CHEMWATCH

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CHEMICAL EFFECTS

Is occupational asthma caused by low-molecular-weight chemicals associated with contact dermatitis? A retrospective study

2022-05-25

Background: Occupational asthma (OA) may have different etiologies, but it is not clear whether the etiologic agents influence the clinical presentation, especially the co-occurrence of skin lesions. Objective: The aim of this study was to determine the impact of different asthmagens on the characteristics of OA, with a focus on the occurrence of prior or concomitant skin disorders. Methods: In a retrospective analysis of patients who visited the Occupational and Environmental Disease Clinic of a tertiary referral hospital from 2009 to 2019, we classified patients into definite, probable or possible OA according to prespecified diagnostic guidelines. In multivariate logistic regression with sensitivity analysis, we examined the relation of high- and low-molecular-weight (HMW and LMW) agents with the clinical presentation. Results: Of 209 cases of OA, 66 were caused by HMW agents, and 143 by LMW agents. OA patients exposed to LMW agents had higher odds of having (had) allergic contact dermatitis (OR: 5.45 [1.80-23.70], p<0.01), compared with patients exposed to HMW agents. Conversely, HMW agents were associated with a higher odds of rhinitis symptoms (OR of LMW/HMW: 0.33 [0.17-0.63], p<0.001) and high total IgE (OR of LMW/HMW: 0.35 [0.17-0.70], p<0.01). Risk factors for having co-existing contact dermatitis included construction work, hairdressing, exposure to metals or epoxy resins. Conclusion: Among patients with occupational asthma, exposure to specific LMW agents was associated with a high frequency of contact dermatitis. Different types of asthmagens within HMW or LMW agents appear to determine the phenotype and co-morbidity of OA.

Authors: Hung-Chang Tsui, Steven Ronsmans, Peter H M Hoet, Benoit Nemery, Jeroen A J Vanoirbeek

Full Source: The journal of allergy and clinical immunology. In practice 2022 May 25;S2213-2198(22)00502-5. doi: 10.1016/j.jaip.2022.05.014.

Background: Occupational asthma (OA) may have different etiologies, but it is not clear whether the etiologic agents influence the clinical presentation, especially the co-occurrence of skin lesions.

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Pulmonary toxicity and gene expression changes in response to whole-body inhalation exposure to multi-walled carbon nanotubes in rats

2022-06-01

Purpose: To investigate the molecular mechanisms underlying the pulmonary toxicity induced by exposure to one form of multi-walled carbon nanotubes (MWCNT-7).Materials and methods: Rats were exposed, by whole-body inhalation, to air or an aerosol containing MWCNT-7 particles at target cumulative doses (concentration x time) ranging from 22.5 to 180 (mg/m3)h over a three-day (6 hours/day) period and toxicity and global gene expression profiles were determined in the lungs. Results: MWCNT-7 particles, associated with alveolar macrophages (AMs), were detected in rat lungs following the exposure. Mild to moderate lung pathological changes consisting of increased cellularity, thickening of the alveolar wall, alveolitis, fibrosis, and granuloma formation were detected. Bronchoalveolar lavage (BAL) toxicity parameters such as lactate dehydrogenase activity, number of AMs and polymorphonuclear leukocytes (PMNs), intracellular oxidant generation by phagocytes, and levels of cytokines were significantly ($p < 0.05$) increased in response to exposure to MWCNT-7. Global gene expression profiling identified several significantly differentially expressed genes (fold change >1.5 and FDR p value <0.05) in all the MWCNT-7 exposed rats. Bioinformatic analysis of the gene expression data identified significant enrichment of several diseases/biological function categories (for example, cancer, leukocyte migration, inflammatory response, mitosis, and movement of phagocytes) and canonical pathways (for example, kinetochore metaphase signaling pathway, granulocyte and agranulocyte adhesion and diapedesis, acute phase response, and LXR/RXR activation). The alterations in the lung toxicity parameters and gene expression changes exhibited a dose-response to the MWCNT exposure.Conclusions: Taken together, the data provided insights into the molecular mechanisms underlying the pulmonary toxicity induced by inhalation exposure of rats to MWCNT-7.

Authors: Tina M Sager, Christina M Umbright, Gul Mehnaz Mustafa, Jenny R Roberts, Marlene S Orandle, Jared L Cumpston, Walter G McKinney, Theresa Boots, Michael L Kashon, Pius Joseph

Full Source: Inhalation toxicology 2022 Jun 1;1-19. doi: 10.1080/08958378.2022.2081386.

Purpose: To investigate the molecular mechanisms underlying the pulmonary toxicity induced by exposure to one form of multi-walled carbon nanotubes (MWCNT-7). Materials and methods: Rats were exposed, by whole-body inhalation, to air or an aerosol containing MWCNT-7 particles at target cumulative doses (concentration x time) ranging from 22.5 to 180 (mg/m3)h over a three-day (6 hours/day) period and toxicity and global gene expression profiles were determined in the lungs. Results: MWCNT-7 particles, associated with alveolar macrophages (AMs), were detected in rat lungs following the exposure.

ENVIRONMENTAL RESEARCH

Traffic-Related Air Pollution and Lung Cancer Incidence: The California Multiethnic Cohort Study

2022-06-01

Background: While the contribution of air pollution to lung cancer risk is well characterized, few studies have been conducted in racially/ethnically and socioeconomically diverse populations. Methods: Among 97,288 California participants of the Multiethnic Cohort Study, we used Cox proportional hazards regression to examine associations between time-varying traffic-related air pollutants (gaseous and particulate matter (PM) pollutants and regional benzene) and lung cancer risk (n=2,796 cases; average follow-up=17 years), adjusting for demographics, lifetime smoking, occupation, neighborhood socioeconomic status (nSES), and lifestyle factors. Subgroup analyses were conducted for race/ethnicity, nSES, and other factors. Results: Among all participants, lung cancer risk was positively associated with nitrogen oxide (hazard ratio (HR)=1.15 per 50 ppb; 95% CI: 0.99-1.33), nitrogen dioxide (HR=1.12 per 20 ppb; 95% CI: 0.95-1.32), PM2.5 (HR=1.20 per 10 µg/m3; 95% CI: 1.01-1.43), carbon monoxide (HR=1.29 per 1000 ppb; 95% CI: 0.99-1.67) and regional benzene (HR=1.17 per 1 ppb; 95% CI: 1.02-1.34) exposures. These patterns of association were driven by associations among African American and Latino American groups. There was no formal evidence for heterogeneity of effects by nSES (p heterogeneity>0.31); although participants residing in low SES neighborhoods had increased lung cancer risk associated with nitrogen oxides and no association was observed among those in high SES neighborhoods. Conclusion: These findings in a large multiethnic population reflect an association between lung cancer and the mixture of traffic-related air pollution, and not a particular individual pollutant. They are consistent with the adverse effects of air pollution that have been described in less racially/ethnically and socioeconomically diverse populations. Our results also suggest an increased risk of lung cancer among those residing in low SES neighborhoods.

Authors: Iona Cheng, Juan Yang, Chiuchen Tseng, Jun Wu, Salma Shariff-Marco, Sung-Shim Lani Park, Shannon M Conroy, Pushkar P Inamdar, Scott Fruin, Timothy Larson, Veronica W Setiawan, Mindy C DeRouen, Scarlett Lin Gomez, Lynne R Wilkens, Loïc Le Marchand, Daniel O Stram, Jonathan Samet, Beate Ritz, Anna H Wu

Full Source: American journal of respiratory and critical care medicine 2022 Jun 1. doi: 10.1164/rccm.202107-1770OC.

Background:
While the contribution of air pollution to lung cancer risk is well characterized, few studies have been conducted in racially/ethnically and socioeconomically diverse populations.

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PHARMACEUTICAL/TOXICOLOGY

Epigenome-wide DNA methylation signature of plasma zinc and their mediation roles in the association of zinc with lung cancer risk

2022-05-30

Essential trace element zinc is associated with decreased lung cancer risk, but underlying mechanisms remain unclear. This study aimed to investigate role of DNA methylation in zinc-lung cancer association. We conducted a case-cohort study within prospective Dongfeng-Tongji cohort, including 359 incident lung cancer cases and a randomly selected sub-cohort of 1399 participants. Epigenome-wide association study (EWAS) was used to examine association of plasma zinc with DNA methylation in peripheral blood. For the zinc-related CpGs, their mediation effects on zinc-lung cancer association were assessed; their diagnostic performance for lung cancer was testified in the case-cohort study and further validated in another 126 pairs of lung cancer case-control study. We identified 28 CpGs associated with plasma zinc at $P < 1.0 \times 10\text{-}5$ and seven of them (cg07077080, cg01077808, cg17749033, cg15554270, cg26125625, cg10669424, and cg15409013 annotated to GSR, CALR3, SLC16A3, PHLPP2, SLC12A8, VGLL4, and ADAMTS16, respectively) were associated with incident risk of lung cancer. Moreover, the above seven CpGs were differently methylated between 126 pairs of lung cancer and adjacent normal lung tissues and had the same directions with EWAS of zinc. They could mediate a separate 7.05% 22.65% and a joint 29.42% of zinc-lung cancer association. Compared to using traditional factors, addition of methylation risk score exerted improved discriminations for lung cancer both in case-cohort study [area under the curve (AUC) = 0.818 vs. 0.738] and in case-control study (AUC = 0.816 vs. 0.646). Our results provide new insights for the biological role of DNA methylation in the inverse association of zinc with incident lung cancer.

Authors: Hua Meng, Wei Wei, Guyanan Li, Ming Fu, Chenming Wang, Shiru Hong, Xin Guan, Yansen Bai, Yue Feng, Yuhan Zhou, Qiang Cao, Fangfang Yuan, Meian He, Xiaomin Zhang, Sheng Wei, Yangkai Li, Huan Guo

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 May 30;307:119563. doi: 10.1016/j.envpol.2022.119563.

Essential trace element zinc is associated with decreased lung cancer risk, but underlying mechanisms remain unclear.

Per- and polyfluoroalkyl substances (PFAS) exposure in women seeking in vitro fertilization-embryo transfer treatment (IVF-ET) in China: Blood-follicular transfer and associations with IVF-ET outcomes

2022-05-27

As follicular fluid constitutes a critical microenvironment for the development of oocytes, investigation of environmental contaminants in follicular fluid may facilitate a better understanding of the influence of environmental exposure on reproductive health. In the present study, we aimed to investigate per- and polyfluoroalkyl substances (PFAS) exposure in women receiving in vitro fertilization-embryo transfer (IVF-ET) treatment, determine the blood-follicle transfer efficiencies (BFTE) of PFAS, and explore potential associations between PFAS exposure and selected IVF-ET outcomes. Our results revealed that n-PFOA was the most abundant PFAS in both serum and follicular fluid (FF) (median = 5.85 and 5.56 ng/mL, respectively), followed by n-PFOS (4.95 and 4.28 ng/mL), 6:2 Cl-PFESA (2.18 and 2.10 ng/mL), PFNA (1.37 and 1.37 ng/mL), PFUdA (0.33 and 0.97 ng/mL), PFDA (0.37 and 0.66 ng/mL), PFHxS (0.42 and 0.39 ng/mL), and PFHpS (0.11 and 0.10 ng/mL). The median BFTE ranged from 0.65 to 0.92 for individual PFAS, indicating a relatively high tendency of PFAS to cross the blood-follicle barrier (BFB). An inverted V-shaped trend was observed between the median BFTE and the number of fluorinated carbon atoms or the log Kow (octanol-water partition coefficient) for individual PFAS, suggesting the influence by physicochemical properties and molecular structures. Although our data did not find any clear pattern in the link between blood or follicular fluid concentrations of PFAS and selected IVF-ET outcomes, our study raises the need for better characterization of exposure to environmental chemicals in follicular fluid together with its potential influence on reproductive health.

Authors: Aobo Hong, Lili Zhuang, Qun Lu, Pan Yang, Shu Su, Bin Wang, Guohuan Zhang, Da Chen

Full Source: The Science of the total environment 2022 May 27;156323. doi: 10.1016/j.scitotenv.2022.156323.

As follicular fluid constitutes a critical microenvironment for the development of oocytes, investigation of environmental contaminants in follicular fluid may facilitate a better understanding of the influence of environmental exposure on reproductive health.

Health risk assessment of inhalation exposure to dry fogging of hydrogen peroxide in a dental clinic during the COVID-19 pandemic

2022-06-02

After the outbreak of COVID-19, many dental clinics use dry fogging of hydrogen peroxide (H2O2) to disinfect the air and surfaces. Inhalation

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of highly concentrated solutions of H2O2 may cause severe respiratory problems. This study aimed to estimate the health risk assessments of inhalation exposure to dry fogging of H2O2 in a dental clinic. This cross-sectional, descriptive-analytical study was performed to determine the inhalation exposure and health risk of 9 dental clinic staff with H2O2 in six rooms. Occupational exposure to H2O2 was assessed using the OSHA VI-6 method and a personal pump with the flow rate of 500 mL/min connected to the midget fritted-glass impinger containing 15 mL of TiOSO4 collecting solution. The health effects of H2O2 exposure were assessed using a respiratory symptoms questionnaire. The health risk assessment of inhaled exposure to H2O2 was also performed using the method provided by the Singapore occupational health department. The mean respiratory exposure of clinic staff to H2O2 was ranged from 1.3 to 2.83 ppm for six rooms which was above the limits recommended by international organizations. Dyspnea (44.4%), cough (33.3%), and nasal burning (22.2%) were the most prevalent health problems. The results also showed a medium risk for endodontics and surgery, and lower risk for periodontics, restorative care, orthodontics, and prosthetics. The results of this study indicate that when using an automated hydrogen peroxide-vapor fogger, calculating the spraying time based on room volume and using the rooms after 30 min of fogging is very important and can greatly reduce the risk ranking.

Authors: Ghasem Hesam, Masoomeh Vahabi Shekarloo, Ali Atamaleki, Mahdi Jalali, Behnam Hajipour-Verdom, Zahra Moradpour

Full Source: Environmental science and pollution research international 2022 Jun 2;1-6. doi: 10.1007/s11356-022-21174-1.

OCCUPATIONAL

Chronic effects of occupational exposure to mineral fibres and recurrent chest infections in insulators

2022-05-30

Exposure to mineral fibres (man-made forms of vitreous fibres often used as insulating material) is a risk factor for recurrent chest infections among workers, underscoring the necessity of workplace surveillance for protection from hazardous substances https://bit.ly/38cUpmA.

Authors: Subhabrata Moitra, Ali Farshchi Tabrizi, Linda Henderson, Fadi Khadour, Mohamed Osman, Lyle Melenka, Paige Lacy

Full Source: ERJ open research 2022 May 30;8(2):00095-2022. doi: 10.1183/23120541.00095-2022.

Exposure to mineral fibres (man-made forms of vitreous fibres often used as insulating material) is a risk factor for recurrent chest infections among workers, underscoring the necessity of workplace surveillance for protection from hazardous substances https://bit.ly/38cUpmA.

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Differences in Fine Particle Exposure and Estimated Pulmonary Ventilation Rate with Respect to Work Tasks of Wildland Firefighters at Prescribed Burns: A Repeated Measures Study

2022-06-02

Wildland firefighters (WLFFs) are exposed to a mixture of chemicals found in wildland fire smoke and emissions from nonwildland-fuel smoke sources such as diesel. We investigated compositional differences in exposure to particulate matter and explored differences in ventilation rate and potential inhaled dose relative to the work tasks of WLFFs. Repeated measures on ten professional and two volunteer firefighters were collected on prescribed burn and nonburn days. Personal monitoring consisted of real-time and gravimetric fine particulate matter (PM2.5), carbon monoxide (CO), and accelerometer measurements to estimate ventilation rate and potential dose of PM2.5. The fine particulate matter was analyzed for levoglucosan (LG) and light absorbing carbon as a surrogate for black carbon (BC). Breathing zone personal exposure concentrations of PM2.5, LG, BC, and CO were higher on burn days ($P < 0.05$). Differences in exposure concentrations were observed between burn day tasks ($P < 0.05$) with firefighters managing fire boundaries (holders) being exposed to higher CO and LG concentrations and less BC concentrations than those conducting lighting (lighters). While no statistical difference in PM2.5 exposure measures was observed between the two tasks, holders in the study tended to be exposed to higher PM2.5 concentrations (~1.4×), while lighters tended to have more inhaled amounts of PM2.5 (~1.3×). Our findings demonstrate possible diversity in the sources of particulate matter exposure at the fireline and suggest the potential importance of using dose as a metric of inhalation exposure in occupational or other settings.

Authors: Anna M Adetona, Olorunfemi Adetona, Ryan T Chartier, Michael H Paulsen, Christopher D Simpson, Stephen L Rathbun, Luke P Naeher

Full Source: Annals of work exposures and health 2022 Jun 2;wxac037. doi: 10.1093/annweh/wxac037.

Wildland firefighters (WLFFs) are exposed to a mixture of chemicals found in wildland fire smoke and emissions from nonwildland-fuel smoke sources such as diesel.

Occupational exposure to organophosphate esters in e-waste dismantling workers: Risk assessment and influencing factors screening

2022-07-15

Organophosphate esters (OPEs) are increasingly added in electronic products as alternative flame retardants, which may result in high occupational exposure of electronic waste recycling employees. This study investigated occupational exposure to OPEs in an e-waste recycling site in northern China, with intent to explore the impacts of occupational exposure and dismantling manipulation mode. Human urine samples from three sites with different distances from the core dismantling area, including employees from family workshops and plants with centralized management and residents from nearby areas, were collected and analyzed for OPEs' metabolites (mOPEs). The urinary ∑mOPEs' median concentrations (0.910 ng/mL) of all employees were significantly higher than those of residents in Ziya Town (0.526 ng/mL) and Jinghai downtown (0.600 ng/mL), suggesting the risk of occupational OPEs' exposure associated with e-waste dismantling. However, the spatial variation was insignificant for residents with different distances from the e-waste recycling site. Besides, OPEs' exposure levels were significantly affected by manipulation modes and the urinary ∑mOPEs' median concentrations in the employees of family workshops (1.05 ng/mL) were significantly higher than those in plants with centralized management (0.667 ng/mL). The result suggests that mechanical dismantling and active ventilating measures can reduce the OPEs' occupational exposure risk. Moreover, ∑mOPEs were higher in volunteers with age above 50 years old and in the underweight subgroup. Finally, different categories of mOPEs in human urine showed associations with corresponding OPEs in dust samples in the same area.

Authors: Xiaoying Li, Lei Wang, Yu Wang, Yiming Yao, Peng Zhang, Hongzhi Zhao, Hongwen Sun

Full Source: Ecotoxicology and environmental safety 2022 Jul 15;240:113707. doi: 10.1016/j.ecoenv.2022.113707.

Polycyclic aromatic hydrocarbon exposure and DNA oxidative damage of workers in workshops of a petrochemical group

2022-05-29

The petrochemical industry has promoted the development of economy, while polycyclic aromatic hydrocarbons (PAHs) produced by the industry become the threat for environment and humans. Data on human occupational exposure in petrochemical industry are limited. In the present study, urinary hydroxylated PAH metabolites (OH-PAHs) and a biomarker of DNA oxidative damage (8-hydroxy-2'-deoxyguanosine (8-OHdG)) were measured in 546 workers of a petrochemical group in Northeast China, to investigate PAH exposure and related potential health risk. The concentrations of ∑9OH-PAH in all workers were 0.25-175 μg/g

The petrochemical industry has promoted the development of economy, while polycyclic aromatic hydrocarbons (PAHs) produced by the industry become the threat for environ-ment and humans.

Cre with a median value of 4.41 μg/g Cre. Metabolites of naphthalene were the predominant compounds. The levels of PAH metabolites were significantly different for workers with different jobs, which were the highest for recycling workers (13.7 μg/g Cre) and the lowest for agency managers (5.12 μg/g Cre). Besides, higher levels of OH-PAHs were usually found in males and older workers. There was a dose-response relationship between levels of 8-OHdG and ∑9OH-PAHs ($p < 0.01$). No difference was observed in concentrations of 8-OHdG for workers of different gender or ages, work history as well as noise. Furthermore, workers simultaneously exposed to other potential pollutants and higher levels of ∑9OH-PAH had significantly higher levels of 8-OHdG compared with those in the corresponding subgroups. Our results suggested that exposure to PAHs or co-exposure to PAHs and potential toxics in the petrochemical plant may cause DNA damage. We call for more researches on the associations among noise, chemical pollution and oxidative stress to workers in the real working environment.

Authors: Xiao-Ya Lin, Yan-Xiang Liu, Ying-Jie Zhang, Hui-Min Shen, Ying Guo

Full Source: Chemosphere 2022 May 29;303(Pt 2):135076. doi: 10.1016/j.chemosphere.2022.135076.