restricted to nurses below 30 years of age, odds ratio (OR) 3.4 (95% confidence interval [CI] 1.0–12.4). A similar increase in risk for experiencing spontaneous abortions throughout life was found among permanent night-shift workers, OR 4.4 (95% CI 1.2–16.3), also in this case for nurses below 30 years of age. No increased risk of spontaneous abortions was found among nurses above 30 years of age.

Conclusions The findings suggest that night work may cause spontaneous abortion by disrupting the circadian rhythms, but other unknown mechanisms may also play a role. More studies of night-shift workers considering different age groups are needed to supplement the findings.

**Session: Parallel session 2 RICOH: Child behavior and semen quality**

### 222 MALE REPRODUCTIVE TOXICITY OF PHTHALATES: A CROSS-SECTIONAL STUDY OF TOTAL SPERM COUNT IN EUROPEAN AND INUIT POPULATIONS

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**Objectives** Phthalates are widely used man-made chemicals that in spite of a short half-life in the organism are detectable in urine among more than 95% of investigated men and women. Phthalates are with varying potency anti-androgens through interaction with several metabolic steps involved in endogenous sex-steroid metabolism. Some cross-sectional studies have shown inverse associations between phthalates and plasma levels of testosterone and some semen characteristics, but the evidence base is limited and results are conflicting. The aim of this study was to examine the hypothesis that phthalates are associated with reduced levels of plasma testosterone and total sperm counts.

**Methods** Spouses of pregnant women from Greenland (n = 196), Poland (n = 190) and Ukraine (n = 203) were enrolled into the study. We measured six metabolites of di-2-ethylhexyl phthalate (DEHP) and diisononyl phthalate (DINP) in serum and concurrent testosterone, sperm concentration, sperm volume and total sperm count. Analyses were stratified by country as well as analysed across countries.

**Results** The most abundant metabolite from DEHP namely 5-cx-MEPP (mean concentration in serum 2.22 ng/ml) was negatively associated with testosterone, sperm volume and total sperm count in the overall analysis after adjustment for country, age, sexual abstinence time and current smoking. Testosterone decreased with 1.08% pr ng/ml 5-cx-MEPP (p = 0.032), volume with 1.59% (p = 0.043) and total sperm count with 3.47% (p = 0.030). When analysed by country the association was strongest in Ukraine and Poland, but the inverse relationship between 5-cx-MEPP and outcomes was observed in all three countries. No significant association between phthalate metabolites and sperm concentration was observed.

**Conclusions** These results are compatible with a weak anti-androgenic action of the DEHP metabolite 5-cx-MEPP on testosterone and total sperm count. Whether this cross-sectional association reflects causal mechanisms remains to be established.
Abstracts

PCB and DDE and child motor development have found contradicting results. The aim of this follow-up study was to examine the association between prenatal exposure to DDE and PCB and motor development and developmental milestones; crawling, standing-up and walking in children in Greenland, Ukraine and Poland.

Methods CB-153 and p,p'-DDE were measured in maternal blood in second or third trimester of pregnancy as a bio-marker of the child's prenatal exposure to the compounds. A total of 1,103 children aged 5 to 9 years were followed up in 2010–2012. Motor development were measured in terms of the parentally assessed screening tool Developmental Coordination Disorder Questionnaire 2007 (DCDQ’07) and developmental milestones were assessed via parental reports of child age at the first time of crawling, standing up and walking. The association between PCB/DDE and motor skills and milestones were analysed by means of linear multiple regression analyses using tertiles of exposure and stratified by country. Both complete case analyses and multiple imputation based analyses were executed. Adjustment were performed for the co-variates; maternal age, maternal smoking during pregnancy, maternal alcohol before pregnancy, maternal education, parity, gestational age at blood sampling, preterm birth, breastfeeding, child sex and child age at interview.

Results We found no associations between prenatal PCB and DDE exposure and developmental milestones or motor skills. Complete case- and multiple imputation based analyses showed adjusted mean differences in motor skills and age at milestones around null, in all three countries.

Conclusions These results on 1,103 mother–children-pairs from the INUENDO cohort in Greenland, Ukraine and Kharkiv (Ukraine), indicate no association between in utero PCB/ DDE exposure and developmental milestones and motor skills.

225 EXPOSURE TO POLYBROMINATED DIPHENYL ETHERS AND MALE REPRODUCTIVE FUNCTION IN ARCTIC AND EUROPEAN POPULATIONS

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Background Animal and a few human studies suggest that polybrominated diphenyl ethers (PBDEs) may affect male reproductive function. The aim of the present study was to evaluate if male reproductive function was associated with serum levels of PBDEs.

Methods We evaluated the effects of environmental exposure to BDE-28, BDE-47 and BDE-153 on reproductive hormones and semen quality, including markers of DNA damage and apoptosis, in 299 men from Greenland, Poland and Ukraine.

Results Adjusted linear regression models indicated that sperm DNA damage measured by the TUNEL assay increased by 0.22%, confidence interval (CI) 0.03% to 0.42% for each percentage increase in lipid adjusted BDE-47 concentration, and semen volume decreased by 0.11% (0.01% to 0.19%) for each percentage increase in BDE-28 exposure.

Conclusions Adverse effects of PBDE exposure on semen volume and sperm DNA damage were observed but other conventional semen parameters and reproductive hormones were not affected. Harmful effects of PBDE exposure on sperm DNA damage is supported by experimental evidence based on other cell types.

226 PRENATAL BLOOD LEAD LEVEL AND CHILDHOOD NEUROBEHAVIORAL DEFICIT

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Background Lead is a neurotoxicant that can affect brain development and lead to neurobehavioral deficits.

Methods We examined the associations between prenatal blood lead levels (PBL) and childhood neurobehavioral deficits in a cohort of 1825 children in the Takatsuki City, Japan. PBL was measured using a Pb-101P (HPI-1) lead analyzer. Neurobehavioral outcomes were assessed using the Achenbach Child Behavior Checklist (CBCL). This study was approved by the Ethics Committee of the University of Occupational and Environmental Health, Japan.

Results We found significant positive associations between prenatal blood lead levels and childhood neurobehavioral deficits, particularly in the areas of attention, aggression, and hyperactivity.

Conclusions These results suggest that prenatal lead exposure is a significant risk factor for childhood neurobehavioral deficits, and interventions aimed at reducing lead exposure during pregnancy could potentially improve children’s cognitive and behavioral outcomes.