Assessing PAH exposures with multiple approaches including silicone wristbands

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BACKGROUND

To assess human exposure to environmental chemicals, researchers rely on a variety of methods including:

- Questionnaires
  - Insight into participant background, behavior, activities
  - Participant may not know which chemicals s/he is exposed to

- Active Sampling – Air Monitoring Backpack
  - Well-recognized for monitoring chemicals in air
  - Pump noise and carrying backpack can be burdensome

- Biological Samples
  - Integrates all chemical exposure routes
  - Hard to control for some confounding factors influencing metabolic capacity

- Passive Sampling
  - Does not incorporate a battery or pump
  - Only accounts for chemicals in the external environment – does not account for dietary exposure

Recent applications of passive sampling include the use of silicone wristbands, which can sequester a wide variety of target compounds:

- Pesticides1
- Flame Retardants2,3
- PAHs4 (Polycyclic Aromatic Hydrocarbons)

METHODS

- Paired study at the Columbia Center for Children’s Environmental Health (CCCEH) in New York with 22 women in their 3rd trimester of pregnancy
- The CCCEH has associated PAH exposure with allergies, asthma, impaired neurodevelopment, and obesity in young children since 19985,7
- The use of silicone wristbands or wristbands in 48 hour deployments
- Of the 62 PAHs analyzed in wristbands:
  - 84% of the PAHs were detected in at least 1 wristband
  - 32 PAHs were detected in over 50% of the wristbands

AIM I

I. Demonstrate that PAHs are captured and recovered from silicone wristbands in 48 hour deployments
II. Compare and characterize PAHs in wristbands and backpacks
III. Compare and characterize PAHs in wristbands and PAH metabolites in urine samples

AIM I Conclusions:
- PAHs are captured and recovered in wristbands in a 48 hour non-occupational exposure period
- Wristbands recovered PAHs in similar frequencies of detection and concentrations as PUFs and filters

AIM II

- PUF and wristband comparisons indicate moderate to strong correlations for 7 of 11 PAHs
- Including filter concentrations does not greatly change correlation trends

AIM III

- PAHs in PUFs + Filters & OH-PAHs are correlated for 2 of 8 comparisons
- PAHs in wristbands & OH-PAHs are correlated for 4 of 8 comparisons
- 1- OH-phenanthrene and 1- OH-pyrene are strongly correlated with associated PAHs in the wristbands

AIM II and III Conclusions:
- Wristbands may be more predictive of PAH metabolites in urine than PUF + filter traditional methods
- Correlation patterns could be the result of wristbands incorporating both dermal and vapor phase PAH exposure and/or wristbands more selectively capturing the bioavailable PAH fraction

SUMMARY

Wristbands appear to be a candidate technology for inclusion in exposure science and epidemiology studies