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Air Pollution, genetic factors, and the risk of incident chronic kidney disease: a prospective study of polygenic risk score analysis in the UK Biobank

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Objectives: Both genetic and environmental factors contribute to chronic kidney disease, but the degree to which air pollution modifies the impact of genetic susceptibility on chronic kidney disease remains unknown. We aimed to investigate the effects and their interaction of air pollution and genetic factors on incident chronic kidney disease.

Methods: We analyzed data from 350,994 participants (53% women) without previous chronic kidney disease at baseline in the UK Biobank. The concentrations of particulate matter (PM) (PM <2.5 mm in aerodynamic diameter [PM2.5], coarse PM between 2.5 mm and 10 mm in aerodynamic diameter [PMcoarse], and PM <10 mm in aerodynamic diameter [PM10]), nitrogen dioxide (NO2), and nitrogen oxides (NOx) were estimated by using land-use regression models, and the association between air pollutants and incident chronic kidney disease was investigated by using a Cox proportional hazard model. Furthermore, we constructed a polygenic risk score and evaluated whether air pollutants modified the effect of genetic susceptibility on the development of chronic kidney disease.

Results: The results showed significant associations between the risk of chronic kidney disease and PM2.5 (hazard ratio [HR], 1.21; 95% confidence interval [CI], 1.06–1.37) and NOx (HR,1.19; 95% CI, 1.05–1.35). There were additive interactions between air pollutants and the genetic risk in PM10 and PMcoarse. Compared with participants with high genetic risk score groups, those with high air pollution exposure and low genetic risk showed the significant increased hazard for incident chronic kidney disease (PM2.5: HR, 1.21; 95% CI, 1.06–1.37; NOx: HR, 1.19; 95% CI, 1.05–1.35).

Conclusions: Long-term exposure to air pollution may increase the risk of chronic kidney disease, especially in those with low genetic risk.

Fig 1. Restricted cubic splines of NOx and PM2.5 for CKD