3042 Physical dimension profiling of accumulated nanoplastics in human brain, kidney, and liver

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Background and Purpose: Recent studies have shown that micro- and nanoplastics have become ubiquitous resulting in inevitable human exposure. To evaluate exposure and link to adverse health outcomes, characterization of internalized plastic particles is necessary. Recent studies provide evidence of plastic particles in various human tissues with reference to accumulated mass, and some provide visual evidence of micron sized particles characteristic of plastic. To date, no study has adequately characterized nanoplastic accumulation in humans. The primary goal of this study was to identify and profile the physical dimensions of nanoplastic fragments in human tissues. **Methods:** Brain, kidney, and liver were obtained from five decedents by the University of New Mexico (UNM) with approval from the Office of the Medical Investigator and UNM Human Research Protection Office. Tissues (n=15) were digested using potassium hydroxide and ultracentrifuged. The pellet generated by the isolation method was previously shown to contain a mass-based (µg/g) level of plastic measured by pyrolysis gas chromatography mass spectrometry. To understand particle morphology, the pellet was resuspended and visualized by transmission electron microscopy using a modification of previously established methods for generating singlet carbon nanotubes and carbon nanofibers (National Institute for Occupational Safety and Health / RJ Lee Group). Identification and physical dimension profiling of single dispersed nanoplastic fragments was done for each tissue for each individual (n=205-231 individual measurements / tissue) with a total of 3251 measurements performed. **Results:** When considering all measured plastic fragments from all sampled tissues, the range for the length and width, respectively, were 46-432 nm and 13-107 nm for brain (n=1103), 31-334 nm and 8-83 nm for kidney (n=1075), and 34-654 nm and 10-116 nm for liver (n=1073). The mean ranges for length and width, respectively, of the five individuals were 154.9-181.7 nm and 41.6-50.2 nm for brain, 110.8-131.8 nm and 30.3-34.3 nm for kidney, and 135.0-172.0 nm and 32.3-40.1 nm for liver. The means of the five separate individuals for length was 171.2 ± 4.6 for brain, 124.4 ± 3.6 for kidney, and 147.6 ± 6.6 for liver. One-way analysis of variance (ANOVA) indicated significance ($p<0.0001$) with a Tukey's HSD post-hoc test indicating all groups were different from one another for length ($p<0.02$). The means of the five separate individuals for width was 45.9 ± 1.5 for brain, 32.3 ± 0.7 for kidney, and 36.1 ± 1.3 for liver. One-way ANOVA indicated significance ($p<0.0001$) with a Tukey's HSD post-hoc test indicating the brain was different from all groups ($p<0.001$). When examining the aspect ratio, the fragments, 78-83%, consisted of fiber morphology (greater than a 3:1 aspect ratio) as opposed to irregular particle shapes (aspect ratio less than 3:1; 17-22%). Raman spectroscopy, Fourier transform infrared spectroscopy, dissolution experiments using solvents such as chloroform and benzene with and without heating, and energy-dispersive X-ray spectroscopy provided confidence that the fragments were polymer plastic. The isolated and dispersed fragments, washed subsequently in benzene and heated to further remove any potential contaminating lipids, had a Raman spectral profile mirroring polyethylene, the most abundant plastic accumulating in human tissues, albeit with a peak from 1600-1700 cm^{-1} possibly due to high carbonyl content. A completely different method of tissue digestion using hydrogen peroxide also confirmed the presence of nanoplastic fragments in brain tissue. Procedural tests of 'blank' samples (no tissue) to evaluate for an artifact contributed no discernable pellet after ultracentrifugation and no measurable nanoplastic fragments. **Conclusions:** The results provide quantification of a size fraction of nanoplastics otherwise not previously characterized in human tissues. From the methods employed, the accumulation of nano-sized plastics comprised of a narrow, but consistent, size range. Interestingly, and quite remarkably, the difference was greater between tissues of a single individual and not across individuals. Consistently, the nano-sized fragments were larger in the brain than kidney or liver. The observations overall suggest some specificity with respect to systemic internalization and subsequent tissue accumulation of nano-sized plastic.

3043 Assessment of False Positive Rates in Capillary Blood Lead Sample Results Using Venous Confirmation Data

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Background and Purpose: A residential metals abatement program (RMAP) has been underway in Butte, MT for more than 20 years. The RMAP includes a blood lead monitoring program with a series of health studies being completed every 5 years to assess blood lead level (BLL) data collected from Butte children. The RMAP is administered by the Butte-Silver Bow County Health Department and includes ongoing blood lead testing for all families participating in the USDA Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Recent RMAP improvements include regular implementation of venous confirmation testing when a capillary test (using the LeadCareII device) indicates a child's BLL is ≥3.5 micrograms per deciliter (µg/dL). Capillary tests are useful for providing immediate results and follow-up, but are subject to false positives due to potential external contamination, and thus can result in overestimation of elevated BLL rates in the population being studied. False positive rates reported in recent literature are quite variable and studies reporting such rates are limited, particularly for BLLs closer to the CDC's more recent blood lead reference values of 3.5 and 5 µg/dL. Available data also indicate that false positive rates vary based on the magnitude of capillary BLL results. **Methods:** In this study, venous confirmation data collected through the RMAP were used to estimate false positive rates in elevated BLLs among Butte children based on capillary testing data. Data included in the study were collected between June 2022 and October 2024 from children aged 12 to 60 months, who tend to have the highest BLLs and are most vulnerable to the health effects of lead. Capillary test results ≥3.5 µg/dL with a venous confirmation sample collected within 14 days of the capillary test were included. The paired capillary and venous confirmation sample results were used to estimate false positive rates within the capillary dataset. The relationship between false positive rates and magnitude of BLLs was also examined. **Results:** Beginning in June 2022, program improvements including better hand washing before administration of capillary tests and regular venous confirmation testing produced a dataset of sufficient quality to reliably assess occurrence of false positives among capillary results. Out of 353 Butte children with a capillary blood lead test completed between June 2022 and October 2024, approximately 10% (36 children) had a capillary BLL ≥3.5 µg/dL paired with a venous confirmation sample collected within 14 days of the capillary test. Of these 36 results, 24 were ≥5 µg/dL and 8 were ≥10 µg/dL. The false positive rate among the 36 capillary blood lead test results ≥3.5 µg/dL was estimated to be 36%. A similar rate of 33% was observed among the 24 BLLs ≥5 µg/dL. Among the 8 capillary BLLs ≥10 µg/dL, the false positive rate was higher at 50%, though too few results occurred in this category to make a reliable conclusion about differences in false positive rates with BLL magnitude. **Conclusions:** The false positive rates among capillary blood lead test results estimated based on recent data from children in Butte, MT supplement the limited data available in the literature. Results of this study can be considered when assessing the potential for false positives to affect results of LeadCareII screening programs. Understanding the potential for false positive results is important for evaluating elevated BLLs in the range of 3.5 to 5 µg/dL, particularly as BLLs and nationwide reference values continue to decline over time.

3044 Subways' sound levels and prediction model in North America

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Background and Purpose: Noise exposure in subway stations is a significant health risk, with levels often exceeding safe limits. Studies indicate that platform noise frequently surpasses in-train noise, posing substantial risk for noise-induced hearing loss (NIHL) and related health issues. Chronic exposure can lead to not only NIHL but also issues like hypertension, sleep disturbances, and mental health impacts. Urban residents who rely on public transit are particularly vulnerable, especially as many passengers listen to portable music, compounding the noise exposure. Therefore, this study was designed to address this problem and focused on the external factors that can influence the generated noise. **Methods:** 180 sound level samples were recorded in New York City's subway system across four boroughs (35 stations per borough - Manhattan, Brooklyn, Queens and Bronx). In addition, 10 station samples were collected in Toronto, Montreal and Philadelphia each city. Platform and on-train samples were measured for 10 minutes to achieve real-life exposure to sound. Throughout the measurements, external factors such as day of the week, time, platform type (single or multiple lined track), station type (underground or above ground), occupancy of the station, width of the station, and the number of passing trains. These factors were used to develop prediction models, using machine learning exercises for sound levels in subway stations. The targeted noise values were Leq (equivalent continuous average) and Lmax (maximum noise level). **Results:** The overall data had a normal distribution ($p=0.349$) for Leq levels with a mean of 81.7 decibels (dB) and standard deviation (SD) of 4.2 dB. As for Lmax, however, the sound levels showed more variety with a mean of 94.9 dB and an SD of 4.9, following a non-normal and right-skewed distribution in data ($p = 0.0001$). Furthermore, the machine learning prediction model provided error of about only 1 dB for both Leq and Lmax, whereas linear regression showed about 2 dB. **Conclusions:** The distribution of data suggests that the overall level of noise in subways, especially in New York, to be higher compared to previously reported studies, and Leq being consistent across most underground stations and boroughs. Moreover, with the use of machine learning and prediction models, it can be concluded that the recorded features influencing the level of noise are enough to help monitor proactive management of sound exposure in subway environments (error close to 1 dB). The current research proposes the potential utility of these methods, as a new way of subway station designing and in the developmental stages of subway planning focusing on noise level sources at stations.

SOT 64TH ANNUAL MEETING & ToxExpo • March 16–20, 2025 ORLANDO, FLORIDA

The Toxicologist

Supplement to *Toxicological Sciences*

SOT | Society of Toxicology

OXFORD UNIVERSITY PRESS

Toxicological Sciences

The Official Journal of the Society of Toxicology

ISSN 1096-6080 Volume 204, Issue S1 (March 2025)
www.academic.oup.com/toxsci

Publication Date: March 5, 2025