window. The risk was especially pronounced for lifting/carrying compared to pushing/pulling. We did not find indications of safe exposure intensities.

Pesticides

O-111 TRANSLATING OBSERVATIONAL RESEARCH INTO REGULATORY SCIENCE: THE ROLE OF U.S. EPA'S OFFICE OF PESTICIDE PROGRAMS IN EVALUATING EPIDEMIOLOGIC EVIDENCE

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Introduction The U.S. Environmental Protection Agency's Office of Pesticide Programs (OPP) is a licensing program that regulates pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). As part of this program, OPP has a regulatory mandate to evaluate research on the health effects of pesticides and plays a critical role in translating epidemiologic research into regulatory science and policy.
Objectives OPP has developed a framework to ensure that pesticide risk assessments include systematic evaluation of epidemiologic research on the potential adverse effects of pesticide exposure. The objective of the presentation is to raise awareness about how epidemiologic research on pesticides can inform risk assessment and occupational health policy by: (1) Providing background on OPP's risk assessment process, (2) Describing how OPP evaluates epidemiologic research using an approach that is scientifically robust and transparent; and (3) Highlighting opportunities for collaboration between researchers and risk assessors on the translation of epidemiologic research into risk assessment.
Methods OPP has extensive experience evaluating epidemiology studies on pesticides and is required to review all registered pesticides according to a 15-year registration review schedule. Building off of this experience, OPP will provide a survey of its evaluation approach and explore challenges that may be promising areas for future collaboration between researchers and risk assessors.
Results and Conclusions EPA/OPP routinely evaluates epidemiology research on pesticides and is guided by a systematic review framework that is scientifically robust and transparent. While epidemiologic research increasingly plays important role in the risk assessment process, there are important regulatory challenges that often limit the ability of OPP to translate research findings into policy. Therefore, there is a critical need to strengthen collaboration between researchers and risk assessors to better understand the scientific capabilities and data needs across occupational health disciplines.

O-188 PESTICIDE EXPOSURE DURING APPLICATION WITH BACKPACK SPRAYERS IN GREENSPACES: A FIELD STUDY ON GLYPHOSATE APPLICATION

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Introduction Data on pesticide exposure during occupational knapsack spraying is scarce.
Objective This field study assessed its levels and determinants.
Methods Private landscapers/gardeners and municipal workers in the Normandy region, France, were enrolled between March and May 2011. They were equipped with cotton undergarments and gloves to assess actual dermal exposure to glyphosate, and with cotton coveralls separately for each phase to assess the contribution of mixing/loading and spraying and the distribution on 11 body areas. A field monitor observed the whole workshift and filled in a standardized observation grid. Respiratory samplings were also systematically performed, and additional surface wipes obtained from various equipment.
Results Twenty-four workers were included, all men, with a median age of 40 years old, and a median experience in pesticide use of 14.5 years. The total work time varied between 110 and 360 min (median 210), and the number of mixing/loading-spraying cycles ranged from 1 to 8 (median 2). Spraying was more exposing than mixing/loading for all body parts except hands. Hands contributed to nearly 90% of body exposure during mixing/loading, and 30% during spraying, followed by back for spraying (14%). The median actual body contamination was 5,256 µg, with a median of 4,620 µg for hands. Dermal PPE use was associated with a decreased actual dermal exposure (estimate -0.81, p=0.001), and the number of mixing/spraying cycles with an increased exposure (more or less than 2 cycles: estimate 0.85, p=0.0006).
Conclusion Given their large contribution to overall dermal exposure, caution should be paid to handwashing and common hygiene rules during knapsack spraying. To our knowledge, our study is the first to report a high contamination of the back during spraying.

O-283 RECALL ABILITY OF PESTICIDE USERS IN UGANDA AND THE UK: RESULTS FROM THE IMPRESS STUDY

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Introduction Epidemiological studies on occupational exposure to pesticides commonly use self-reported questionnaire or interview data, so insight into recall accuracy is crucial to understand study findings.
Objectives To evaluate farmers' and farmworkers' recall of occupational exposure to pesticides and other exposure determinants, and to estimate the size of any recall bias.
Methods We used data from the IMPRESS project (www.impress-project.org), which includes three occupational cohorts of farmers' and farmworkers' exposure to pesticides in the UK and one in Uganda. Participants were surveyed at baseline to ascertain the frequency of their pesticide use, personal protective equipment (PPE) practices, and other information that may affect their exposure to pesticides; re-assessment occurred 2–14 years later, depending on the cohort. To assess recall, we examined the percentage of overall agreement, sensitivity, specificity, and any trends by demographic characteristics using regression analysis.
Results Across the four cohorts, 899 participants provided responses at two time-points. Preliminary analysis identified

no overall trends in the recalled frequency of pesticide application in the Ugandan cohort, where reassessment occurred 2 years later. Initial results in the UK, where re-assessment took place many years later, suggested overestimation of years working with pesticides (Geometric Mean Ratio=1.25 [95% CI: 1.16 to 1.36]). The UK participants reported more frequent use of PPE items than in Uganda, which was mostly limited to long-trousers, shirt, and boots; however, recall ability was similar (mostly >70% agreement). The reporting of specific crops involving pesticide use was low among Ugandan farmers, who cultivated many crops (e.g., only 13% could recall all three major crops). Sensitivity of reported crop use in the UK appeared to be lower (<40%) with a longer recall period.

Conclusion Our results to date suggest limited evidence of recall bias, which appears to differ based on the specific exposure determinant and length of recall period.

O-307 PERMETHRIN USE AND CIRCULATING IMMUNOLOGIC MARKERS: A LONGITUDINAL INVESTIGATION IN THE BIOMARKERS OF EXPOSURE AND EFFECT IN AGRICULTURE STUDY

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Introduction Permethrin is one of the most widely used insecticides in the United States. Previous studies have reported associations of permethrin use with increased risk of multiple myeloma (MM) and its precursor, monoclonal gammopathy of undetermined significance (MGUS). Biological mechanisms underlying these associations remain unclear, with some evidence linking permethrin to altered hematological parameters, underscoring the need to further explore immunologic markers related to permethrin exposure.

Objective Evaluate associations between recent occupational permethrin use and circulating levels of immunologic markers.

Methods We conducted a longitudinal investigation among 33 male permethrin applicators ≥50 years of age in the Biomarkers of Exposure and Effect in Agriculture study who had blood samples collected in the offseason and within a day after permethrin application (recent use); 27 of these applicators also had a sample collected ~3 weeks after permethrin use. As an external comparison, we analyzed one-time blood samples from 70 age-matched non-farming controls. Serum levels of 87 immunologic markers were assessed using a multiplex immunoassay. Multivariable linear mixed models were used to estimate associations between permethrin use and immunologic markers.

Results Among pesticide applicators, recent permethrin use (vs. offseason) was associated with increased serum caspase-8 (mean relative (fold)-change in protein concentration: 1.36; 95% confidence interval: 1.04–1.78) and arginase-1 (1.24; 1.00–1.53) and reduced pleiotrophin (–1.15; –1.26, –1.05) and matrix metalloproteinase-12 (MMP-12; –1.12; –1.26, 1.00) levels. Associations with caspase-8, arginase-1, and pleiotrophin persisted at ~3 weeks after permethrin use (vs. offseason). Compared to non-farming controls, we also observed increased caspase-8 (1.44; 1.10–1.88) and reduced MMP-12 (–1.31; –1.61, –1.06) levels among applicators after recent permethrin use, with associations persisting ~3 weeks after use.

Conclusion Although exploratory, these findings suggest that permethrin use may be associated with certain immunologic markers previously implicated in MGUS/MM pathogenesis, particularly caspase-8 and MMP-12, which are involved in apoptosis and angiogenesis, respectively.

O-406 EXPOSURE TO CHLOROACETAMIDE HERBICIDES IN AGRICULTURE AND LYMPHOID MALIGNANCIES, OVERALL AND BY SUBTYPES, IN THE AGRICULTURE AND CANCER (AGRICAN) COHORT.

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Introduction Since the 80s, more and more epidemiological studies demonstrated a relationship between agricultural exposures - especially pesticide use - and Lymphoid Malignancies (LM). However, the role of specific pesticides remains little explored.

Objective We assessed the relationship between chloroacetamide herbicide exposure (as a group and for specific molecules: acetochlore, alachlor, dimethachlore, DMTA, DMTA-p, flufenacet, S-metolachlor, metolachlor metazachlor, napropamide, pethoxamid) and LM overall and by main subtypes: multiple myeloma (MM), Chronic Lymphocytic Leukemia/ Small Lymphocytic Lymphoma (CLL/SLL), Diffuse Large B-cell Lymphoma (DLBCL).

Methods Lifetime occupational pesticide use on 11 crops were collected from 181,842 people enrolled in the cohort AGRICAN. Incident cases were identified by cross-linkage with population-based cancer registries until 2015. Exposure to 11 chloroacetamides (ever/never) was estimated based on the crop-exposure matrix PESTIMAT.

Results Incident cases included 1,349 LM, 319 MM, 298 CLL/SLL and 221 DLBCL. Among the 51,889 pesticide users, 44% were exposed to chloroacetamides (n=22,862 including 95.4% men), ranging from 7.8% (n=4,059) for dimethachlore to 28.7% (n=14,871) for metolachlor/S-metolachlor. Positive associations were reported between chloroacetamide use on any crop and LM (HR=1.33, 95%CI=1.12–1.59), CLL/SLL (HR=1.66, 95%CI=1.15–2.39) and MM (HR=1.37, 95% CI=0.95–1.96), especially on corn. In addition, specific associations were observed in some categories of farmers: LM overall and CLL/SLL in vinegrowers, LM in beet-growers, LM and DLBLC in rape-growers and MM in potatoes-growers. Exposure to some active ingredients were significantly associated with i) LM: acetochlor, DMTA, flufenacet, alachlor, metazachlor, metolachlor (risks from 1.32 to 1.43); (ii) CLL/SLL: alachlor, metolachlor (risks from 1.75 to 1.79). Trends to increased risks were also observed between (i) LM and DMTA-p or napropamide, (ii) CLL/SLL and napropamid, (iii) MM and alachlor or metolachlor and (iii) DLBCL and dimetachlor or metazachlor.

Conclusion We found positive associations between LM overall incidences and some subtypes, and exposure to chloroacetamide as a group or considering specific molecules.