

September 2017 Alive & Well Update: Chemical Safety

Occupational Exposure to Pesticides and the Incidence of Lung Cancer in the Agricultural Health Study

Background: Occupational pesticide use is associated with lung cancer in some, but not all, epidemiologic studies. In the Agricultural Health Study (AHS), we previously reported positive associations between several pesticides and lung cancer incidence. **Objective:** We evaluated use of 43 pesticides and 654 lung cancer cases after 10 years of additional follow-up in the AHS, a prospective cohort study comprising 57,310 pesticide applicators from Iowa and North Carolina. **Results:** Hazard ratios were elevated in the highest exposure category of lifetime days of use for pendimethalin (1.50; 95% CI: 0.98, 2.31), dieldrin (1.93; 95% CI: 0.70, 5.30), and chlorimuron ethyl (1.74; 95% CI: 1.02, 2.96), although monotonic exposure–response gradients were not evident. The HRs for intensity-weighted lifetime days of use of these pesticides were similar. For parathion, the trend was statistically significant for intensity-weighted lifetime days ($p = 0.049$) and borderline for lifetime days ($p = 0.073$). None of the remaining pesticides evaluated was associated with lung cancer incidence.

Pesticides are Associated with Allergic and Non-Allergic Wheeze among Male Farmers

Background: Growing evidence suggests that pesticide use may contribute to respiratory symptoms. **Objective:** We evaluated the association of currently used pesticides with allergic and non-allergic wheeze among male farmers. **Results:** In models evaluating current use of specific pesticides, 19 pesticides were significantly associated ($p < 0.05$) with allergic wheeze (18 positive, 1 negative) and 21 pesticides with non-allergic wheeze (19 positive, 2 negative); 11 pesticides were associated with both. Seven pesticides (herbicides: 2,4-D and simazine; insecticides: carbaryl, dimethoate, disulfoton, and zeta-cypermethrin; and fungicide pyraclostrobin) had significantly different associations for allergic and non-allergic wheeze. In exposure–response models with up to five exposure categories, we saw evidence of an exposure–response relationship for several pesticides including the commonly used herbicides 2,4-D and glyphosate, the insecticides permethrin and carbaryl, and the rodenticide warfarin.

A longitudinal study of atrazine and 2,4-D exposure and oxidative stress markers among Iowa corn farmers

Reactive oxygen species, potentially formed through environmental exposures, can overwhelm an organism's antioxidant capabilities resulting in oxidative stress. Long-term oxidative stress is linked with chronic diseases. Pesticide exposures have been shown to cause oxidative stress in vivo. We utilized a longitudinal study of corn farmers and non-farming controls in Iowa to examine the impact of exposure to the widely used herbicides atrazine and 2,4-dichlorophenoxyacetic acid (2,4-D) on markers of oxidative stress. 225 urine samples were collected during five agricultural time periods (pre-planting, planting, growing, harvest, off-season) for 30 farmers who applied pesticides occupationally and 10 controls who did not; all were non-smoking men ages 40–60. Atrazine mercapturate (atrazine metabolite), 2,4-D, and oxidative stress markers (malondialdehyde [MDA], 8-hydroxy-2'-deoxyguanosine [8-OHdG], and 8-isoprostaglandin-F_{2α} [8-isoPGF]) were measured in urine. We calculated β estimates and 95% confidence intervals (95%CI) for each pesticide-oxidative stress marker combination using multivariate linear mixed-effect models for repeated measures. Farmers had higher urinary atrazine mercapturate and 2,4-D levels compared with controls. In regression models, after natural log transformation, 2,4-D was associated with elevated levels of 8-OHdG ($\beta = 0.066$, 95%CI = 0.008–0.124) and 8-isoPGF ($\beta = 0.088$, 95%CI = 0.004–0.172). 2,4-D may be associated with oxidative stress because of modest increases in 8-OHdG, a marker of oxidative DNA damage, and 8-isoPGF, a product of lipoprotein peroxidation, with recent 2,4-D exposure. Future studies should investigate the role of 2,4-D-induced oxidative stress in the pathogenesis of human diseases.