

Adapted from: Occupational pesticide exposure and screening tests for neurodegenerative disease among an elderly population in Costa Rica (2013) and Organochlorine chemicals and neurodegeneration among elderly subjects in Costa Rica (2014)

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i Introduction and Purpose

Exposure to chemicals, such as **pesticides**, may contribute to **neurological disease**. Costa Rica has the highest per-capita use of pesticides in Central America. **Pesticides** can be made with many different chemicals, including **organochlorines (OC)**, which are a focus of the research summarized here. This is a summary of two studies, both examining the **neurological** symptoms in elderly Costa Ricans who were exposed to **pesticides** at work.

P How the Study Was Done (Methods)

Study One screened 400 people age 65 or older for self-reported past workplace exposure to pesticides and **neurological disease**. Those who failed the initial **neurological disease** screening test were given additional tests to examine their **neurological** status and risk for **PD**. Those who failed the additional tests were examined by a neurologist.

Study Two recruited and enrolled a subgroup of 89 participants from the original study. All 89 participants provided blood samples to measure levels of **OC pesticides**. The researchers then examined whether the participants who reported being exposed to pesticides while at work had higher levels of pesticides in their blood than the participants who did not. They also examined whether the results of the **neurological** tests varied with the amount pesticides measured in the blood.

✓ Results of Study

Study One:

- 72 participants (18%) reported past workplace pesticide exposure.
 - Participants who reported exposure performed **significantly** worse on the **neurological** tests than the non-exposed, even after taking age, sex, and education into consideration.
- 23% of the participants examined by the neurologist (n=144) were diagnosed with possible **PD**.
 - 85% of these cases had not been previously diagnosed.

Study Two:

- **OC pesticides** were found in all 89 participants.
- 36 participants (40%) reported past workplace pesticide exposure.
 - These participants had **significantly** higher levels of dieldrin (an **OC pesticide**) than those without reported exposure.
 - Other pesticides did not differ between those with and without self-reported exposure.
- There was a small, but not **significant**, higher risk for **tremor-at-rest** with higher dieldrin levels.
- Higher DDT levels (an **OC pesticide**) was slightly related to lower scores on a mental state exam.

− Limitations (Why we can't draw stronger conclusions)

These studies were limited because data was not collected on other factors that may impact **neurological disease**, such as smoking, alcohol use, other illnesses, or medications. Furthermore, the exposure to **pesticides** and the **neurological** outcomes were measured at the same time, so we can't say if one caused the other. Study Two was limited by the small number of people who participated in the study, which means that the findings may not apply to the general population.

? What does this mean?

While it is hard to draw strong conclusions from two studies, these results indicate that workplace exposure to **OC pesticides** likely contributes to higher levels of pesticides in the blood (even years after exposure) and may contribute to **neurological disease**. The number of previously undiagnosed **PD** cases in Study One indicates that **PD** may be under-diagnosed in Costa Rica and that screening may be especially appropriate among elderly subjects with past pesticide exposure. Most **OC pesticides** are banned in the US, so exposure in the US is mainly from legacy residues in the soil and food.

Key Words

Pesticides: Chemicals often applied to grass, fruits, and vegetables to prevent loss or damage from pests. In general, pesticides target specific **neuronal** pathways in the insect, resulting in the death of the insect.

Neurological disease: Any disease of the **neuron**. Many neurological diseases, like Parkinson's and Alzheimer's, are not curable and may cause significant loss of memory and loss of the ability to control body movements.

Neuron/neurological: Brain and nerve cells/relating to brain and nerve cells.

Parkinson's disease (PD): A nervous system disorder that affects movement.

Tremor-at-rest is a symptom of PD.

Organochlorine (OC): A pesticide containing chlorine.

(Statistically) significant: A statistical term that means there is enough evidence that the results obtained were not likely due to chance.

Tips

To prevent exposure in countries where **OC pesticides** are still in use, employers should provide protocols and personal protective equipment for employees.

Read the full articles here: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4739784/>
and <https://www.ncbi.nlm.nih.gov.proxy.library.emory.edu/pubmed/23092715>

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