

NIH-funded twin study finds occupational chemical exposure may be linked to Parkinson's risk

A new research report contributes to the increasing evidence that repeated occupational exposure to certain chemical solvents raises the risk for Parkinson's disease. Researchers analyzed the occupational histories of twins in which one of the pair developed the neurodegenerative disorder, and assessed that twin's likelihood of exposure to six chemicals previously linked to Parkinson's. Of the six chemicals investigated, researchers concluded that two common chemical solvents, trichloroethylene (TCE) and perchloroethylene (PERC), are significantly linked to development of this disease. This study, supported in part by the National Institute of Neurological Disorders and Stroke (NINDS), a part of the National Institutes of Health, appears in the Nov. 14, 2011 issue of *Annals of Neurology*.

Parkinson's disease is a movement disorder caused by the loss of brain cells that produce a molecule called dopamine. The primary symptoms of Parkinson's are tremor, stiffness, slowed movement and impaired balance, and as these symptoms progress, patients may also develop difficulty walking, speaking or completing other activities of daily living. Genes play a role in Parkinson's disease, but fewer than 10 percent of cases are due to a single gene mutation, and not all people with these mutations develop Parkinson's, suggesting that environmental factors also contribute to the likelihood of developing the disease.

The researchers, led by Samuel Goldman, M.D., M.P.H. and Caroline Tanner, M.D., Ph.D. at the Parkinson's Institute in Sunnyvale, Calif., collected the histories of 99 pairs of twins in which one of the pair developed Parkinson's and the other twin did not. Since twins are so genetically similar, twin studies are especially useful in identifying environmental influences in disease. The twins were identified through the National Academy of Sciences/National Research Council World War II Veteran Twins Registry. Of the 99 pairs, half were genetically identical twins, and half were fraternal twins.

The study team assessed the twins' lifetime work and hobby activities, specifically inquiring about occupational tasks such as electrical work, industrial machinery repair, and dry cleaning, which would potentially expose people to chemicals previously linked to Parkinson's. The researchers also collected information on head injuries, which are suspected to increase Parkinson's risk, and smoking history, which is reported to decrease Parkinson's risk. Expert evaluators, unaware of which study subjects had Parkinson's, reviewed this information and calculated lifelong exposure to six chemicals: TCE, PERC, carbon tetrachloride, n-hexane, xylene and toluene. Of these, TCE and PERC posed a notable risk for developing Parkinson's.

"The potential importance is great, since both solvents persist in the environment and are commonly used," said Dr. Goldman, "Parkinson's was sixfold more common in twins exposed to TCE, and ninefold more common in twins exposed to TCE or PERC." There was also a trend toward a tenfold increase in Parkinson's disease in twins exposed to PERC alone.

In this study researchers looked only at occupational chemical exposure, and the association with job categories tended toward significance only for the industrial machinery repairer and industrial worker categories. However, the chemicals evaluated here are found outside industrial settings as well. PERC is the leading chemical used in garment dry cleaning. TCE is the most frequently reported organic groundwater contaminant, was once used as general anesthetic and coffee decaffeinating agent, and is still used widely as a metal degreasing agent.

TCE has also been linked to Parkinson's by other research groups. Researchers at the University of Kentucky, Lexington, and the Kangwon National University in South Korea have reported an association between TCE and Parkinson's in highly-exposed industrial workers, and have also demonstrated that TCE causes neurodegeneration in animal models.

The analysis described in this report expands on preliminary findings presented at the 2010 American Academy of Neurology meeting. The new paper quantifies the individuals' exposures to the chemicals in terms of successive years and cumulative exposure over their lifetime.

Dr. Tanner notes that while the association between chemical exposure and Parkinson's is strong, one limitation of the research is the small number of individuals studied. "It will be important to replicate these results in additional populations with well-characterized exposure histories," she commented.

Wendy Galpern, M.D., Ph.D., program director at NINDS, agreed that replication of these results is necessary. "This epidemiologic study is a noteworthy addition to our growing understanding of the association between environmental exposures and Parkinson's disease," Dr. Galpern said. "The identification of specific chemicals linked to this neurodegenerative disorder may have implications for disease prevention and an improved understanding of how Parkinson's develops."

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For more information about Parkinson's Disease, visit the Parkinson's Disease fact sheet on the NINDS website: <http://www.ninds.nih.gov/PD>

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