Wristband Literature Review Summary

PubMed Search: "wristband" AND "exposure" in the past ten years (2014-2024) = 79 results

16 papers included

Exposures Detected
Summary: Previous studies have been able to detect EDCs, flame retardants OPEs and phthalates DBP, BBP, DEHT, PAHs, CPs, PCBs, and pesticides for analysis. Concentrations of these chemicals can be higher when the wristband is worn longer. PM2.5 AQI data was not correlated with PAH concentrations in wristbands.
Almost half of all chemicals detected included 14 potential EDCs (endocrine disrupting chemicals) (Dixon 2019) Children (4-6 yrs) and flame retardants/plasticizers: 13 of 18 OPEs and all phthalates were detected in >80% of wristbands (Hammel 2020) Nine out of the top 15 detected chemicals detected using the 1,530-screen are classified as EDCs (Samon 2023) Data reflect the ability of silicone wristbands to bind smaller molecular weight, semi volatile PAHs similar to XAD resin. Wristbands may be useful in studies evaluating semi volatile PAHs (Mendoza-Sanchez 2022) Lipid content reported for the first time. Exposures to CPs are related to microenvironments (home, office, outdoors) via wristbands (Yin 2023) 69/94 chemicals were detected in at least 1/364 wristbands. In many cases, higher values of PM2.5 AQI values were correlated with lower concentrations in the wristbands. These correlation results indicate that the personal chemical exposure cannot be solely explained by PM2.5 AQI or HMS data alone (Bramer 2024) The daily increase in wristband concentrations after one day of wear was stable between one and five days of wear. Comparisons for the pesticides cis- and trans-permethrin, and the phthalates DBP, BBP and DEHT were strong and statistically significant overtime (Samon 2024) The majority of the most abundant PCBs in the wristbands, such as PCB-66, -44, and -70, are not captured in the common analyses of indicator PCBs (Hammel 2024)
Work in special populations

Summary: Wristbands can reflect unique/increased exposures that certain populations experience. It is important to compare who is getting exposed to which chemicals to protect them in future work/experiences.

Office workers in India/China exposed to many phthalates, pesticides, PAHs. USA/UK workers had more exposure to flame retardants (BFRs and OPEs). Most of these chemicals are "legacy chemicals" and had been banned for many years (Young 2021)

Roofers using hot asphalt: temporal sensitivity over a single workday versus work week (O'Connell 2014)

Survivors of Hurricane Harvey (TX): Increased exposure to EDCs in minority racial/ethnic groups and low-income neighborhoods following Hurricane Harvey (Samon 2023)

Demolition workers of buildings contaminated with PCBs in Denmark: wristbands of workers working directly with PCB contaminated areas such as sealant cutters were the highest, and workers matched the wristbands of residents of these buildings before demo (Hammel 2024)

Urine as a comparative biospecimen

Summary: Wristbands serve as a better comparative tool to urinary metabolites than hand wipes. Wristbands have been proven to correctly represent OPEs, phthalates, flame retardants TDCIPP and TCIPP, and PAHs that were found in urinary specimens. However, one study found that wristbands better represented triphenyl phosphate, benzophenone, and triclosan exposures than a urine sample showed.

Children (4-6 yrs) and flame retardants/plasticizers: 6 OPEs and 4 phthalates were significantly associated with corresponding urinary metabolites (r_s=0.2-0.6, $p<0.05$). When compared to paired hand wipes and house dust, wristbands were found to have similar or greater correlation coefficients with respective urinary biomarkers (Hammel 2020)

Correlations between wristband TDCIPP and TCIPP (flame retardants) and their corresponding urinary metabolites were highly significant (r_s= 0.5-0.65, $p<0.001$), which suggest that wristbands can serve as strong predictors of cumulative, five-day exposure and may be an improved metric compared to hand wipes. Correlations with TPHP and mono-ITP were insignificant- they were better found in urine (Hammel 2016)

The observed PAH or OH-PAH concentration could predict the other concentration within a factor of 1.47 for 50–80% of the measurements. Wristbands and urine provide similar PAH exposure assessment information (Dixon 2022)

Better detection of triphenyl phosphate, benzophenone, triclosan in wristbands versus urine (Romano 2022)

Effective wristband use

Summary: Wristbands are accessible and effective to use. SVOCs are stable longer than VOCs in wristband storage. In analysis, we must reasonably estimate values that are above the LOD.

Averaged 102% recovery (SD ≤21%). SVOCs stable up to 1 month; VOCs stable for 7 days. Long-term storage at -20 °C, VOCs stable for 3 months, SVOCs stable for 6 months. All chemicals stable from chemical degradation or diffusional losses (Anderson 2017)

PSDs are key measurement strategy for deep exposome phenotyping using untargeted high-resolution mass spec for exposome studies (Fuentes 2022)

Imputing values below the limit of detection (LOD) when scaling features can bias analyses. Instead, consider dimension reduction techniques like projection pursuit for wristband data. Imputing below LOD values with half the LOD creates non-normally distributed, bimodal data, making linear regression unsuitable. Gaussian mixture models are more suitable. (Bramer 2024)

Acronyms:

CP: Chorlinated paraffins commonly used as metal working fluids, flame retardants, plasticizers.

PFRs: tris(1,3-dichloroisopropyl) phosphate (TDCIPP), tris(1- chloro-2-isopropyl) phosphate (TCIPP) triphenyl phosphate (TPHP), and mono-substituted isopropylated triaryl phosphate (mono-ITP).

DBP: Di-n-butyl phthalate

BBP: Benzyl butyl phthalate

DEHT: Di(2-ethylhexyl) terephthalate

PAHs: Polycyclic aromatic hydrocarbons

PCBs: Polychlorinated biphenyls

SVOCs: Semi volatile organic compounds

> Includes: phthalates, phenols, PAHs, PCBs, flame retardants (OPFRs), pesticides, perfluorinated compounds (PFOA, PFOS)

VOCs: Volatile organic compounds

> Includes: benzene, formaldehyde, ethanol, toluene, xylene, acetone