Background/Aims: Exposure measurement error should be reduced when estimates of ambient air pollutant exposures account for spatiotemporal variations in concentrations and time/location/activity. We investigated the relationship of daily concentrations of nitrogen dioxide (NO2), nitrate (NO3), ozone, elemental carbon, PM2.5, coarse fraction of PM10, and both FEV1 and FEF25-75, in a cohort of 315 asthmatic children in Fresno, CA, followed from 2000 to 2008.

Methods: Pollutants were estimated using measurements at a USEPA supersite (SC) within 20 kilometers of all households. Individual estimates of daily ambient exposure (IEADE) were modeled based on concentrations at the supersite, measurements at schools and homes, and a time/location/activity sub-study. Pulmonary function was measured each morning with a programmable spirometer (EasyOne®, ndd, Zurich, Switzerland) for 14 days, up to 3 times a year. Effects of 0- to 7-day lags and 2- to 7 day moving averages for a change in interquartile range were investigated.

Results: After adjustment for height cubed, African American race and asthma diagnosis before the age of 2, NO2 was the only pollutant associated with declines in pulmonary function (both FEV1 and FEF25-75), when SC were used to estimate exposure. However, with IADE, both NO2 and NO3 were associated with decrements in FEF25-75. NO2 lag 1 was associated with a 43.2 ml/s decline in FEF25-75 (95 CI=10.3-76.1 ml/s declines for a 12ppb increase) with SC and a 69.5 ml/s decline in FEF25-75 (95% CI= 14.3 to 125 ml/s decline, 4.2 ppb increase). For NO3 lag 1, declines increased from 9.2 to 107.3 ml/s with use of IADE (95% CI= -23.2 to 4.8, for a 5.1 µg/m3 increase in SC and -14.3 to 125 ml/s for a 0.9 µg/m3 increase in IADE respectively.

Conclusion: IIADE were associated with greater impacts on pulmonary function in asthmatic children, possibly due to reduction of exposure measurement error.