

TITLE

Early life air pollution exposure, childhood cognitive ability and subsequent mortality: A record-linkage life-course study from Scotland

AUTHORS

Gergő Baranyi¹, Lee Williamson^{1,2}, Zhiqiang Feng¹, Chris Dibben¹

AFFILIATIONS

¹Centre for Research on Environment, Society and Health, School of GeoSciences, The University of Edinburgh, Edinburgh, UK

²Longitudinal Studies Centre - Scotland (LSCS), School of GeoSciences, The University of Edinburgh, Edinburgh, UK

ABSTRACT (299/300 words)

Background: Living in areas with high air pollution concentrations is associated with all-cause and cause-specific mortality. Exposure in sensitive developmental periods might be long-lasting but studies with very long-term follow-up are rare, and direct and indirect associations between early life exposure and life-course mortality are not fully understood.

Methods: Data were drawn from the Scottish Longitudinal Study Birth Cohort of 1936, a representative record-linkage study comprising 5% of the Scottish population born in 1936. Participants had valid age 11 cognitive ability test scores; mortality data between age 11 and

86 were derived from the NHS Central Register. Fine particle (PM_{2.5}) concentrations estimated with the EMEP4UK atmospheric chemistry transport model were linked to participants' residential address in 1939 (age 3). Confounder-adjusted Cox regression estimated associations between PM_{2.5} and mortality; regression-based causal mediation analysis explored mediation through childhood cognitive ability.

Results: The total sample consisted of 2734 individuals with 1608 deaths registered during the 1,833,517 person-months at risk follow-up time. Higher early life PM_{2.5} exposure increased the risk of all-cause mortality (HR=1.03, 95%CI: 1.01-1.04 per 10µg m⁻³ increment), associations were stronger for mortality between age 65 and 86. PM_{2.5} increased the risk of cancer-related mortality (HR=1.05, 95%CI: 1.02-1.08), especially for lung cancer among females (HR=1.11, 95%CI: 1.02-1.21), but not for cardiovascular and respiratory diseases. Higher PM_{2.5} in early life ($\geq 50\mu\text{g m}^{-3}$) was associated with lower childhood cognitive ability, which, in turn, increased the risk of all-cause mortality and mediated 25% of the total associations.

Conclusions: In our life-course study with 75-year of continuous mortality records, we found that exposure to air pollution in a sensitive developmental period was associated with higher mortality in late adulthood, and that childhood cognitive ability partly mediated this relationship. Findings suggest that past air pollution concentrations will likely impact health and longevity for decades to come.