

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



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# Electrohypersensitivity & Heart Problems

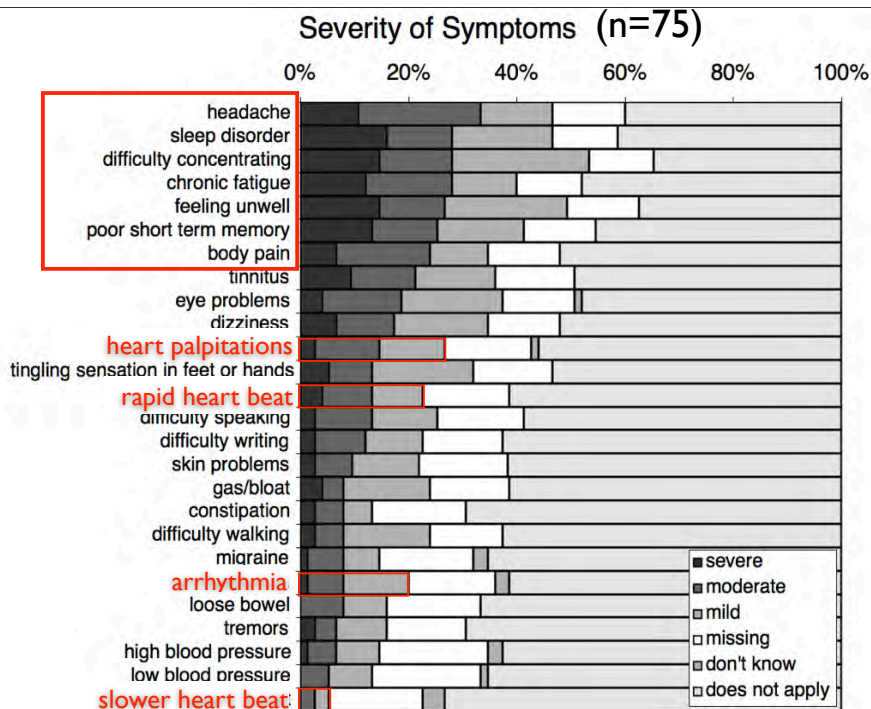
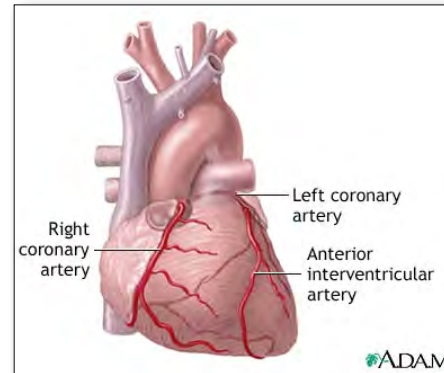
## Heart

palpitations

arrhythmias

low or high blood pressure

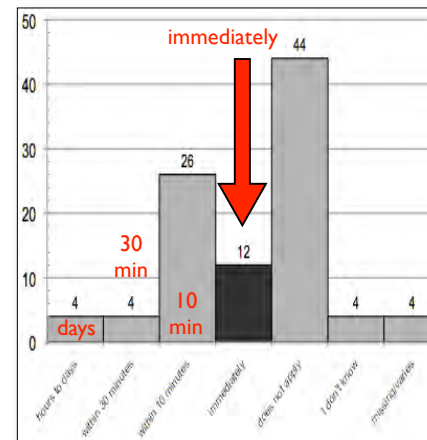
pain or pressure in the chest



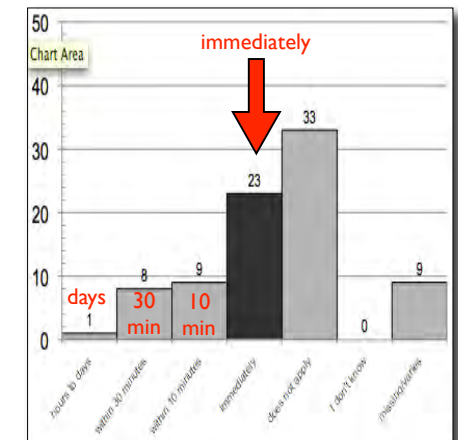
Self-proclaimed electrosensitivity of participants.

## How quickly do you RESPOND?

First Study: (n=25)



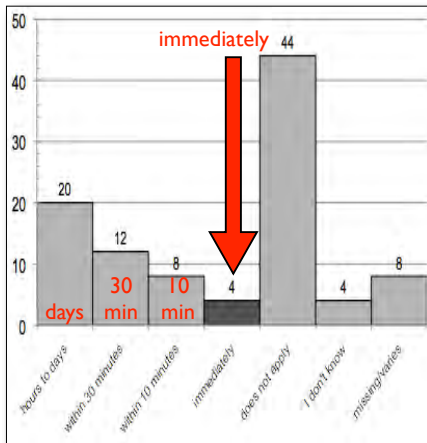
Second Study: (n=75)



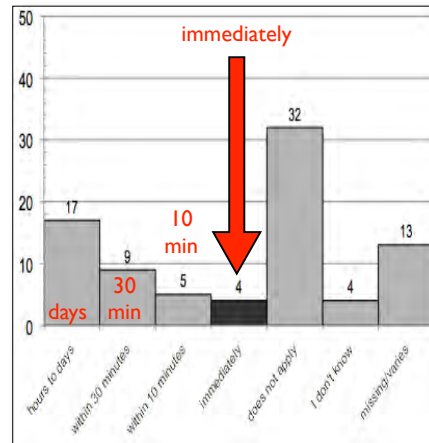
Self-proclaimed electrosensitivity of participants.

## How quickly do you RECOVER?

First Study: (n=25)

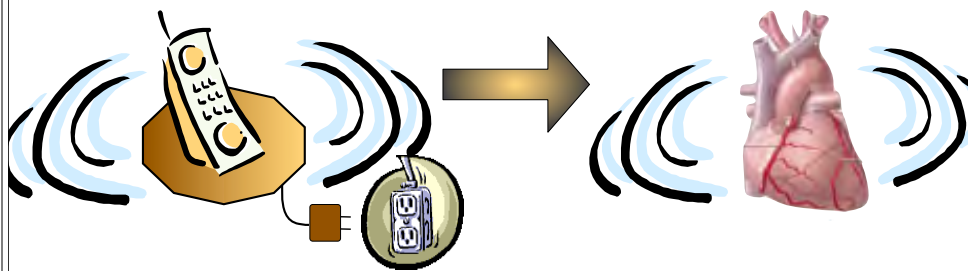


Second Study: (n=75)

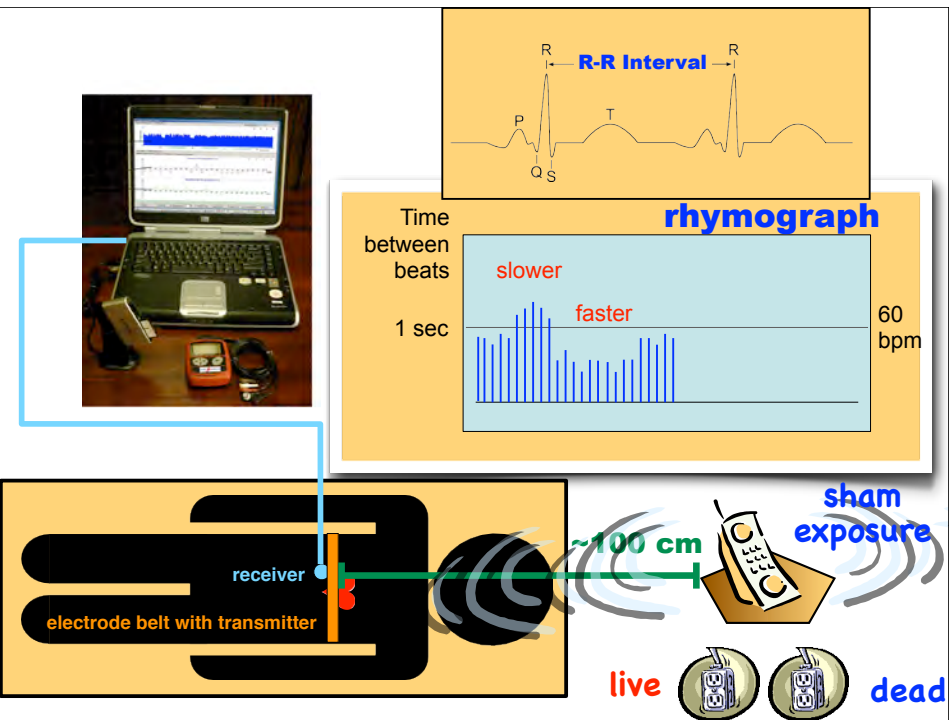


## "Proof of Concept" Provocation Study

Do cordless phones affect the heart?



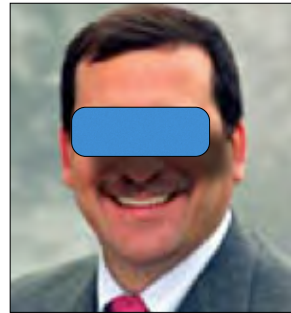
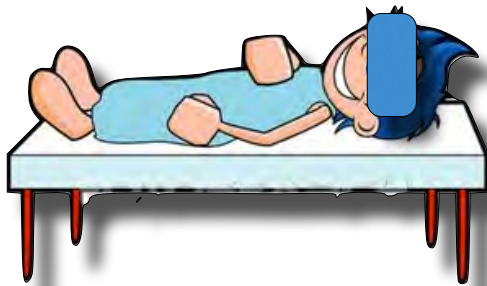
<b>0.3%</b>	<b>ICNIRP/US/Canadian</b>	<b>Cordless</b>
<b>frequency</b> (GHz):	<b>Guideline</b>	<b>Phone</b>
	<b>2.4</b>	<b>2.4</b>
<b>intensity</b> (microW/cm <sup>2</sup> ):	<b>1000 (540)</b>	<b>3</b>



# Double Blind Study

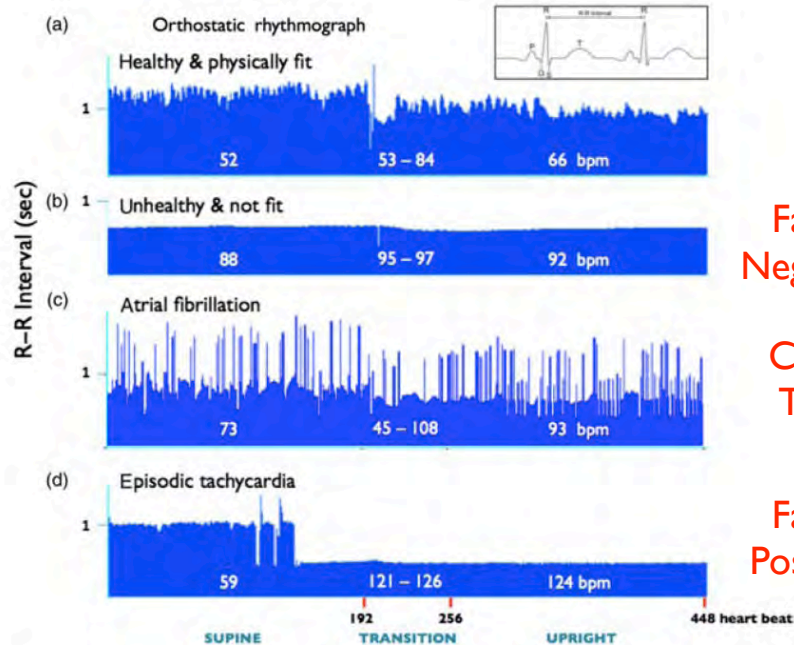
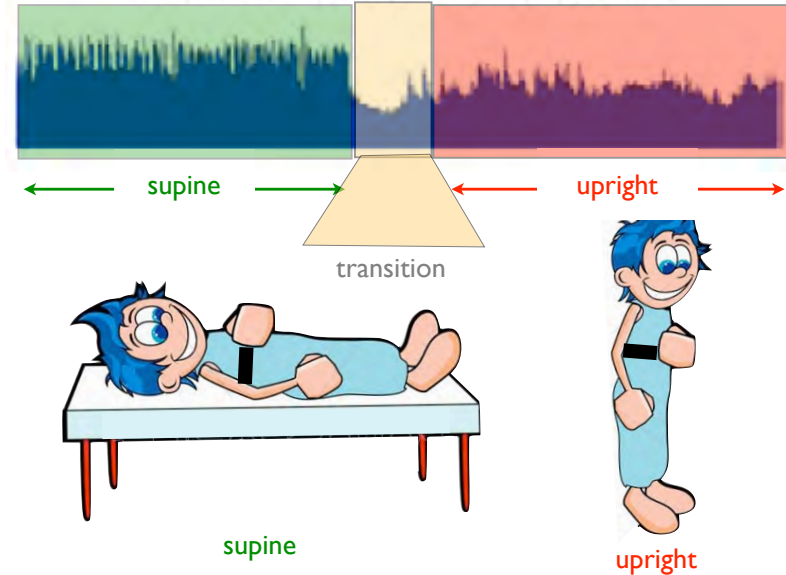


Dr. Jeff Marrongelle



# Orthostatic Test

Professional athlete



False  
Negative

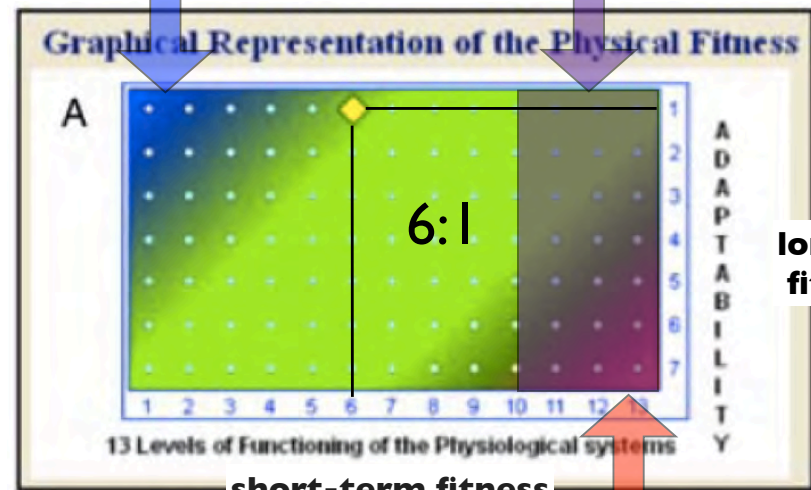
Can't  
Test

False  
Positive

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

top athletes

fatigue



short-term fitness

long-term  
fitness

chronically ill



## Continuous monitoring of heart digital cordless phone provocation

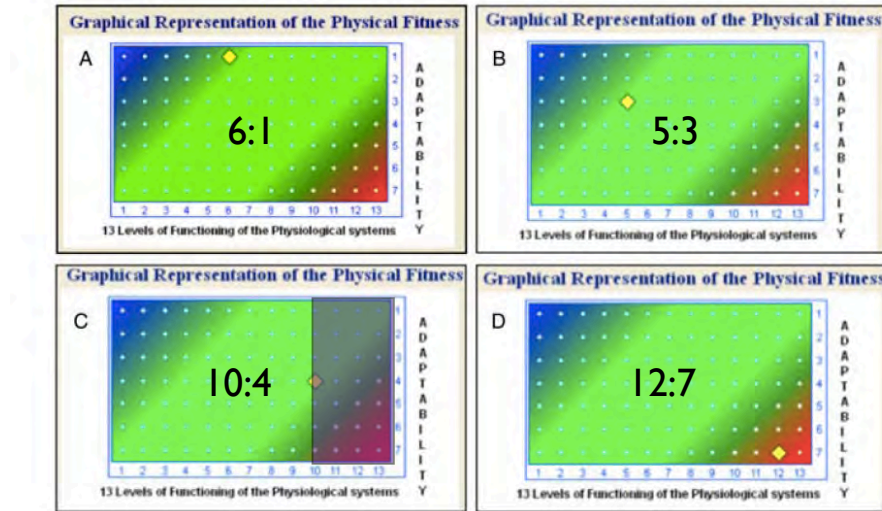
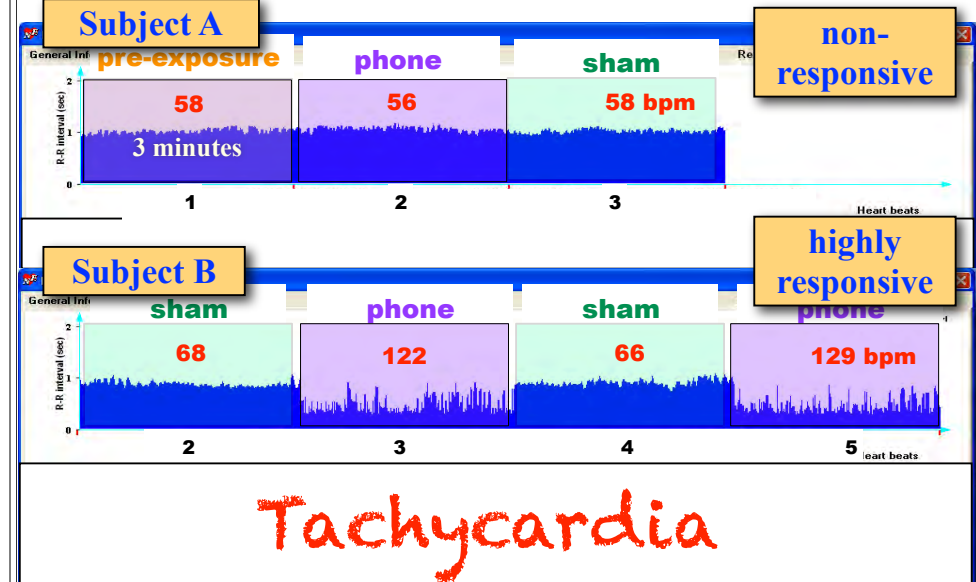
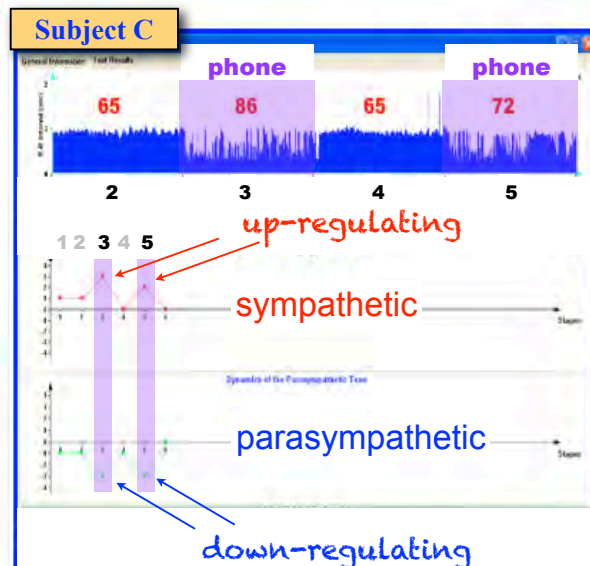


Figure 3. Physical fitness based on the orthostatic test. Fitness decreases as one approaches the lower right corner of the graph. A fitness score at and above 10 (horizontal axis). The relative fitness of the four examples decreases from A (6-1) to D (12-7).

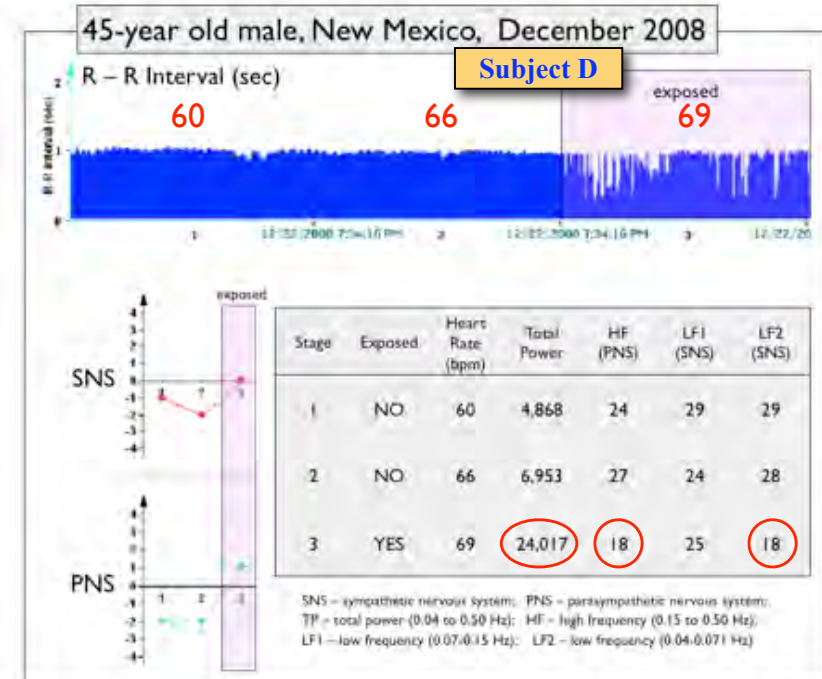
## Real Time Monitoring

### 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



Is this person EHS?

False Negative Response

Can't tell due to adrenal exhaustion.

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

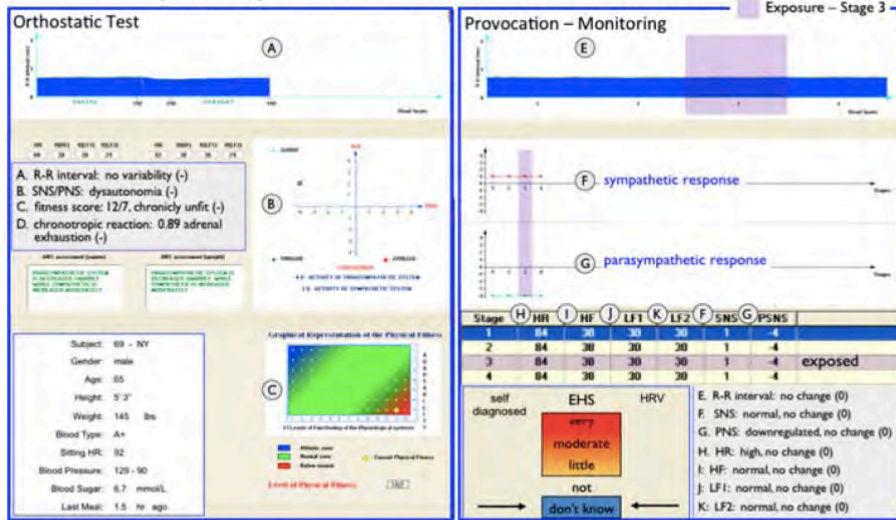


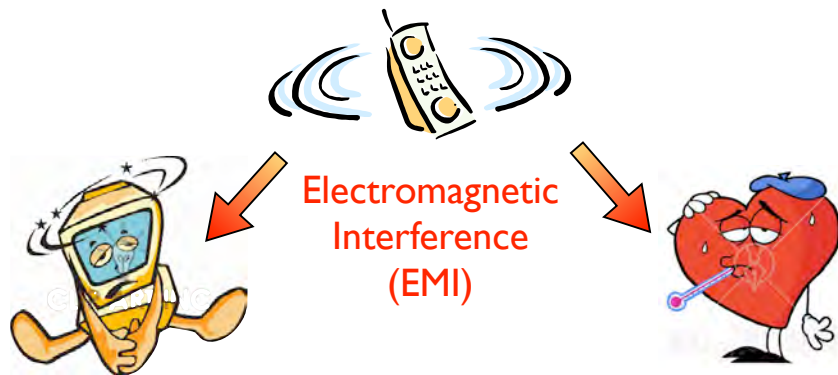
Figure 6. HRV parameters for a subject with dysautonomia and adrenal exhaustion who is not responding to any exposure. This subject's electrical hypersensitivity was classified as unknown due to adrenal exhaustion.

Subject E

## Question:

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

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



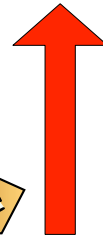
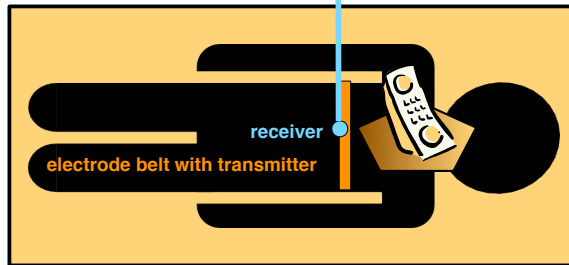
## Test for Interference



# Exposure Protocol cordless phone & heart



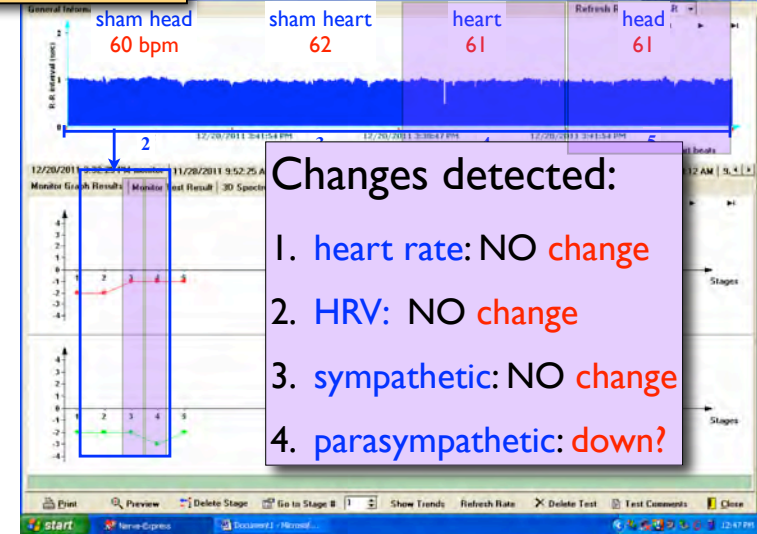
PHONE NEAR	DISTANCE from receiver (cm)	RADIATION at receiver ( $\mu\text{W}/\text{cm}^2$ )
HEAD	80 - 110	2 - 3
HEART	~ 5	100 - 200



3

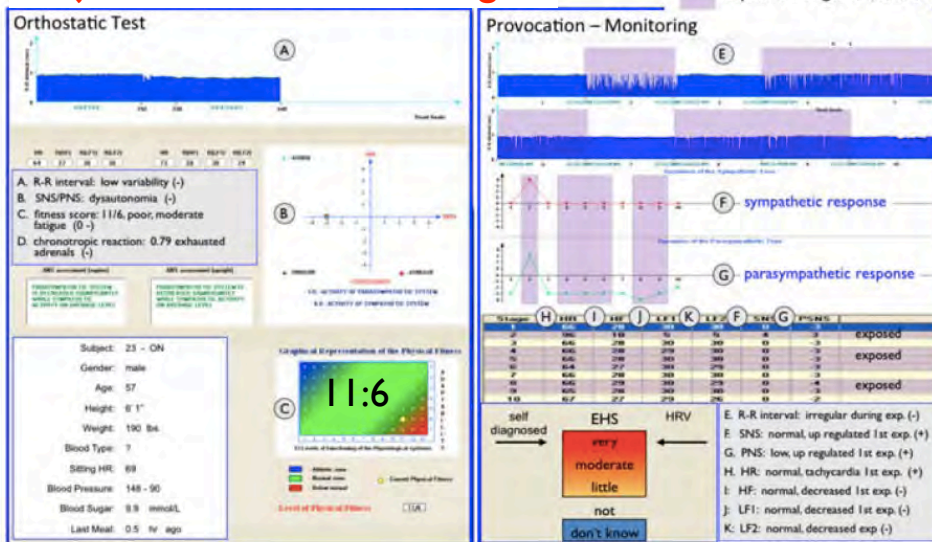
## Female-50s: HRV does not react to 2.4 GHz [ December, 2011 ]

### Subject F Non-Reactive



### Subject G

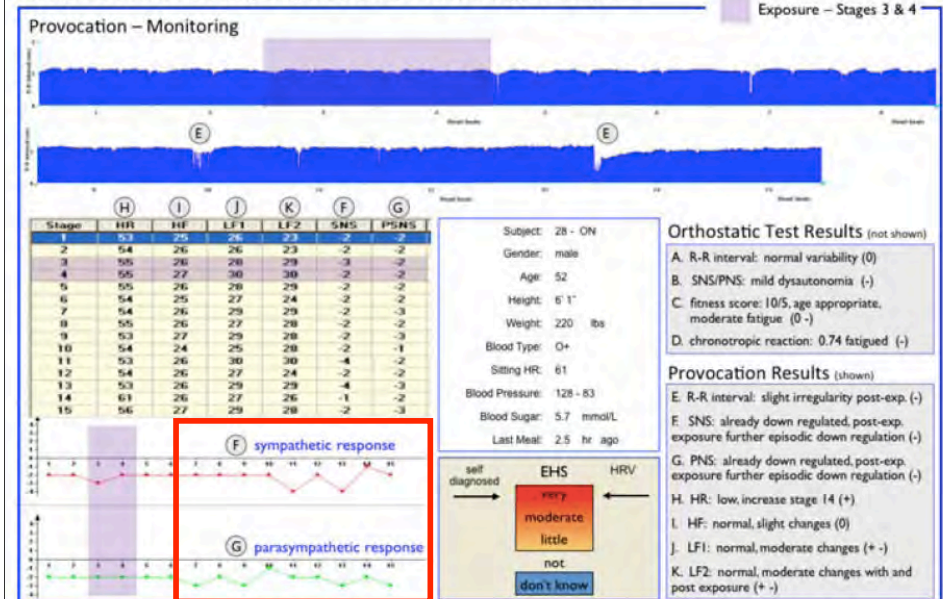
## Subject with moderate fatigue



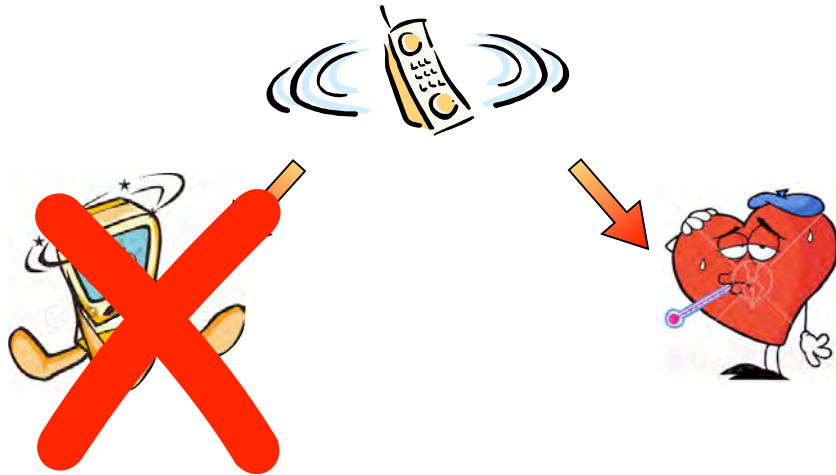
### Delayed Reaction

### Subject H

Delayed reaction, healthy subject with moderate fatigue: very EHS



# Interference?



## Biological Effects and Health Implications of Microwave Radiation

Symposium Proceedings

Richmond, Virginia, September 17-19, 1969

Edited by  
3<sup>rd</sup> Stephen F. Cleary, ed.  
Department of Biophysics  
Virginia Commonwealth University

1969

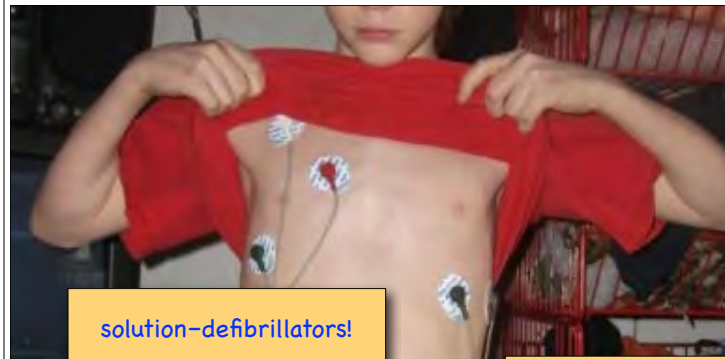


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Virginia Commonwealth University

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!

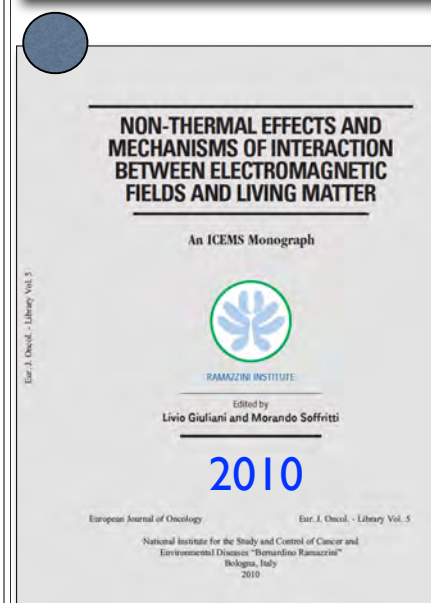
### Mountain View School: Wi-Fi

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](http://www.safeschool.ca)

## ICEMS: The International Commission for Electromagnetic Safety



### 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.

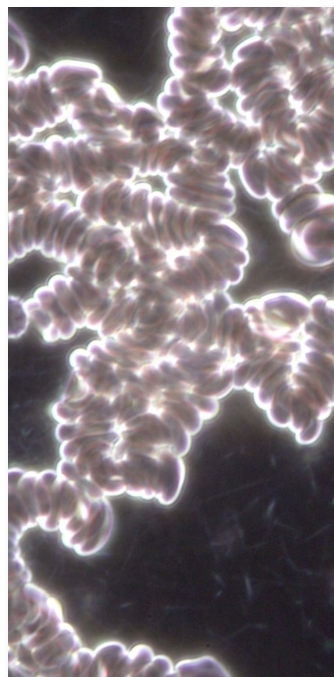
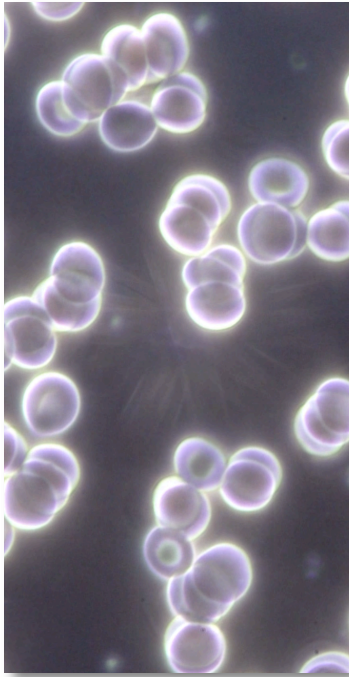
**Materials and Methods:** Twenty-five subjects in Colorado between the ages of 37 to 79 completed an electrosensitivity (EHS) questionnaire. After recording their orthostatic HRV, we did continuous real-time monitoring of HRV in a provocation study, where supine subjects were exposed for 3-minute intervals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

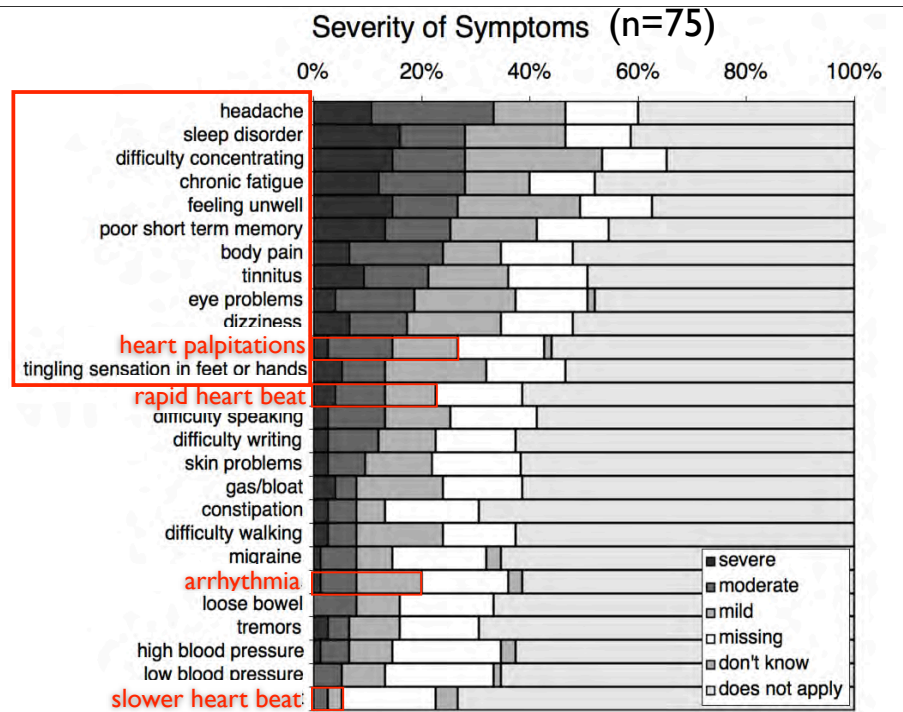
**Provocation Experiment:** Forty percent of the subjects experienced some changes in their HRV attributable to digitally pulsed (100 Hz) MW radiation. For some the response was extreme (tachycardia), for others moderate to mild (changes in sympathetic nervous system and/or parasympathetic nervous system), 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 µW/cm<sup>2</sup>).





## Wi-Fi & Blood



## Wi-Fi & Plant Growth



Thank You!

[www.magdahavas.com](http://www.magdahavas.com)