

Adverse Fetal and Childhood Health Effect of In-Utero Exposure to Magnetic Fields Non-ionizing Radiation

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Story of EMF Health Effect

- Discovery in 1979:
 - Nancy Wertheimer and Ed Leeper findings
 - Their incredible luck
 - Their two unfortunate legacies
 - Poor EMF measurements
 - Outcome inefficient to study

Current Prevailing Perceptions about EMF Health Effect

- Misconceptions – no association:
 - Poor measurement for EMF, though evolved:
 - Wire codes
 - Interviews
 - Distance from power lines or power stations
 - Spot measurements
 - Personal EMF measurement (carrying a meter)
 - Inability to measure EMF exposure: no association
- Bottom Line: You need to measure EMF correctly and accurately before claiming that there is no association.

Current Prevailing Perceptions about EMF Health Effect

- *Inensive* outcomes to study
 - Cancer
 - Long latency period: 20-25 years from exposure to diagnosis
 - Rare outcomes needing *Retrospective* ascertainment of EMF exposure (bad combination)
- Bottom line: Need to focus on sensitive endpoints first

Current Prevailing Perceptions about EMF Health Effect

- Power line EMF and Cell phone EMF have different health effect
 - Both are EMF
 - Only difference is frequency: low vs. high
- Energy level
 - Heat injury (thermal effect), not the main concern
 - **Non-thermal** effect largely unknown and the main concerns (miscarriage, cancer, autoimmune diseases, obesity, etc.)

Why EMF exposure ?

- Significant increase in last 30 years
 - Build out of wireless network 5G now
 - Wireless devices (e.g., cell phones)
 - Emerging evidence of adverse effects
 - Miscarriage
 - Blood glucose level
 - Childhood asthma
 - Childhood obesity
 - Childhood neurodevelopment disorders
 - Childhood abnormal thyroid condition
 - Poor sperm quality

Our Latest Studies

- A prospective cohort study
- Exposure measured in pregnancy
- Outcome followed
 - Miscarriage in pregnancy
 - Childhood conditions (*no time to discuss today*)
 - Asthma
 - Obesity
 - ADHD
 - Abnormal thyroid condition

Study Population & Recruitment

- Kaiser Permanente Northern California (KPNC) members
- All pregnant women
- Recruited in the 1st or 2nd trimester
- In-person interview

Exposure Measurement

- All participants wore a meter for 24 hours in pregnancy (1st or 2nd trimester)
- **Diary of activities**
- Assessment of representativeness of measurement day: a **typical day** in pregnancy



Findings on *In-utero* EMF Exposure

- Exposure to high level of MF non-ionizing radiation during pregnancy is associated with an increased risk of:
 - Miscarriage (RR=2.7)
 - Asthma in offspring (RR=2.5)
 - Obesity in offspring (RR=5.0)
 - ADHD (RR=2.9)
 - Abnormal thyroid function (RR=3.1)
- Dose-response relationship (long-term effects)
- Stronger when measured on a typical day

Daily Magnetic Field Exposure during Pregnancy and the Risk of Miscarriage

MF 99 th Percentile	Total N	N with miscarriage (%)	aHR ^a (95%CI)
<u>Overall</u>			
<2.5mg	219	36 (16.4%)	Ref
≥2.5mg	694	164 (23.6%)	1.48 (1.03-2.14)
<u>Typical day</u>			
<2.5mg	106	11 (10.4%)	Ref
≥2.5mg	347	84 (24.2%)	2.72 (1.42-5.19)
<u>Non-typical day</u>			
<2.5mg	113	25 (22.1%)	Ref
≥2.5mg	347	80 (23.1%)	1.08 (0.67-1.73)

aHR: Adjusted Hazard Ratio.

^aAdjusted for maternal age at interview, race, education, smoking since LMP and prior miscarriage

Daily Magnetic Field Exposure during Pregnancy and the Risk of Miscarriage – Dose-Response, on typical day only

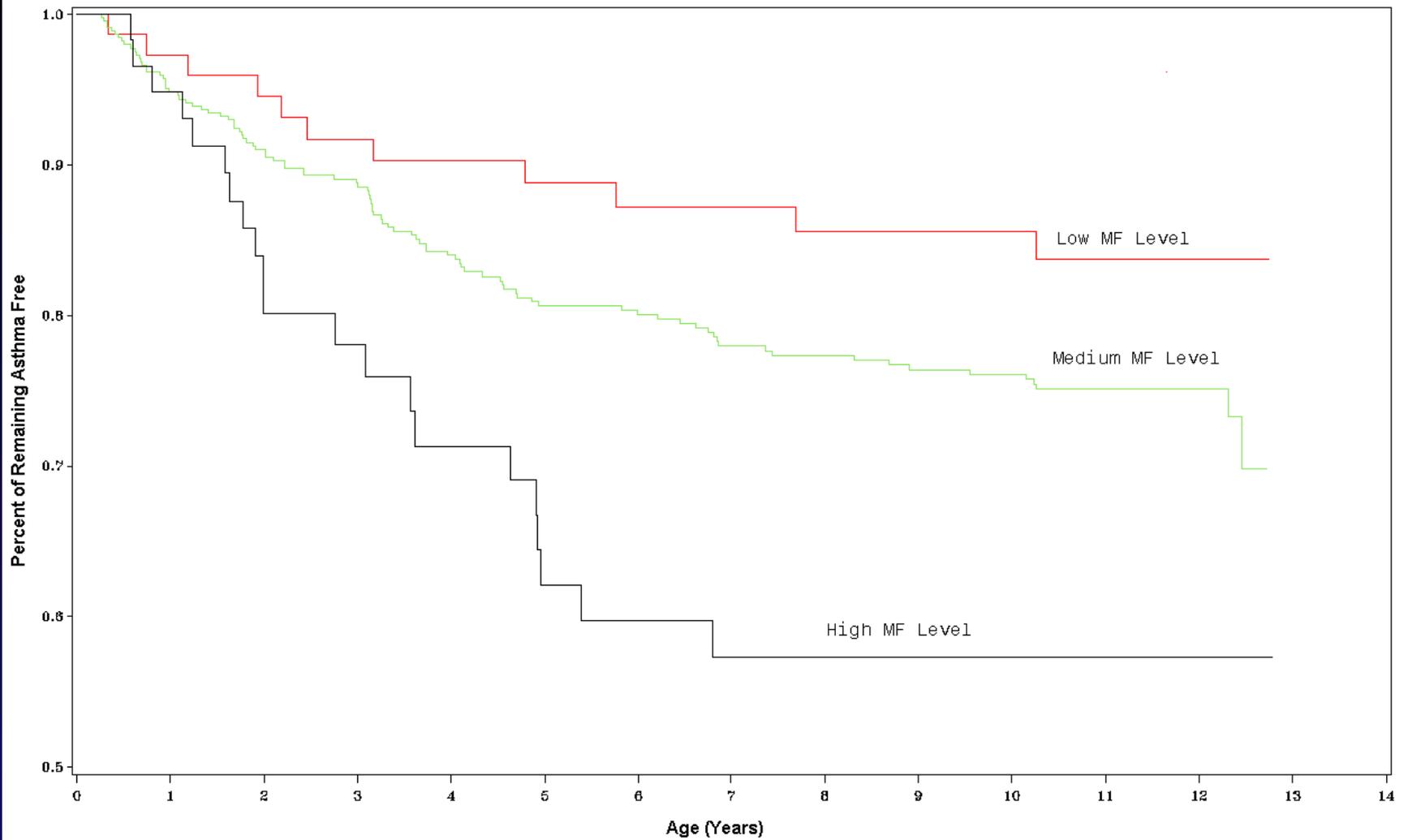
MF 99 th Percentile	Total N	N with miscarriage (%)	aHR ^a (95%CI)
Overall			
<2.5mg	106	11 (11.4%)	ref
2.5mg-5.0mg	195	53 (27.2%)	3.11 (1.58-6.13)
≥5.0mg	152	31 (20.4%)	2.29 (1.13-4.64)

aHR: Adjusted Hazard Ratio.

^aAdjusted for maternal age at interview, race, education, smoking since LMP, and prior miscarriage.

^bAdjusted for maternal age at interview, race, education, smoking since LMP, and gravidity.

Figure 1. Kaplan-Meier Estimates of Asthma Risk by Maternal Magnetic Field (MF) Exposure Level during Pregnancy



CONCLUSION

- Exposure to high level of MF non-ionizing radiation during pregnancy is associated with
 - an increased risk of **miscarriage** (immediate effect)
 - Likely a threshold effect, thus, no apparent dose-response relationship

CONCLUSION

- Exposure to high level of MF non-ionizing radiation during pregnancy is associated with long-term adverse impacts on offspring
 - Childhood asthma
 - Childhood obesity
 - Neurodevelopmental disorders like ADHD
 - Abnormal thyroid condition
- Does-response relationship

STOP HERE

