**Evaluation of Methods to Assess Residential Non-Dietary Exposure to Insecticides**
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Neurological disorders and cancer are prevalent diseases of seniors. For example, Parkinson's disease (PD) affects 1 to 1.5 million people in the U.S. Pesticides are potential risk factors of PD, Alzheimer's and various cancers, but the exposure-disease relationship is not fully understood. Epidemiology offers a means for direct observation of pesticide exposure-disease relationships. The accuracy and interpretation of these is often limited due to relatively weak exposure assessments.

Current limitations binding studies include the lack of biomarkers for retrospective studies. Biomarkers for prospective studies are expensive and non-specific. Questionnaire and interview methods are another cause for inadequacy. These methods are rarely specific to a chemical or class of chemicals. Recall bias can also occur. The link between presence or use and true exposure is variant, along with the possibility of exposure from multiple pathways.

The objective of the study was to determine if questionnaire and personal interview methods are accurate indicators of exposure to selected neurotoxic insecticides. The hypotheses stated the presence of insecticide product in the home is independent of insecticide occurrence in air and settled dust of the home. In addition, the mean air and dust concentration of insecticides is equal in homes with and without products containing the insecticide.

The study design included 37 residents in Athens, Georgia, USA, and occurred between November 2000 and April 2001. The participants lived in the Urban Services District and were solicited by mail (water bill addresses). Each participant was sent a letter of intent along with a postcard with questions concerning pesticide use. There was an 11% response rate with fifty-seven postcards returned out of five thousand. Four insecticides were studied: the pyrethroids, permethrin and tralomethrin and the organophosphates, chlorpyrifos and diazinon. The questionnaire asked about products used in the home, frequency of use, location of use, and the time the product was owned. Participants were also questioned about the utilization of commercial pest control services. Inventories were taken of chemicals (active ingredients in insecticides) present in the home at the time of monitoring.

Sampling methods occurred over a one-week period. Air was pulled at a rate of 4lpm through quartz filters and a polyurethane foam plug in a series. Dust samples were taken with an HVS3 sampler over a 2-m2 area. The HVS3 is equipped with a cyclone separator that is size selective for particles ranging from 5-150mm in size. Vacuum bags were collected from participants in some cases due to small sample size taken with the HVS3.

The dust was prepared for analysis with ultrasonic extraction by methanol. Chemical analysis was performed by gas chromatography-electron capture detection with conformation by GC-mass spectrometry.

Data analysis included statistics for the questionnaire, product inventory, and environmental sample results. Chi-squared tested the hypothesis about the inventory and presence of specific chemicals. ANOVA was used to test inventory and mean concentration of specific chemicals.

A total of 37 carpet dust samples were collected. Twenty-two were sieved to 150mm fraction. At present, extraction and analysis has not been completed on any of the samples. Two samples are pending. Thirty-seven indoor air samples were also taken. Extraction and analysis is completed on thirty-three samples with four samples pending. Three samples were lost due to flow fault. Two samples are pending.

The frequency of chemical present in indoor air samples was compared to the frequency of chemical present in the inventories of the homes. The following table displays this comparison (also in Figure 1).

| Chemical | Chemical Not In Inventory | Chemical In Inventory |
|---|---|---|
| Permethrin | 1/27 (3%) | 1/3 (33%) |
| Tralomethrin | 8/28 (27%) | 0/2 (0%) |
| Diazinon | 16/30 (53%) | ---- |
| Chlorpyrifos | 17/22 (57%) | 4/8 (50%) |

The mean (SE) indoor air levels (ng/m2) by inventory status were also calculated (Figure 2). Levels of chemicals not in inventory were 0.02 (0.02) for permethrin, 0.57 (0.21) for tralomethrin, 5.95 (1.90) for diazinon, and 250 (75.0) for chlorpyrifos. Levels of chemicals in inventory were 1.83 (1.84) for permethrin, 0 (0) for tralomethrin, and 175 (87.9) for chloropyrifos.

In conclusion, permethrin and tralomethrin rarely present a household inventory and indoor air of residences in this population. Diazinon and chlorpyrifos are present in at lease 50% of the air in homes in the population. The study cannot reject the null hypotheses of independence between presence of chemical in household inventory and indoor air.

Implications are that pesticide exposure assessment by household product inventory may result in substantial exposure misclassification. This raises questions about the accuracy of results from previous epidemiological investigations that use questionnaire and inventory methods to assess pesticide exposure.

Limitations of the study included a small population, only four pesticide active ingredients were investigated, indoor air exposure standard, and use of a short questionnaire and brief interview.

As follow up, complete indoor air and dust chemical extraction and analysis are to be completed. The associations between the questionnaire responses and chemical measurements will be evaluated. The results were used as preliminary data for a proposal to the US Environmental Protection Agency and a second proposal to the National Cancer Institute. The EPA proposal was accepted for funding at $710,000 over three years and the NCI proposal is in peer review.