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Children's Personal and Microenvironmental Exposures to $PM_{2.5}$ and Ozone in Shanghai, China

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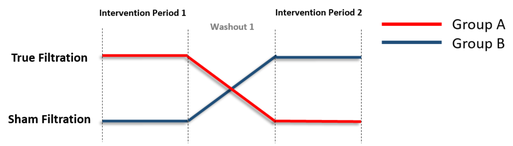
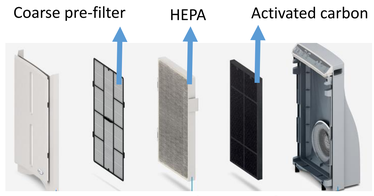
Study design

- A randomized, double-blind, crossover study
- 43 asthmatic children living in suburban areas of Shanghai
- True filtration: prefilter + HEPA + activated carbon (2 weeks)
- Sham filtration: only coarse pre filter (2 weeks)
- Two 48-hour periods of personal monitoring attempted (1 during true & 1 during sham)

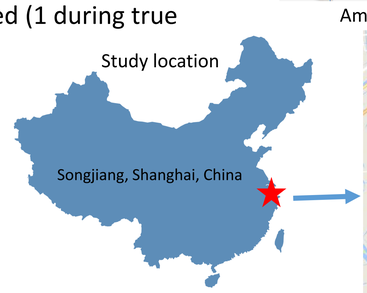


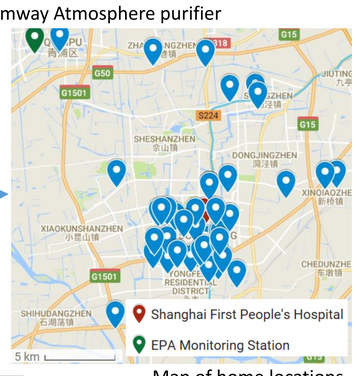
Crossover design: each child acts as their own control



Amway Atmosphere purifier

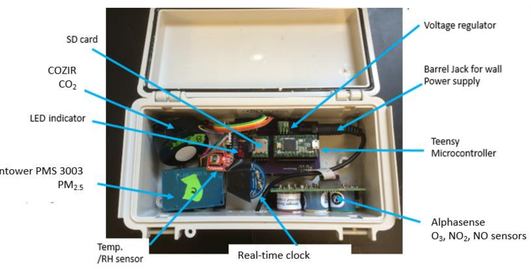
Personal air quality sensor





Map of home locations

Internal sensor components



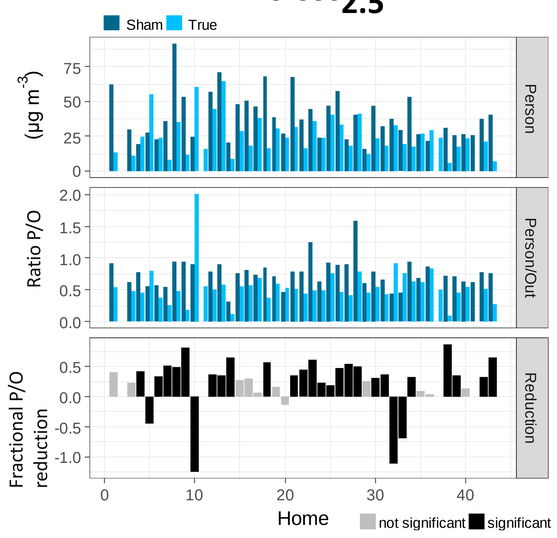
Additional information about the sensors used during this project can be found at **Dukearc.com**

Impacts of filtration on personal exposure

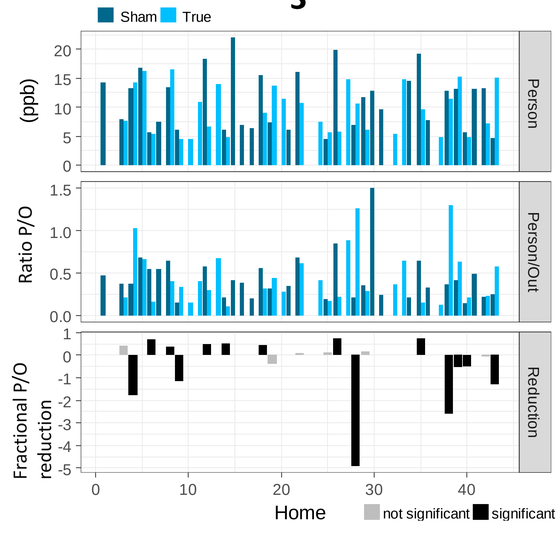
In most cases purifiers are effective at reducing personal exposure to $PM_{2.5}$ but have no significant impact on O_3

A t-test was used to compare the 1-hour P/O ratios ($p \leq 0.5$)

$PM_{2.5}$

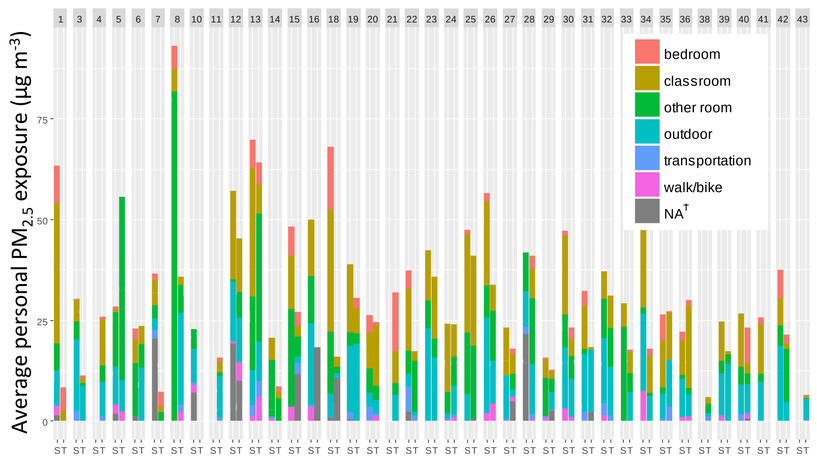


O_3



Personal exposure by microenvironment

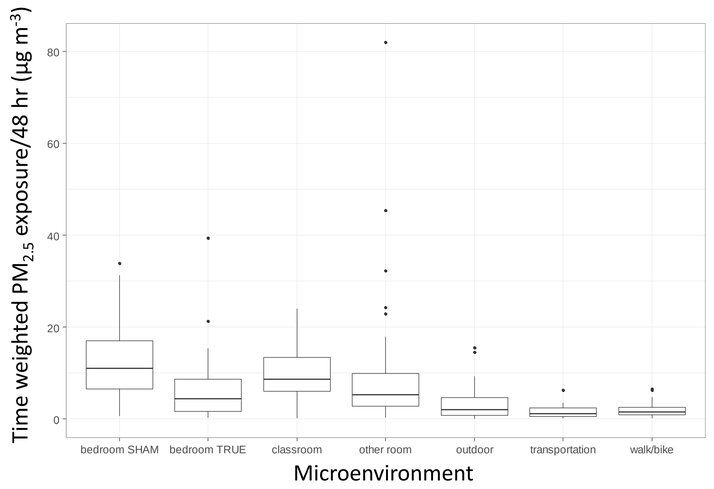
$PM_{2.5}$



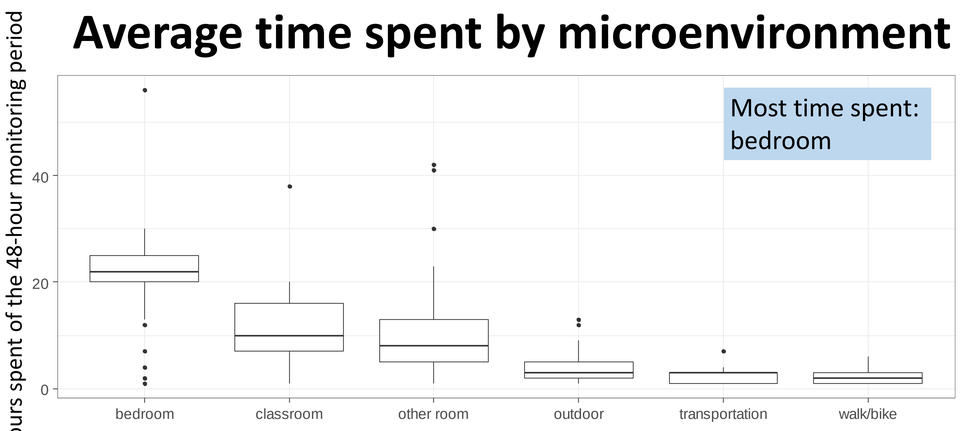
S=sham filtration
T=true filtration

†NA: indicates that the participant or their guardian did not make any indication of their location during this time period

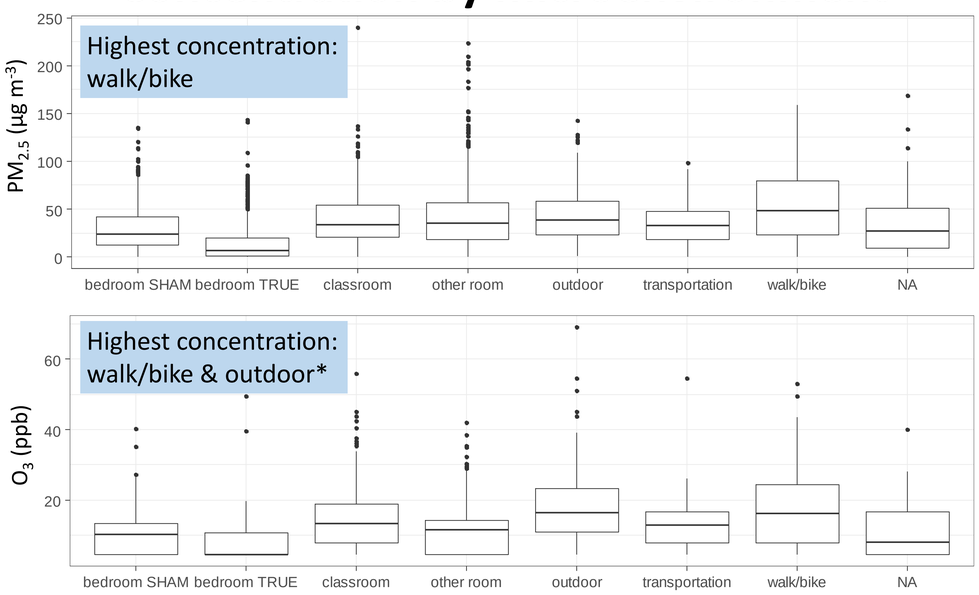
Ranked top contributing microenvironments:
During Sham: 1) bedroom 2) home other room & classroom*
During True: 1) classroom & bedroom* 2) home other room



Average time spent by microenvironment



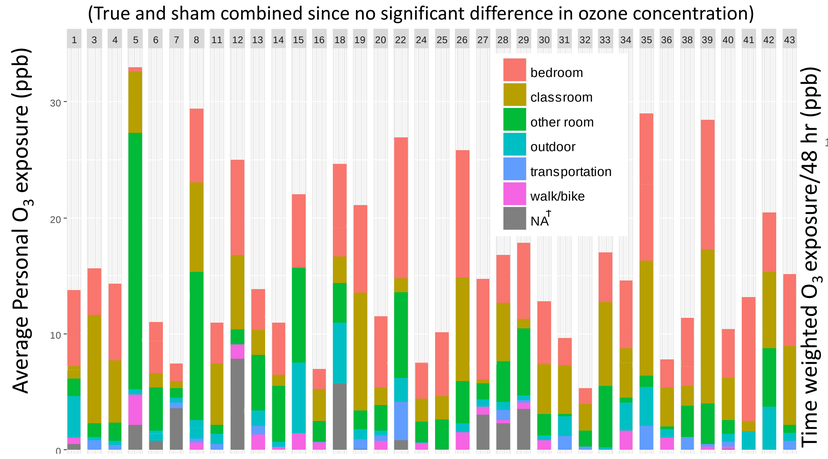
Concentration by microenvironment



*Multiple locations listed have concentrations that are not significantly different (Mann-Whitney U Test)

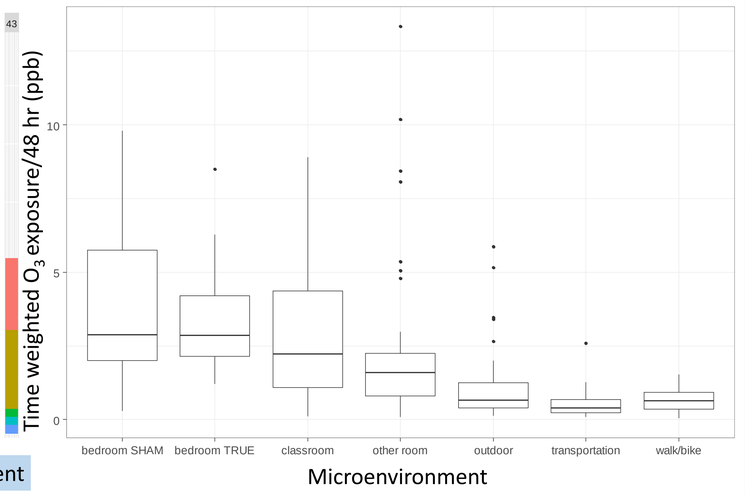
Ozone

(True and sham combined since no significant difference in ozone concentration)



*Multiple locations listed have contributions that are not significantly different

Ranked top contributing microenvironments:
1) bedroom (true & sham) & classroom* 2) other room



Conclusions

- Portable air purifiers can reduce personal exposure to $PM_{2.5}$.
- The bedroom environment should be targeted for ozone and $PM_{2.5}$ reduction since this is the largest contributor to their personal exposure.
- The bedroom environment is the largest contributor because the children spend the most time in the bedroom.
- Other indoor environments should be prioritized next, since other rooms and classroom are the next largest contributors to personal exposure.

Acknowledgments

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