (tachycardia), for others moderate to mild (changes in sympathetic nervous system and/or parasympathetic nervous system), and for some there was no observable reaction either because of high adaptive capacity or because of systemic neurovegetative exhaustion.

Conclusions: Orthostatic HRV combined with provocation testing may provide a diagnostic test for some EHS sufferers when they are exposed to electromagnetic emitting devices. This is the first study that documents immediate and dramatic changes in both Heart Rate (HR) and HR variability (HRV) associated with MW exposure at levels well below (0.5%) federal guidelines in Canada and the United States ($1000 \mu\text{W/cm}^2$).



Wi-Fi & Blood



Wi-Fi & Plant Growth



Thank You!

www.magdahavas.com