

C1: UMWELT UND CHRONISCHE KRANKHEITEN C1 : ENVIRONNEMENT ET MALADIES CHRONIQUES

TEMPORAL TRENDS OF RADIOFREQUENCY ELECTROMAGNETIC FIELD EXPOSURE IN EVERYDAY ENVIRONMENTS ACROSS EUROPEAN CITIES

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Introduction

The rapid development and increased use of wireless telecommunication technologies led to a substantial change of radiofrequency electromagnetic field (RF-EMF) exposure for the general population. However, change of the exposure patterns in the everyday environment has not been systematically addressed so far.

The objectives of our study were to monitor RF-EMF exposure in everyday microenvironments, to identify temporal trends and to compare exposure levels across microenvironments and over different European cities.

Methods

We used a longitudinal study and performed measurements using a common data collection protocol in the cities of Basel (Switzerland) during two years (May 2010-April 2012), Ghent and Brussels (Belgium) during one year (May 2011-April 2012). We used a portable measurement device (exposimeter) capable to quantify RF-EMF exposure on 12 different frequency bands ranging from FM (Frequency modulation, 88 MHz) to WLAN (Wireless Local Area Network, 2.5 GHz). We included characteristically everyday environments such as outdoor areas (residential areas, downtown and suburb), public transports (train, bus and tram or metro rides) and indoor places (train station, airport and shopping centers). Measurements were collected every four seconds when walking during 10 to 30 minutes in a microenvironment.

Results

Average RF-EMF exposure between May 2011 and April 2012 in all microenvironments was always highest in Brussels and lowest in Basel. Highest Total RF-EMF exposure levels occurred in public transports (all combined) with arithmetic mean values of 0.84 V/m in Brussels, 0.72 V/m in Ghent and 0.58 V/m in Basel. In all outdoor areas combined, mean exposure levels were 0.45 V/m in Brussels, 0.32 V/m in Ghent and 0.33 V/m in Basel.

Between May 2011 and April 2012, we observed a striking increase of total RF-EMF exposure levels of 17.4 % in Ghent, 45 % in Brussels and 32.8 % in Basel (25.7 % for the period 2010-2012).

Discussion

A substantial increase of RF-EMF exposure has been observed between May 2010 and April 2012. However, exposure levels were still far below regulatory limits of each country.

A continuous monitoring is needed to identify high exposure areas and to anticipate critical development of RF-EMF exposure at public places.



SEASONAL AND SPATIAL VARIATION OF INDOOR AND OUTDOOR PARTICULATE MASS AND NITROGEN DIOXIDE CONCENTRATION IN EIGHT SWISS AREAS

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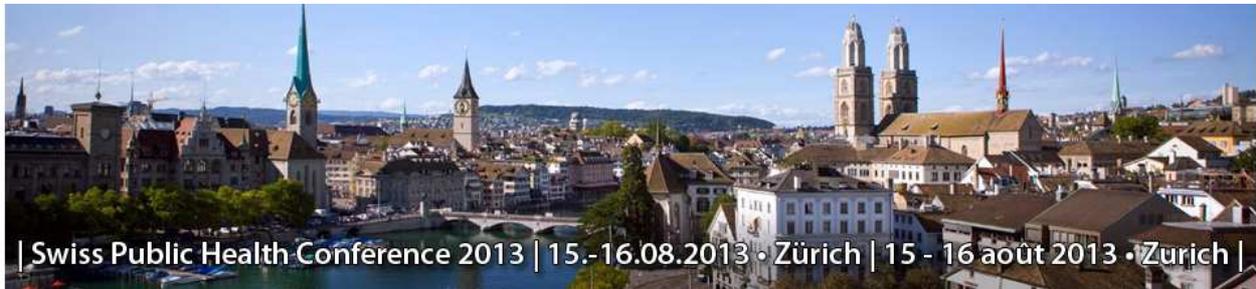
Background: This study is part of the Swiss Study on Air Pollution and Lung and Heart Diseases in Adults (SAPALDIA), a nearly 20-year old cohort study spread in eight geographically diverse areas in Switzerland. Innovative outdoor PM₁₀ and NO₂ exposure modeling has been conducted in SAPALDIA earlier for PM₁₀ and NO₂, however, its relationship with indoor levels has not been assessed.

Aims: The overarching aim is to provide estimates of individual long-term home outdoor traffic-related air pollution exposures for all cohort participants. This paper focuses on seasonal and spatial variation of residential outdoor PM₁₀, PM_{2.5} and NO₂ and its correlation with indoor pollutant levels.

Methods: Biweekly NO₂ measurements are made at 40 outdoor locations in each study area over three different seasons during 2011-2012. Four (of the eight) areas are additionally monitored for indoor and outdoor PM_{2.5}, PM₁₀, and indoor NO₂ at 20 locations. NO₂ is measured using passive Passam tubes while PM_x are measured using Harvard Impactors at a flow rate of 4L/min. Detailed home characteristics and indoor activities are also recorded for each of the monitored homes.

Results: Mean biweekly outdoor NO₂, aggregated across all seasons and sites, is highest in Lugano (32.4±14.9 ug/m³) and lowest in Montana (12.6±8.3 ug/m³). Across all eight areas, winter levels are highest (range: 15.9-44.7 ug/m³) and summer the lowest (7.2-20.8 ug/m³). The indoor NO₂ levels are about half of the outdoor levels in winter across all areas but similar in summer. Seasonally averaged outdoor PM₁₀ and PM_{2.5} ranged 9.7-40.5 ug/m³ and 5.6-35.8 ug/m³, respectively. Corresponding indoor levels are 8.1-28.1 ug/m³ and 4.6-22.2 ug/m³, respectively. Computation of area-specific indoor versus outdoor and between pollutant correlations is currently underway.

Conclusions: Our results show significant seasonal differences in outdoor PM_x and NO₂ levels, seasonal and site-dependent infiltration indoors, and large spatial differences within and across Switzerland.



EXPOSURE TO RADIOFREQUENCY ELECTROMAGNETIC FIELDS FROM BROADCAST TRANSMITTERS AND RISK OF CHILDHOOD CANCER: A CENSUS-BASED COHORT STUDY FROM SWITZERLAND

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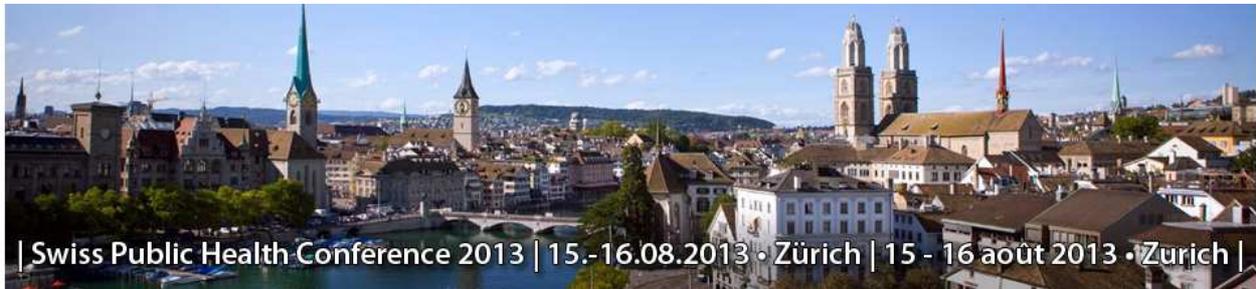
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Radio-frequency electromagnetic fields (RF-EMF) from broadcast transmitters (radio and TV transmitters) have been hypothesized to cause childhood cancer. The aim of this study was to investigate the association between RF-EMF exposure and childhood cancer in a census based cohort study in Switzerland. We conducted a time-to-event analysis using Cox regression models including children aged between 0 and 15 years and living in Switzerland on 5 December 5th 2000 adjusted for age, gender, benzene exposure and ionizing gamma radiation. Follow-up lasted until the date of diagnosis, death, emigration, the children becoming 16 years old or 31 December, 2008. RF-EMF Exposure from 34 short-wave, medium-wave and very high frequency (VHF) radio and TV transmitters was modeled for each study participant.

We included 999 childhood cancer cases out of 7,627,646 person-years in the time-to-event analysis. Hazard ratios (HR) for the highest exposure category (≥ 0.2 V/m) compared to the reference group (<0.05 V/m) were 1.02 (95% CI 0.74, 1.42) for all cancers, 0.53 (95%-CI: 0.25, 1.14) for leukemia, 0.58 (95%-CI: 0.26, 1.34) for ALL and 1.70 (95%-CI: 0.99, 2.93) for CNS tumors. In conclusion, this large census based cohort study does not indicate a consistent association between RF-EMF exposure and childhood cancers.



CHILDREN'S EXPOSURE TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS: A PERSONAL EXPOSURE MEASUREMENT STUDY

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Background:

There is concern regarding the possible health effects of exposure to sources of extremely low frequency magnetic fields (ELF MF) at the microtesla level, mainly as a possible risk factor for childhood leukaemia. However, no biological mechanism is known, to explain an association at such low levels and little is known about the real everyday exposure of children.

Aims:

Within the framework of the EU FP7 research project "Advanced Research on Interaction Mechanisms of electromagnetic exposures with Organisms for Risk Assessments" (ARIMMORA) our study aims to close a knowledge gap of levels and temporal patterns of exposure for European children.

Methods:

Three groups (n=50) of a total of 150 children (age: 5-13) in Italy and Switzerland are equipped with personal measurement devices (EMDEX II) and a GPS logger to record ELF MF exposure during their regular activity during 48 hours twice, in summer and winter. Furthermore a time-activity diary about the children's whereabouts is filled in and spot measurements in the children's bedrooms are conducted. Group I consists of children living or attending school within 200m of a high voltage power line; group II comprises children living in a building with a transformer substation and group III represents a control group composed of children sampled randomly. Exposure patterns derived from the measurements are analysed according to location and behavioural activity.

Results:

Preliminary results of the summer measurements from 40 Italian and 70 Swiss children show an overall median geometric mean exposure of 0.03 μ T with an interquartile range (IQR) of 0.02 μ T. A linear mixed model clustering for children of the same family reveals no significant differences according to group, country, age or urban setting. Median geometric mean of spot measurements in the bedroom was 0.03 μ T (IQR 0.03 μ T). Weighted kappa coefficient for exposure classification (<0.1 μ T, 0.1-0.3 μ T, >0.3 μ T) of personal and spot measurements was 0.344.



ASSOCIATION OF CAROTID DISTENSIBILITY AND PRIOR BLOOD PRESSURE CATEGORIES: THE SAPALDIA COHORT STUDY

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Hypertension is one of the major risk factors for cardiovascular events and local carotid stiffness is an early vascular marker for atherosclerotic burden and an independent predictor of cardiovascular events. Therefore, we examined the association of prior blood pressure categories and current local carotid stiffness based on the change of lumen diameter for a given pulse pressure (distensibility (DC)) in participants of the **Swiss Cohort Study on Air Pollution And Lung and Heart Diseases In Adults (SAPALDIA)**.

In the second SAPALDIA follow up in 2010/2011 (SAP3) carotid lumen diameter of ultrasound images were analysed in 3487 participants in a standardised one cm segment over at least one heart cycle. Brachial systolic (sBP) and diastolic blood pressure (dBp) were measured directly after ultrasound examination.

In the first follow up (SAP2) in 2002 sBP and dBp were measured in 6456 subjects. Participants were divided into five categories (CAT sBP/dBP mmHg: CAT1 'optimal' <120/<80; CAT2 'normal' 120-129/80-84; CAT3 'high normal' 130-139/85-89; CAT4 'grade1 hypertension' 140-159/90-99 and CAT5 'grade2+3 hypertension' $\geq 160/\geq 100$). When sBP and dBp fell into different categories, the higher category was chosen. Overall, the study sample included 2822 participants with complete parameter information. The association between blood pressure categories and DC was assessed using mixed-effects linear regression models with fixed effects for sex (49.3% men, 50.7% women), age (55.5 ± 8.1 years), weight (73.6 ± 14.0 kg), height (168.8 ± 8.9 cm), total cholesterol (6.1 ± 1.1 mmol/l), high-density cholesterol (1.5 ± 0.4 mmol/l), heart rate (70 ± 10.3 bpm), pack years in SAP2 (10.3 ± 17.5 years) and random effects for study centres.

The adjusted average DCs with their 95% confidence intervals [$10^{-3}/\text{kPa}$] were 16.96 (16.6, 17.3) for CAT1, 15.49 (15.09, 15.88) for CAT2, 14.70 (14.27, 15.12) for CAT3, 14.01 (13.62, 14.41) for CAT4 and 13.30 (12.65, 13.95) for CAT5. Every category differed significantly from CAT1 ($p < 0.001$), CAT2 ($p < 0.004$), CAT3 ($p < 0.011$) and CAT4 ($p < 0.046$).

In conclusion, the results showed significantly lower DC values for each increase in blood pressure category measured in SAP2. This is suggestive of a dose dependent harmful long term effect of elevated blood pressure categories resulting in an increased local carotid stiffness and thus increased risk for future cardiovascular events.