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Abstract Title: Younger Groundwater Associated with Greater Risk of Parkinson's Disease in Nationwide Medicare Study: Implications of Aquifer Type

Press Release Title: Newer groundwater associated with higher risk of Parkinson's disease

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Objective: To assess the relationship between groundwater age and risk of Parkinson disease (PD).

Background: Older groundwater typically contains fewer anthropogenic contaminants because it is generally deeper and better shielded from surface contaminants than newer groundwater. Although environmental neurotoxicants are linked to PD, the contribution of groundwater exposures remains poorly understood.

Design/Methods: We performed a population-based, case-control study of 12,370 incident PD patients and 1,224,174 matched controls in the Medicare population in the 3 miles surrounding 1,279 groundwater sample sites across 21 principal aquifers. Groundwater age, aquifer type, and drinking water source (municipal vs private well) were evaluated as a proxy for neurotoxicant exposure. All models adjusted for age, sex, race, smoking, use of care, income, urban/rural residence, and air pollution in the form of average annual $PM_{2.5.}$ ore rapid.

Results: After adjusting for covariates, beneficiaries living in regions sourcing drinking water from municipal groundwater systems or private wells on carbonate aquifers exhibited the highest overall risk of PD—24% higher compared to all other aquifer types (OR = 1.24, 95% CI: 1.18–1.30) and 62% higher when compared to glacial aquifer types (OR = 1.62, 95% CI: 1.45–1.81). Additionally, we observed an interaction between groundwater age and aquifer type, with the protective effect of older groundwater observed only within carbonate systems. In carbonate aquifers, for each one–standard-deviation increase in groundwater age, the risk of Parkinson's disease declined by approximately 6.5%. When modeled categorically, individuals sourcing Anthropocene-aged groundwater in carbonate systems had a greater risk of PD (OR = 1.11, 95% CI: 1.02–1.20) compared with those using Pleistocene-aged water.

Conclusions: These findings suggest that groundwater age and aquifer type contribute independently to PD risk, with newer groundwater posing greater risk particularly in carbonate systems where contaminant infiltration is more rapid.

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