Abstract

Leveraging wireless inhaler sensors to estimate the impact of rising temperatures and pollutant levels on asthma symptoms

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background: Louisville ranks in the top 20 most challenging places to live with asthma in the US. Local stakeholders are collaborating to leverage digital health to improve their understanding of how pollutants and temperature may influence asthma. objective: This study aimed to monitor the temporal and spatial patterns of short-acting beta agonist (SABA) use with inhaler sensors, and identify how asthma symptoms are associated with environmental covariates for current and future climate conditions. methods: Participants recorded SABA use with a wireless sensor, which passively collected the date and time of SABA use, as well as “heartbeats” of non-use. Locations of use were also collected. Using linear mixed models models, we evaluated associations among daily SABA use counts per participant, Nitrogen Dioxide (NO2) concentrations and surface temperatures (ST) derived from Landsat 8 remote sensing data. Using BRFSS data to estimate the asthma population in Jefferson County, we then calculated the potential impact of this increased SABA use county-wide. results: Sensors recorded 61,238 SABA events and 151,706 heartbeat events in space and time for 1217 participants from 06/2012 to 11/2016. We identified that NO2 ($p < 0.001$) and ST ($p< 0.01$) were both significantly and positively associated with SABA use. For each additional degree of ST, we estimated an increase of 0.63 ppb of NO2. Based on IPCC A1F1 climate scenarios, the temperature could increase anywhere from 2oC to 6oC. For a 2oC increase, SABA use could increase to 102.5 per person per year (a 1.2% increase). For a 6oC increase, SABA use could rise to 104.9 per person per year (a 3.5% increase). Across the county-wide asthma population (N=82,191), we projected 95,342 to 286,025 additional SABA uses per year for a 2oC or 6oC increase, respectively. conclusions: Municipalities should consider the future impact of increasing temperatures on pollutants such as NO2 and on asthma symptoms, which are estimated to increase in frequency.

Environmental health sciences Public health or related public policy Public health or related research