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CHEMICAL EFFECTS

Development and child health in a world of synthetic chemicals

2024-09-14

Chemical pollution is one of today's most significant threats to the developmental potential of children worldwide. Maternal exposure to toxicants can perturb sensitive windows of fetal development, indirectly through promoting antenatal disorders, abnormal placental adaptation, or directly through maternal-fetal transport. Current evidence clearly shows that persistent organic chemicals promote hypertensive disorders of pregnancy, placental abnormalities, and fetal growth restriction, whereas findings are less consistent for phthalates and bisphenols. Prospective birth cohorts strongly support a link between adverse neurodevelopmental outcomes and prenatal exposure to flame retardants and organophosphate pesticides. Emerging evidence reveals a potential association between in utero exposure to bisphenols and childhood behavioral disorders, while childhood metabolic health is more consistently associated with postnatal exposure to phthalates and bisphenols. IMPACT: Synthesizes emerging evidence linking modern forms of chemical pollution to antenatal disorders, fetal growth restriction and childhood disorders. Highlights potential developmental impacts of emerging pollutants of concern now ubiquitous in our environment but without regulatory restrictions.

Authors: Jessica L Wager, Jennifer A Thompson

Full Source: Pediatric research 2024 Sep 14. doi: 10.1038/s41390-024-03547-z.

Synergistic Toxicity of Pollutant and Ultraviolet Exposure from a Mitochondrial Perspective

2024-08-23

Ultraviolet (UV) exposure and atmospheric pollution are both independently implicated in skin diseases such as cancer and premature aging. UVA wavelengths, which penetrate in the deep layers of the skin dermis, exert their toxicity mainly through chromophore photosensitization reactions. Benzo[a]pyrene (BaP), the most abundant polycyclic aromatic hydrocarbon originating from the incomplete combustion of organic matter, could act as a chromophore and absorb UVA. We and other groups have previously shown that BaP and UVA synergize their toxicity in skin cells, which leads to important oxidation.

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Even if mitochondria alterations have been related to premature skin aging and other skin disorders, no studies have focused on the synergy between UV exposure and pollution on mitochondria. Our study aims to investigate the combined effect of UVA and BaP specifically on mitochondria in order to assess the effect on mitochondrial membranes and the consequences on mitochondrial activity. We show that BaP has a strong affinity for mitochondria and that this affinity leads to an important induction of lipid peroxidation and membrane disruption when exposed to UVA. Co-exposure to UVA and BaP synergizes their toxicity to negatively impact mitochondrial membrane potential, mitochondrial metabolism and the mitochondrial network. Altogether, our results highlight the implication of mitochondria in the synergistic toxicity of pollution and UV exposure and the potential of this toxicity on skin integrity.

Authors: Eloïse Larnac, Sébastien Méthot, Frédéric Pelchat, Marc-Antoine Millette, Alicia Montoni, Christian Salesses, Valérie Haydont, Laurent Marrot, Patrick J Rochette

Full Source: International journal of molecular sciences 2024 Aug 23;25(17):9146. doi: 10.3390/ijms25179146.

Silico-tuberculosis: An updated review

2024-10

Silico-Tuberculosis (silico-TB) is a severe combination of tuberculosis and silicosis, caused by occupational exposure to fine crystalline silica dust, which has become a global health concern. This comprehensive review compiles the updated knowledge regarding pathophysiology, clinical manifestations, important diagnostic techniques, treatment aspects, and challenges in understanding silico-TB. The review compiles the disease's history and epidemiology, highlighting a lack of data owing to poor monitoring and healthcare particularly in low- and middle-income countries like India. Further weak safety regulations, lack of preventative measures, and inadequate education increase the rates of silico-TB. The pathophysiology shows how silica particles impair the immune system and stimulate Th2 cells and M2 macrophages, which exacerbate TB, while inhibiting Th1 cells and M1 macrophages, which fight against the disease. Subsequently, it can be difficult to distinguish current TB from pre-existing silicosis. In cases where sputum and X-ray results are negative, chest CT scans may be helpful since radiographic screening identifies TB earlier than sputum assessment. Isoniazid, rifampicin, or both minimize the risk of active tuberculosis in people with silicosis. Consistent anti-tuberculosis drug therapy is recommended for 8-9 months to stop recurrence. The

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assessment recommends integrating silicosis and TB control initiatives to fight this combined health issue.

Authors: Swati Sharma, Snehasish Nayak, Bhavani R, Kamal Singh

Full Source: The Indian journal of tuberculosis 2024 Oct;71(4):471-475. doi: 10.1016/j.ijtb.2024.01.005.

ENVIRONMENTAL RESEARCH

A conceptual framework for landscape-based environmental risk assessment (ERA) of pesticides

2024-09-10

While pesticide use is subject to strict regulatory oversight worldwide, it remains a main concern for environmental protection, including biodiversity conservation. This is partly due to the current regulatory approach that relies on separate assessments for each single pesticide, crop use, and non-target organism group at local scales. Such assessments tend to overlook the combined effects of overall pesticide usage at larger spatial scales. Integrative landscape-based approaches are emerging, enabling the consideration of agricultural management, the environmental characteristics, and the combined effects of pesticides applied in a same or in different crops within an area. These developments offer the opportunity to deliver informative risk predictions relevant for different decision contexts including their connection to larger spatial scales and to combine environmental risks of pesticides, with those from other environmental stressors. We discuss the needs, challenges, opportunities and available tools for implementing landscape-based approaches for prospective and retrospective pesticide Environmental Risk Assessments (ERA). A set of "building blocks" that emerged from the discussions have been integrated into a conceptual framework. The framework includes elements to facilitate its implementation, in particular: flexibility to address the needs of relevant users and stakeholders; means to address the inherent complexity of environmental systems; connections to make use of and integrate data derived from monitoring programs; and options for validation and approaches to facilitate future use in a regulatory context. The conceptual model can be applied to existing ERA methodologies, facilitating its comparability, and highlighting interoperability drivers at landscape level. The benefits of landscape-based pesticide ERA extend beyond regulation. Linking and validating risk predictions with relevant environmental impacts under a solid science-based approach will support the setting of protection goals and the formulation of sustainable agricultural strategies. Moreover, landscape

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ERA offers a communication tool on realistic pesticide impacts in a multistressors environment for stakeholders and citizens.

Authors: Jose V Tarazona, Mercedes de Alba-Gonzalez, Carole Bedos, Pierre Benoit, Colette Bertrand, Olivier Crouzet, Cécile Dagès, Jean-Lou Cm Dorne, Ana Fernandez-Agudo, Andreas Focks, Maria Del Carmen Gonzalez-Caballero, Alexandra Kroll, Matthias Liess, Susana Loureiro, Manuel E Ortiz-Santaliestra, Jes J Rasmussen, Raphaël Royauté, Maj Rundlöf, Ralf B Schäfer, Stephen Short, Ayesha Siddique, José Paulo Sousa, Dave Spurgeon, Pierre-François Staub, Chris J Topping, Marc Voltz, Johan Axelman, Annette Aldrich, Sabine Duquesne, Vanessa Mazerolles, Yann Devos

Full Source: Environment international 2024 Sep 10:191:108999. doi: 10.1016/j.envint.2024.108999.

Impact of Bisphenol A and its alternatives on oocyte health: a scoping review

2024-09-14

Background: Bisphenol A (BPA) is an endocrine disrupting chemical released from plastic materials, including food packaging and dental sealants, persisting in the environment and ubiquitously contaminating ecosystems and human populations. BPA can elicit an array of damaging health effects and, alarmingly, 'BPA-free' alternatives mirror these harmful effects. Bisphenol exposure can negatively impact female fertility, damaging both the ovary and oocytes therein. Such damage can diminish reproductive capacity, pregnancy success, and offspring health. Despite global government regulations in place to indicate 'safe' BPA exposure levels, these policies have not considered the effects of bisphenols on oocyte health.

Objective and rationale: This scoping review was conducted to evaluate evidence on the effects of BPA and BPA alternatives on standardized parameters of oocyte health. In doing so, this review addresses a critical gap in the literature providing a comprehensive, up-to-date synthesis of the effects of bisphenols on oocyte health.

Search methods: This scoping review was conducted in accordance with PRISMA guidelines. Four databases, Medline, Embase, Scopus, and Web of Science, were searched twice (23 February 2022 and 1 August 2023) to capture studies assessing mammalian oocyte health post-bisphenol exposure. Search terms regarding oocytes, ovarian follicles, and bisphenols were utilized to identify relevant studies. Manuscripts written in English and reporting the effect of any bisphenol on mammalian oocyte health from all years were included. Parameters for toxicological studies were evaluated, including the number of bisphenol concentrations/doses

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tested, dosing regimen, biological replicates and/or animal numbers, and statistical information (for human studies). Standardized parameters of oocyte health including follicle counts, oocyte yield, oocyte meiotic capacity, morphology of oocyte and cumulus cells, and oocyte meiotic spindle integrity were extracted across the studies.

Outcomes: After screening 3147 studies, 107 studies of either humans or mammalian animal models or humans were included. Of the in vitro exposure studies, 96.3% (26/27) and 94.1% (16/17) found at least one adverse effect on oocyte health using BPA or BPA alternatives (including BHPF, BPAF, BPB, BPF, and BPS), respectively. These included increased meiotic cell cycle arrest, altered morphology, and abnormal meiotic spindle/chromosomal alignment. In vivo, 85.7% (30/35) of studies on BPA and 92.3% (12/13) on BPA alternatives documented adverse effects on follicle development, morphology, or spindle/chromosome alignment. Importantly, these effects were recorded using levels below those deemed 'safe' for human exposure. Over half (11/21) of all human observational studies showed associations between higher urinary BPA levels and reduced antral follicle counts or oocyte yield in IVF patients. Recommendations are presented based on the identified shortcomings of the current evidence, incorporating elements of FDA requirements for future research in the field.

Wider implications: These data highlight the detrimental impacts of low-level BPA and BPA alternative exposure, contributing to poor oocyte quality and reduced fertility. These outcomes are valuable in promoting the revision of current policies and guidelines pertaining to BPA exposure internationally. This study serves as a valuable resource to scientists, providing key recommendations on study design, reporting elements, and endpoint measures to strengthen future studies. Ultimately, this review highlights oocyte health as a fundamentally important endpoint in reproductive toxicological studies, indicating an important direction for future research into endocrine disrupting chemicals to improve fertility outcomes.

Authors: Alexandra E Peters, Emmalee A Ford, Shaun D Roman, Elizabeth G Bromfield, Brett Nixon, Kirsty G Pringle, Jessie M Sutherland

Full Source: Human reproduction update 2024 Sep 14:dmae025. doi: 10.1093/humupd/dmae025.

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PHARMACEUTICAL/TOXICOLOGY

Targeted investigation of per- and polyfluoroalkyl substances from domestic cosmetics and personal care products in China and its implications for human exposure

2024-09-12

Per- and polyfluoroalkyl substances (PFASs) are synthetic chemicals reported in daily supplies, and skin absorption is one of the routes for human exposure to PFASs. This study aims to evaluate the potential risk of PFASs exposure from cosmetics and personal care products in China. A random sampling of 44 domestic cosmetics and personal care products, summarized into 6 categories, was conducted to investigate the concentrations of 24 target PFASs. PFASs concentrations of 86.4 % products were lower than 100 ng/g, and 34.2 % products were lower than 10 ng/g. PFCAs and PAPs were dominant. Keywords of "wear-resistant" and "long-lasting" may indicate the presence of PFASs in products. Disabled PFOA, PFOS, and PFHxA were not detected. Notably, the presence of PFHxA should be of concern, and its detection frequency reached 59.1 %, with the maximum concentration of 1274.77 ng/g. Further, the daily exposure dose (DED) of Σ PFASs from skin exposure through cosmetics and personal care products was evaluated to be 3.01 ng/kg-bw/day, which wasn't negligible compared to the prescribed acceptable intake value. Conclusively, this study emphasizes that cosmetics and personal care products are important sources leading to the PFASs skin exposure and provides a basis for future regulation of PFASs as product additive.

Authors: Xuan Zhao, Mengru Fu, Shanqi Zhou, Yanna Han, Wei Zhang, Cheng Peng, Qingqing Li, Qinghe Zhu, Jie Yang

Full Source: The Science of the total environment 2024 Sep 12:176207. doi: 10.1016/j.scitotenv.2024.176207.

Tetrachloroethylene exposure and neurobehavioral performance among children living near multiple contamination sites

2024-09-12

Background: Tetrachloroethylene (PCE) is a known neurotoxicant mainly observed in populations with high level occupational exposure, but health effects of low-level community exposure are poorly understood. This study evaluated PCE exposure and neurobehavioral performance in 6- to 11-year-old children living in a community with multiple PCE contamination sites.

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Methods: This cross-sectional study recruited eighty-nine children who attended public schools in Martinsville, Indiana. PCE was measured in exhaled breath using proton transfer reaction mass spectrometry, children were classified into three exposure groups 'Level 1' ($\leq 0.75 \mu\text{g}/\text{m}^3$), 'Level 2' ($0.75\text{-}1.90 \mu\text{g}/\text{m}^3$), and 'Level 3' ($>1.90 \mu\text{g}/\text{m}^3$). A battery of tests assessed children's neurobehavioral performance related to their cognition, behavior, and academic achievement and a questionnaire collected demographic and exposure characteristics. Adjusted regression models estimated associations of PCE exposure with neurobehavioral outcomes.

Results: Seventy-three participants completed data collection. The average scores for all participants on the Fluid, Total, Early Childhood Composites, Behavioral Symptoms Index, and Math Computation were significantly lower than standard scores of normative sample, with 30 % of participants having one or more scores two standard deviations worse than the standard scores. Compared to children having the lowest PCE exposure, significant inverse associations were identified for PCE exposure with Fluid Composite for Level 2 ($\beta = -12.0$ (95 % CI = $-23.4, -0.6$)) and Level 3 (-12.2 ($-23.4, -1.0$)) exposure groups, Total Composite for Level 2 (-10.1 ($-19.2, -1.1$)) and Level 3 (-11.8 ($-20.4, -3.2$)) exposure groups, and Early Childhood Composite for Level 3 exposure group (-11.0 ($-18.7, -3.4$)).

Conclusions: This study identified associations of PCE in exhaled breath with lower cognitive functioning, problem-solving abilities, and adaptive functioning in children. Mainly, working memory, episodic memory, processing speed, and executive function-cognitive flexibility were affected by PCE exposure. These results underscore the need for further investigations, considering the impact of low-level environmental exposure on children's neurobehavioral outcomes.

Authors: Marwan Alajlouni, Ian Kurz, Jung Hyun Lee, Alaina K Bryant, Jackson Pechin, Brandon Tso, Abigail Valdez, Sujana Vemuru, Monica Bozyski, Bethaney Latham, Stephanie Littell, Samantha Mills, Steven M Koch, Mary E Turyk, Sa Liu
Full Source: The Science of the total environment 2024 Sep 12:176172. doi: 10.1016/j.scitotenv.2024.176172.

OCCUPATIONAL

Occupational exposure and new-onset asthma in the population-based Telemark study: a 5-year follow-up

2024-09-13

Objectives: This study aimed to estimate the incidence of asthma and assess the association between job exposure matrix (N-JEM) assigned

Objectives: This study aimed to estimate the incidence of asthma and assess the association between job exposure matrix (N-JEM) assigned occupational exposure, self-reported occupational exposure to vapour, gas, dust and fumes (VGDF), mould, damages from moisture and cold, and new-onset asthma.

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occupational exposure, self-reported occupational exposure to vapour, gas, dust and fumes (VGDF), mould, damages from moisture and cold, and new-onset asthma. We also aimed to assess the corresponding population attributable fraction (PAF) for ever exposure to VGDF.

Design: Longitudinal population-based respiratory health study.

Setting: Responders from the baseline Telemark Study in south-eastern Norway were followed up from 2013 to 2018.

Participants: 7120 participants, aged 16-55, were followed during a 5-year period.

Main outcome measures: New-onset asthma and its association with self-reported occupational exposure to VGDF, data from the N-JEM and self-reported workplace conditions were assessed using logistic regression adjusted for gender, age, smoking and body mass index. The PAF was calculated using the PUNAF command in STATA.

Results: There were 266 (3.7%) cases of new-onset asthma and an incidence density of 7.5 cases per 1000 person-years. A statistically significant association was found for ever exposed to VGDF with an OR of 1.49 (95% CI 1.15 to 1.94), weekly OR 2.00 (95% CI 1.29 to 3.11) and daily OR 2.46 (95% CI 1.39 to 4.35) exposure to VGDF. The corresponding PAF for ever exposed to VGDF was 17% (95% CI 5.4% to 27.8%) and the risk of asthma onset increased with frequent VGDF exposure, indicating a possible exposure-response relationship ($p=0.002$ for trend). The N-JEM exposure group, accidental peak exposure to irritants had an increased risk of new-onset asthma, OR 2.43 (95% CI 1.21 to 4.90). A significant association was also found for self-reported exposure to visible damages due to moisture 1.51 (95% CI 1.08 to 2.11), visible and smell of mould 1.88 (95% CI 1.32 to 2.68), 1.55 (95% CI 1.12 to 2.16) and cold environment 1.41 (95% CI 1.07 to 1.86).

Conclusion: Participants had elevated ORs for asthma associated with self-reported and N-JEM-assigned exposures. A PAF of 17% indicates that work-related asthma is still common. The possible exposure-response relationship suggests that reducing occupational VGDF exposure frequency could prevent the onset of asthma.

Authors: Nikola Zivadinovic, Keson Jaoiun, Geir Klepaker, Anthony Wagstaff, Kjell Torén, Paul K Henneberger, Johny Kongerud, Regine Abrahamsen, Anne Kristin Moeller Fell

Full Source: BMJ open 2024 Sep 13;14(9):e090131. doi: 10.1136/bmjopen-2024-090131.

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Historical exposure to metals in contaminated areas and its impact on cardio- and cerebrovascular health

2024-09-14

Environmental pollution is of global concern. In Southeast Sweden, historical glass production has contaminated communities with toxic metals. Long-term residency in these communities and high consumption of local foods may constitute a risk for cardiovascular disease (CVD) or stroke. The current study investigates if residency in these contaminated sites and long-term consumption of local foods is associated with self-reported CVD and stroke. In addition, the body burden of the toxic metals arsenic, cadmium, and lead, as well as inflammatory protein markers, were studied for association with CVD and stroke. From an existing questionnaire cohort and biomonitoring sub cohort (n = 2290/882) of people living in the contaminated areas, self-reported CVD cases (n = 366/166) and stroke cases (n = 78/25) were identified. Individuals were grouped based on their residency within a 2 km radius of glassworks with historical high, moderate, or low air-borne lead emissions. Body burden of arsenic, cadmium, and lead was analyzed using ICP-MS. Inflammatory markers were investigated using electrochemiluminescence. Long-term residency near glassworks with historically high levels of lead emissions, and high consumption of local foods, were associated with CVD. The risk was increasing for each year of residency in high emission areas. Increased body burden of arsenic in blood, and lead in urine, were associated with stroke. Five and two inflammatory markers, respectively, were elevated in CVD and stroke cases after adjusting for confounders. An increased risk for CVD was found in areas with historically high emissions of lead but possibly also other toxic metals. Interestingly, there was an indication of a dose-response relationship with increasing risk for CVD per year of residency time. Inhalation and consumption of local food may constitute major pathways for this association. The study shows that long-term exposure to toxic metals in these contaminated areas is associated with CVD and that there is a need to limit exposure in the general population.

Authors: Louise Ekholm, Stefan Ljunggren, Ingela Helmfriid

Full Source: International journal of hygiene and environmental health 2024 Sep 14;263:114461. doi: 10.1016/j.ijheh.2024.114461.

Environmental pollution is of global concern.

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Impact of continuous Triazophos exposure on *Labeo rohita*: Physiological, biochemical, and histological alterations and IBRv2 index assessment

2024-09

Pesticides are commonly used in agriculture and aquaculture. Triazophos, an organophosphate-based pesticide, is widely used in agriculture to control many insect pests. Due to its high photochemical stability and mode of action, Triazophos could persist in the aquatic ecosystem and cause toxic effects on non-target organisms. We have studied the potential toxic effects of Triazophos on *L. rohita*. Primarily, we determined the median lethal concentration (LC50) of Triazophos for 24 and 96 h. Next, we studied acute (96 h, LC50-96 h) toxicity. Then, we studied chronic (35 days, 1/10th LC50-24 h Treatment I: 0.609 mg/L, 1/5th LC50-96 h Treatment II: 1.044 mg/L) toxicity. We analyzed blood biomarkers such as hematology (Hb, Hct, RBC, WBC, MCV, MCH and MCHC), prolactin, cortisol, glucose and protein levels. Concurrently, we analyzed tissue biomarkers such as glycogen, GOT, GPT, LDH and histopathology. IBRv2 index assessment method was also to evaluate the Triazophos toxicity. Studied hematological, hormonal, biochemical and enzymological biomarkers were affected in Triazophos treated groups when compare to the control group. The changes in these biomarkers were statistically significant at the 0.05 alpha level. Triazophos exposed fish shown a severe degenerated primary and secondary lamellae, lamellar fusion, hypertrophy and telangiectasia in the gills. In the hepatic tissue, it caused moderate necrosis, blood congestion, distended sinusoids with minor vacuolation, prominent pyknotic nuclei, hypertrophy, cloudy swelling of cells, lipid accumulation and fibrotic lesions. In the renal tissue, Triazophos caused thickening of Bowman's capsule, hyaline droplets degeneration, irregular renal corpuscle, congestion, cellular swelling, degeneration of tubular epithelium, necrosis, shrunken glomerulus, vacuolated glomerulus, hypertrophy, exudate and edema. IBRv2 analysis suggested that tissue biomarkers are highly sensitive to Triazophos toxicity and prolonged exposure could cause serious health effects like acute toxicity in fish. Triazophos could cause multiorgan toxicity at studied concentrations.

Authors: Mathan Ramesh, Subbaraya-Gounder Selvaraju, Rama-Krishnan Poopal, Zongming Ren, Bin Li

Full Source: Pesticide biochemistry and physiology 2024 Sep;204:106043. doi: 10.1016/j.pestbp.2024.106043.

Pesticides are commonly used in agriculture and aquaculture.