**Air pollution, asthma and circadian clocks**
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## Abstract

Societies become increasingly urban. The increased exposure to air pollutants is associated with exacerbations of asthma via several proposed mechanisms such as oxidative stress. Asthma has a clear temporal signal. The time-dependent worsening of symptoms is associated with poorer disease control, more frequent medication, and higher asthma-related morbidity and mortality. Lung function oscillates over the course of 24 hours, peaking around noon and reaching its nadir during early morning hours. **A provocative observation is that the time-of-day-dependent modulation of pulmonary function including lung volume and airway resistance is larger in asthmatics than in healthy controls**. This suggests that circadian rhythms amplify disease expression. Concentrations of air pollutants show oscillating patterns in urban settings driven foremost by traffic and weather conditions. Hyperlocal but not central-site concentrations of air pollutants track with lung function. Taken together, we **hypothesize that the spatiotemporal interaction between lung function and air pollutants increases the risk of nocturnal asthma**. In this application, based on preliminary data, we start to address this question using remote sensing and wearable devices. As a first step, **we will comprehensively deep phenotype patients with nocturnal asthma for spatiotemporal fluctuations in pulmonary, cardiovascular, behavioral, environmental, and metabolomic outputs**. Digital native asthmatics and matched controls will incorporate remote sensing and wearable devices into their daily routines to collect data on environmental (hyperlocal air pollutants, temperature, humidity, light intensity), disease expression (remote pulmonary function), prescription drug exposure (smart inhalers), behavior (activity, sleep/wake rhythms, sleep quality, communication), and geolocation outputs over several months enriched with cardiovascular (blood pressure, heart rate), circadian (remote body core temperature, cortisol, melatonin), smart food intake and metabolomics outputs over 48 hours. This multidimensional dataset will be the foundation to explore the variability of such outputs across multiple microenvironments in free-ranging individuals and to afford insight into mechanism and therapeutic opportunity**.**