Longitudinal Lung Function Effects Of Fine Particulate Matter In Children With Cystic Fibrosis

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Background: Chronic exposure to ambient-source fine particulate matter ($PM_{2.5}$) is associated with decreased lung function in healthy children. Because children with cystic fibrosis (CF) have decreased lung function, they may be highly susceptible to the adverse chronic effects of air pollution exposure.

Methods: Data were obtained from the Cystic Fibrosis Foundation Patient Registry. Included were Caucasian children 6-18 years of age with at least one spirometry measure from 1994-2006. Ambient levels of $PM_{2.5}$ were obtained from the US EPA and estimated using the year 2000 annual average concentration at the population-based monitor closest to the patient's home zip code centroid, within 30 miles of the residence. FVC and FEV_1 were regressed separately for males and females on age-adjusted height, age, year of birth (cohort effect), and two-way interactions using linear spline models including cross-sectional effects at age 6.

Results: 5,204 (54.0%) patients lived within 30 miles of a population-based $PM_{2.5}$ monitor. Annual average $PM_{2.5}$ ranged from 5.5-28.2μg/m^3 for males and 3.8-28.2μg/m^3 for females. A 10 μg/m^3 increase in $PM_{2.5}$ exposure was significantly associated with a 10ml/year decrement in lung function for both males and females. 10-year trend due to cohort effect was associated with a 6ml/year and a 7ml/year increase in FEV_1 in males and females, respectively.

Annual change in lung function associated with a 10 μg/m^3 increase in $PM_{2.5}$[1] and birth cohort[2]

	FEV_1 (ml) (95% CI)	**FVC (ml) (95% CI)**
Females		
PM Effect[1]	-10.10 (-18.29, -1.91)	-10.54 (-19.10, -1.99)
Cohort Effect[2]	7.02 (0.13, 13.90)	-0.40 (-7.58, 6.77)
Males		
PM Effect[1]	-10.12 (-19.93, -0.32)	-10.16 (-19.92, -0.40)
Cohort Effect[2]	5.91 (-2.20, 14.02)	8.39 (0.11, 16.67)

[1]Adjusted for age-adjusted height, age (in years from age 6), year of birth (in years from 1990), linear splines at ages 12 and 16 for males and 13 and 15 for females, and two-way interactions; annual change for a 10 μg/m^3 increase in $PM_{2.5}$

[2]Change in lung function per 10-year birth cohort

Conclusions: Chronic exposure to ambient $PM_{2.5}$ is associated with decreased lung function, over time, in children with cystic fibrosis. This effect is greater than the increase in FEV_1 and FVC associated with birth cohort over time.

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