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

- *Insensitive* 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

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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

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

aHR: Adjusted Hazard Ratio.

[a]Adjusted for maternal age at interview, race, education, smoking since LMP and prior miscarriage

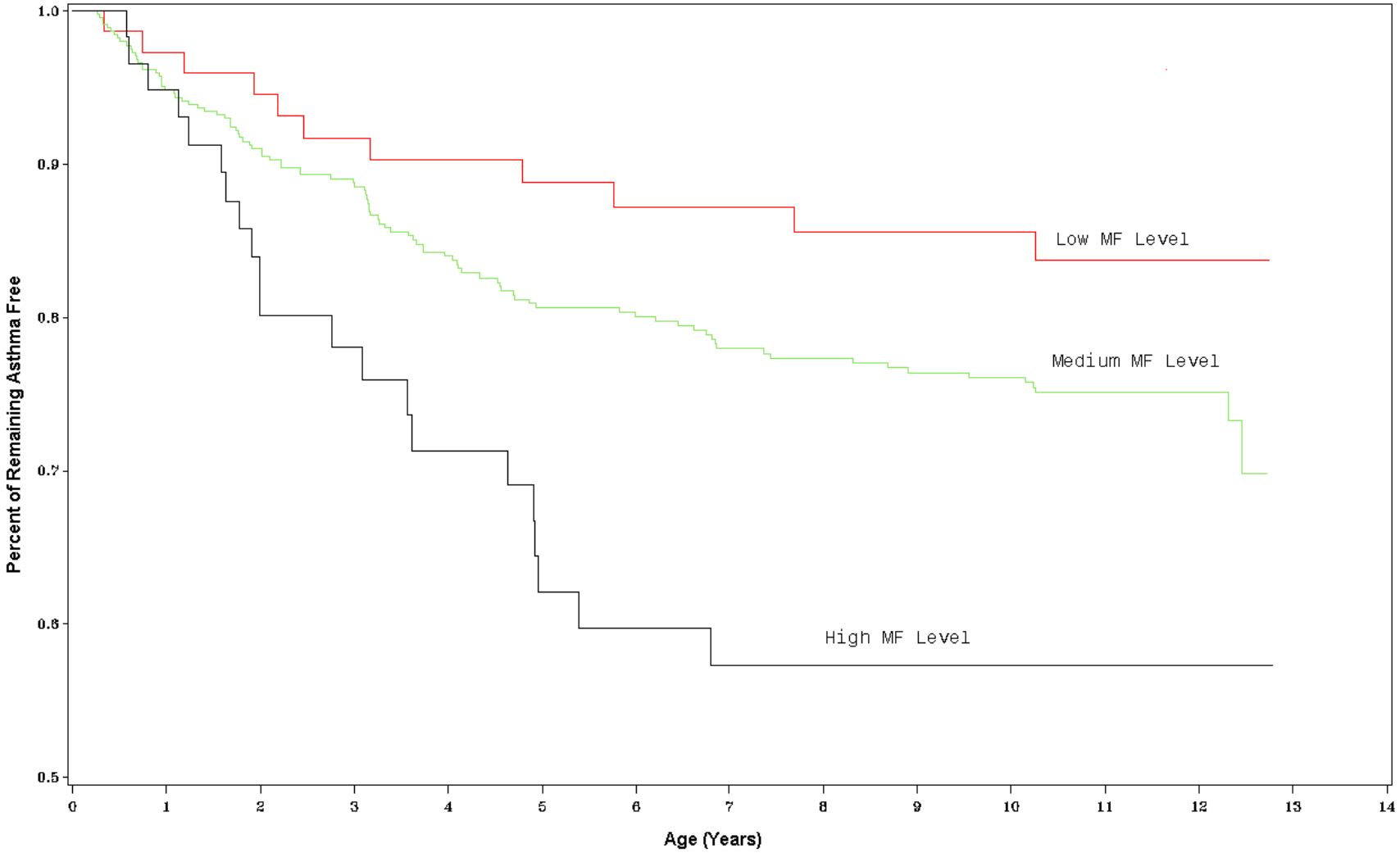
Daily Magnetic Field Exposure during Pregnancy and the Risk of Miscarriage – Dose-Response, on typical day only

MF 99th 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.

[a]Adjusted for maternal age at interview, race, education, smoking since LMP, and prior miscarriage.
[b]Adjusted 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



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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

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