

Thursday, 12th April 2018
Comittees Hearing on Radiation
Folketinget, Christiansborg
Denmark

Exposure to radiofrequency electromagnetic fields
and health outcomes
in the ELFE French birth cohort



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Radiofrequency electromagnetic fields (RF EMF)

- Knowledge on RF EMF exposure of children remains scarce
- The use of devices generating RF EMF is constantly growing
⇒ as well as the number and the diversity of sources:
 - broadcast transmitters, base stations, ...
 - mobile and DECT (cordless) phones, smartphones,
 - Wifi, blue tooth, WiMax,...

=> Increased levels of exposure in the population

Radiofrequency electromagnetic fields (RF EMF)

Health concern:

- Biological mechanisms not known (thermal, melatonin, hormones, ...)
- 2011 : classification by IARC* as possibly carcinogenic to humans
- **RF EMF from mobile phones:**
 - adult brain tumours: no clear evidence for an increased risk except in long term use or « heavy » users,
 - Child /adolescent brain tumours: no clear evidence but lack of studies
- **RF EMF from base stations, broadcast transmitters, other sources:**
 - Lack of convincing data

Still many questions about their possible impact on human health

→ **Consequences of exposure during fetal life / childhood:**

Pregnancy issues, child neurodevelopment, behavioral problems, ADHD, ... ?

**International Agency for Research on Cancer*

Environment International 104 (2017) 122–131



Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint



Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts



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Results: Overall, 38.8% of mothers, mostly from the Danish cohort, reported no cell phone use during pregnancy and these mothers were less likely to have a child with overall behavioral, hyperactivity/inattention or emotional problems. Evidence for a trend of increasing risk of child behavioral problems through the maternal cell phone use categories was observed for hyperactivity/inattention problems (OR for problems in the clinical range: 1.11, 95%CI 1.01, 1.22; 1.28, 95%CI 1.12, 1.48, among children of medium and high users, respectively). This association was fairly consistent across cohorts and between cohorts with retrospectively and prospectively collected cell phone use data.

Conclusions: Maternal cell phone use during pregnancy may be associated with an increased risk for behavioral problems, particularly hyperactivity/inattention problems, in the offspring. The interpretation of these results is unclear as uncontrolled confounding may influence both maternal cell phone use and child behavioral problems.



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Outdoor and indoor sources of residential radiofrequency electromagnetic fields, personal cell phone and cordless phone use, and cognitive function in 5–6 years old children



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RESULTS: Residential presence of RF-EMF indoor sources was associated with an improved speed of information processing. Higher residential RF-EMF exposure from mobile phone base stations and presence of indoor sources was associated with an improved inhibitory control and cognitive flexibility whereas we observed a reduced inhibitory control and cognitive flexibility with higher personal cordless phone use. Higher residential RF-EMF exposure from mobile phone base stations was associated with a reduced visuomotor coordination whereas we observed an improved visuomotor coordination with residential presence of RF-EMF indoor sources and higher personal cell phone use.

CONCLUSIONS: We found inconsistent associations between different sources of RF-EMF exposure and cognitive function in children aged 5-6 years.

The ExpoCEM study - Objective



To assess exposure to RF (& ELF) EMF in the French **ELFE** birth cohort, from prenatal period to adulthood
and to study potential impact on different health outcomes

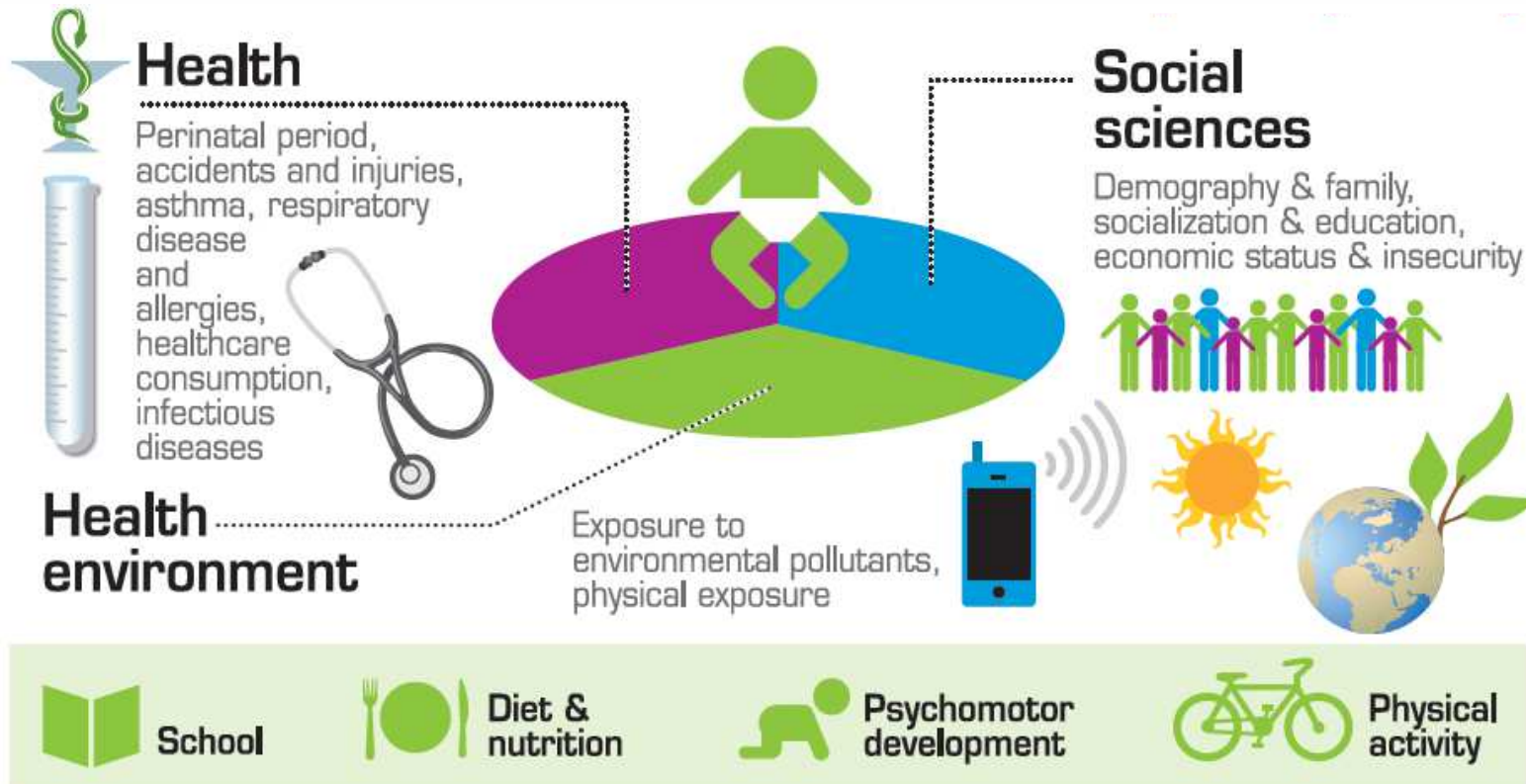
By the means of :

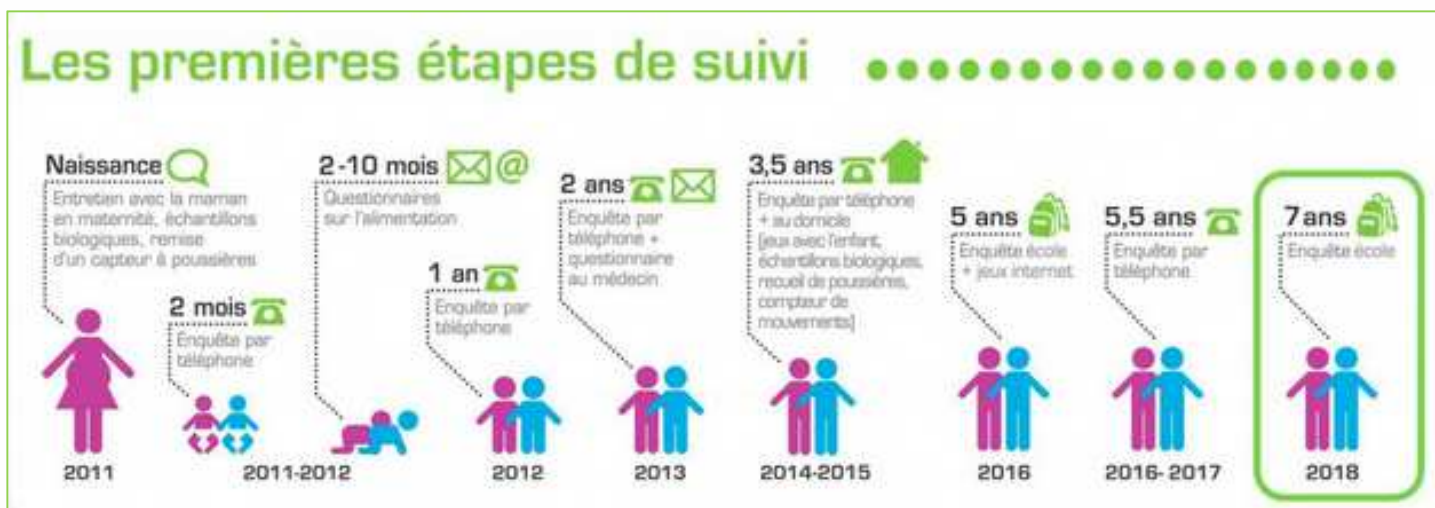
1. Questionnaires at birth, 2 months and regularly during childhood, gathering information on sources of exposure related to the child's age and modifications due to residential mobility
2. Geographic location of potential sources of EMF for the entire cohort
3. Direct measurements performed in a subsample of the cohort children to look for the main determinants of the exposure at different ages

What is the ELFE birth cohort study?



- ELFE = « Etude Longitudinale Française depuis l'Enfance »
- First large-scale longitudinal cohort study from birth to adulthood in France
- Children born in 2011 in metropolitan France enrolled at birth
- **Objective:**
to assess the impact of family characteristics, lifestyle, living conditions, socio-cultural and demographic factors, diet, and environment
on the physical and psychological development, health, schooling and socialization of children





The ExpoCEM study - Objective



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By the means of :

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- Interviews at birth, at two months, 1, 2, and 3 years and then regularly until 20 years:
 - Parental occupational exposure during conception and pregnancy assessed by experts and job exposure matrices using detailed job, tasks and activity sector
 - Communication and electric devices at home and use by the parents / the child
- Medical imaging (MRI, ...)
- Home characteristics and environment (urban/rural area, height (floor), environmental emission sources,...)
- Residential proximity to broadcast transmitters, base

- N = 200 children of the ELFE cohort in places representing different geographical situations
-
- Exposimeters
 - 50Hz: EMDEX II, Enertech,
 - RF: EME SPY 200, Satimo (88-5,850 MHz)
- EMF exposure of children during 24 hours
- Time-activity diaries and a detailed interview will be performed at home by a trained interviewer
- The interviewer will also record short-term measurements at different locations in each room of the house
- **Period 2018 - 2019**



First Analysis in the Elfe Birth Cohort Study :
Prematurity, Small for Gestational Age
and
Maternal occupational exposure to RF EMF
during pregnancy

Prematurity :

- Birth before 37 completed weeks of gestation
- In Europe, 5 to 10% of live births are preterm (Euro_peristat 2010)
- Increasing preterm births in many countries

Small for gestational age :

- Birth weight for gestational age < 10th percentile of reference curves
- In Europe, 3 to 10% of live births have a weight <2500 grams (Euro_peristat 2010)

Consequences :

- Poorer perinatal outcomes, cognitive and motor impairments
- Elevated risks of cardiovascular disease, diabetes, obesity... in adult life
(Barker 2006; Cosmi *et al.* 2011; Cunningham *et al.* 2003; De Boo *et al.* 2006; Yanney et Marlow 2004)

Pregnancy outcomes

- Moderate prematurity : birth between 33 and 37 weeks of gestation
- Small for gestational age : weight < 10thp. / individualized French reference curves
 - AUDIPOG algorithm (<http://www.audipog.net/croissance-neonat.php>)
 - Gestational age ; child's sex and rank of birth ; mother's age, height and weight

Mothers' occupational situation

- Job status, occupation and length of time they have worked during pregnancy
- Coding jobs with French and International Classifications of Occupations and Activities
- Use of a Job Exposure Matrix to assess occupational exposure:

=> Ongoing collaboration with the GERoNiMO consortium to develop and complete a RF-JEM and apply it to our data

Development of a Job-Exposure Matrix for occupational exposure assessment of high frequency electromagnetic fields (3 kHz-300 GHz)

Lucile Migault, Isabelle Baldi, Ghislaine Bouvier: Inserm, Bordeaux University

Hans Kromhout: Utrecht University

Jordi Figuerola, Michelle C Turner, Elisabeth Cardis, Javier Vila: ISGlobal, Barcelona

And the GERoNiMO Project (Generalized EMF Research using Novel Methods)

“In conclusion, we have constructed the first available JEM, describing occupational exposure to high-frequency EMF, for which we gathered a large number of measurements available for jobs held by subjects in the multinational INTEROCC study. The jobs are classified into an international classification which facilitates its application in population-based epidemiological studies. [...] The RF-JEM will be maintained and made publicly available at the ISGlobal website for use by other researchers in epidemiological studies and occupational health management programs.”

- Consequences of maternal exposure on very or extreme preterm birth ?

=> Data from a French birth cohort of premature babies only
(born in 2011): EPIPAGE2
 - Increases the power of the study
 - Allows to study the link with all stages of prematurity
- Further analyses:
 - to study the link with child's neurodevelopment (SDQ, questionnaires, K-classic test, ...)
 - To study the link between environmental exposure due to mobile phone, cordless phone, Wi-Fi ... devices at home

Thank you for your attention



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EPICENE / Epidemiology
of cancer and environmental
exposures

