Human exposure estimation to air pollution plays an important role in epidemiological studies which are designed to reveal correlations between human exposures to certain air pollutants and certain diseases, such as asthma, cardiovascular disease and reproductive diseases. Traditionally, when people's mobile data is hard to get, home location is used to estimate people's exposures assuming that people stay at home all the time. Whereas, people move and it is more accurate to estimate people's exposures including people's mobility. In our study, we showcased two methods to obtain people's mobile data: Google Maps location history (GMLH) data and Call Detailed Record (CDR) data. GMLH data was compared with Global Positioning System (GPS) data from four aspects: 1) spatial movement of the subject; 2) time the subject spent at different microenvironments; 3) time the subject spent on driving; 4) subject's time-weighted exposures to ambient particulate matter. The results showed that compared with GPS data, GMLH data capture well the subject's spatial mobility with resolution of 200m * 200m or larger and successfully captured the time the subject spent at different microenvironments and the time on driving. Also, with GMLH data we were able to accurately estimate the subject's time-weighted exposure to ambient PM pollution. CDR data was used to estimate subjects' mobile exposures for five chosen pollutants (CO, NO2, SO2, O3, and PM2.5). And the correlation between difference between static exposures and mobile exposures with mobility level is also investigated. My study revealed that there is no substantial difference between home based exposure (HBE) and CDR based exposure (CDRE) at population level. But at individual level, difference between HBE and CDRE increased with mobility increased. It was also found that HBE would likely under-estimate exposure to traffic-related pollutants (CO, NO2 and PM2.5) during afternoon rush-hour, but over-estimate exposures to ozone during mid-afternoon. As smartphone and Google Maps application are used widely, these two methods have huge potential on obtaining people's mobility data. My study also tested the relative accuracy and reliability of two brand commercial sensors (PrippleAie and Dylos). Results showed that PippleAir has good relative accuracy and reliability, while Dylos has moderate relative accuracy and reliability.

Major: Environmental Engineering

Educational Career:
Bachelor's of environmental science, BS, 2010, Fudan University
Master's of environmental engineering, MS, 2013, Fudan University

Committee in Charge:
Haofei Yu, Chair, Civil, Environmental, and Construction Engineering
Andrew Randall , Civil, Environmental, and Construction Engineering
Naveen Eluru, Civil, Environmental, and Construction Engineering
Xinwen Fu, Computer Science
Samiul Hasan , Civil, Environmental, and Construction Engineering

Approved for distribution by Haofei Yu, Committee Chair, on November 14, 2018.

The public is welcome to attend.