



Long-term Air Pollution and Brain: results from the Ruhr Area observational studies

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Abstract: Air pollution has deleterious effects on human health promoting a wide panel of chronic non-communicable diseases both in adults and children. Recent evidence raises concerns about the potential effects of air pollutants on brain structure and function. The objective of this contribution is to show the results of extensive research in a cohort of adults in the Ruhr Area. The results provide evidence of associations of higher exposure to air pollutants with disadvantageous outcomes in older populations.

The Heinz Nixdorf Recall (HNR) study is an ongoing population-based cohort study of 45–75-year-old men and women that started in the year 2000 in Bochum, Essen and Mülheim/Ruhr. The first and the second follow-up examinations were performed in 2006–2008 and 2011–2015. From 2011 to 2016, partners and children of HNR participants were invited to participate in the HNR-Multigeneration Study (HNR-MGS). 1000BRAINS is another ongoing population-based cohort study started in 2011 for characterizing the interindividual variability of brain structure and function. Participants were recruited from the second follow-up of the HNR study as well as the HNR-MGS.

We found that higher exposure to air pollutants and road traffic noise was independently associated with a poorer performance in a range of cognitive tests as well as with higher prevalence of mild cognitive impairment in the HNR population. Moreover, in 1000BRAINS, we observed that air pollution and noise were both associated with reductions in language and short term/working memory performance and with local atrophy in a functional network in a brain associated with these cognitive processes. Also, we investigated the strength of functional connections between different brain regions and found that high exposure to air pollution and noise were associated with changes in the brain that are similar to changes of a one-year increase in age. The results suggest that chronic air pollution and noise exposure may harmfully influence the physiological aging process of the brain.

These results highlight the urgent need to take into account exposure to air pollutants and noise in urban settings whenever urban interventions are planned. Moreover, areas with higher exposure to pollutants are often socio-economically deprived, putting a double burden on the people living where and creates a systematic inequality in the society. Reducing emissions of air pollution and noise, for example by providing opportunities for active transport, will positively influence health, quality of life and social equality in urban settings.

The contribution will be presented by Dr Katherine Ogurtsova, a statistician in the Institute of Occupational, Social and Environmental Medicine, the working group of Environmental Epidemiology, of the Heinrich-Heine-University. Her primary qualification includes statistical methods in medicine, epidemiology, and public health. In the working group, she is specialized in research of cognitive and neurological consequences of an exposure to air pollution.