Keynote Abstracts

K-01 AGRICULTURAL EXPOSURES AND HEALTH OUTCOMES

Laura Beane Freeman. *US National Cancer Institute, Division of Cancer Epidemiology & Genetics, Occupational and Environmental Epidemiology Branch*

10.1136/OEM-2019-EPI.1

Pesticides, including herbicides, insecticides, fungicides, fumigants and rodenticides, represent a diverse set of chemicals. They provide important benefits in public health, food production and aesthetics. However, unlike most other chemicals, pesticides are designed to impact living systems. Consequently there has long been a concern about the consequences on both human health and the environment. Pesticide use increased dramatically in the last half of the 20th century, with use continuing to increase in low and middle income countries, reflecting changing agricultural practices. Over 1 billion people are estimated to be exposed to pesticides occupationally through production, mixing, application and other tasks, particularly in the agricultural sector. But, these exposures can also be experienced by the general population through various pathways, including drift and contamination of water and food supplies. Not surprisingly, given their diverse properties, various pesticides have been linked to a number of adverse health outcomes, including cancer, respiratory and neurologic disease and reproductive outcomes. With hundreds of pesticide active ingredients and changing practices over time, exposure assessment for etiologic research is a challenge, particularly for chronic diseases with potentially long latency. The ubiquity of the exposure and the concern about health risks by the general population make it imperative to study these important chemicals.

K-02 THE EVOLUTION OF OCCUPATIONAL EPIDEMIOLOGY

Neil Pearce. *Director of the Centre for Global Non-communicable Disease, London School of Hygiene and Tropical Medicine*

10.1136/OEM-2019-EPI.2

In this talk, I review the evolution of occupational epidemiology over the last 40 years. Methodologically, the field is almost unrecognizable compared to what was 'standard practice' 40 years ago. Methodological changes include the use of new study design and statistical methods, such as counterfactual theory, directed acyclic graphs (DAGs), IPW, g-estimation, g-computation, multiple imputation for missing values, sensitivity analysis, and bootstrapping. Biomarkers and various molecular and omics measures are increasingly used for exposure assessment, and exploration of mechanisms. The exposures and outcomes under study have also evolved, e.g. with increased consideration of psychosocial factors, work organisation, musculoskeletal problems, mental health and neurological disease. Despite all of these changes, many of the fundamentals of occupational epidemiology remain the same. The *discovery* of new causes of occupational disease continues to be led by astute observers (including astute clinicians and astute workers), rather than by 'bigdata' or 'omics' methods. The strategy for *investigation* of possible occupational causes of disease continues to require a variety of study designs and approaches, including 'descriptive' studies, and triangulation

across study designs and populations (albeit while utilising new molecular biology and statistical techniques). The *causal assessment* of occupational exposures and their health effects continues to require a wide variety of types of evidence in humans and animals, as well as mechanistic evidence. Forty years later, the Bradford-Hill considerations have been augmented but not been replaced, and the IARC 'rules' for combining various types of evidence remain the state-of-the-art. Reports of the death of 'traditional epidemiology' (and its replacement by 'modern epidemiology' and 'causal inference' methods) have been exaggerated.

K-03 A GLOBAL DISEASE BUT A LOCAL PHENOMENON

Jackie Benschop. *School of Veterinary Science, Massey University, New Zealand*

10.1136/OEM-2019-EPI.3

Leptospirosis is a globally important multi-host, multi-pathogen zoonosis with over 1 million cases and 60,000 deaths annually. Humans are infected through contact with urine from infected mammals including wildlife, rodents, farmed species and pets. Despite extensive nationwide intervention measures, leptospirosis remains an unacceptable burden on New Zealanders particularly those living in rural communities and on Māori. Farmers and meat-workers remain most at risk and key intervention strategies for these occupations are the use of personal protective equipment (PPE) and animal vaccination. I will present our work on leptospirosis at the human-animal interface with focus on meat-workers who are required to use PPE yet have no say in the vaccination status of animals they are exposed to.

K-04 CONCEPTUALIZING CHILD LABOR IN CONFLICT SETTINGS: THE CASE OF SYRIAN REFUGEES

Rima Habib. *American University of Beirut, Lebanon*

10.1136/OEM-2019-EPI.4

The persistence of child labor as a widespread global phenomenon is a result of the failure to challenge the conditions of economic injustice and child exploitation. Underlying this failure are policy frameworks that do not address the underlying conditions that produce child labor, namely state fragility, armed conflict, and environmental problems. An estimated 250 million children live in armed-conflict affected areas (Raqib, 2017), where the incidence of child labor is at least 77% higher than the global average (International Labour Organization, 2017). UNICEF (2016) estimates that about 535 million children live in conflict or disaster-stricken areas. Child labor thrives under these conditions because of the poverty, vulnerability, and lack of opportunities characteristic of areas affected by conflict and ecological disasters. The international system has not addressed the root causes of child labor, failing to raise and coordinate adequate relief and development resources when conflicts transpire.

This presentation will propose a new theoretical framework on child labor that incorporates the prominent role state fragility and armed conflict play in the constitution of this phenomenon. The presentation will further explore this theoretical framework through a case study of child labor in

Syrian refugee communities. The Syrian conflict has resulted in one of the greatest humanitarian crises of the 21st century. Over 5.6 million Syrians have become refugees, mostly residing in the neighboring countries of Turkey, Jordan, and Lebanon. Bleak prospects for Syrian refugee youth have raised concerns of a 'lost generation' of children who have had their housing, schooling, and childhoods interrupted. The combination of inadequate national refugee policies, abject poverty, and withering international aid for the crisis have made child labor endemic among many Syrian refugee communities in Jordan, Lebanon, and Turkey (Küppers & Ruhmann, 2016; International Labour Organization et al., 2017; Habib et al., 2019). This address will share stories that elucidate how child labor takes root in conflict settings and how the international community can better address the challenges facing those who are most vulnerable.

K-05 INTERVENTION STUDIES IN OCCUPATIONAL HEALTH: THE MISSING LINK

Martie van Tongeren. *The University of Manchester, UK*

10.1136/OEM-2019-EPI.5

Interventions are very common in workplaces mainly to improve productivity and efficiencies, but also in order to comply with regulatory requirements (environmental and occupational) and to improve the health of workers. Consequently, exposure to chemical agents, at least in Western Europe and the US, have declined in the last 4–5 decades. However, there is a remarkable paucity of properly conducted intervention studies in occupational health, in particular in relation to chemical and biological agents and their health outcomes. As a result, we don't have a very good understanding of what interventions actually work to reduce exposure and to improve the health of workers. Very wide estimates of the effectiveness of control measures have been noted from observational studies, probably because only few studies were probably conducted and many studies just compared the exposure between workplaces with and without the intervention. However, there is an important role for properly conducted intervention studies to reduce exposure and improve occupational health, and results of properly designed intervention studies will lead to a better understanding of causality as well as better understanding of effective interventions.

Pesticide Exposure Assessment

O1A.1 PESTICIDE EXPOSURE OF WORKERS DURING TREATMENT AND RE-ENTRY TASKS IN APPLE-GROWING: RESULTS FROM THE CANEPA STUDY IN FRANCE

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10.1136/OEM-2019-EPI.6

Few studies were performed to assess workers' exposure to pesticides in orchards and even less during re-entry activities. However, nearly 40 pesticide treatments per year are carried out in apple-growing especially against fungal diseases, mainly scab. In order to characterize pesticide exposures of farmers in epidemiological studies, we performed a non-controlled field study in 3 regions of France (Normandy, South-West and Rhône-Alpes) in apple orchards during the 2016 and 2017 seasons. We observed the activity of the workers trying to disrupt it as little as possible. Workers' external contamination and their determinants were assessed during 158 working days, corresponding to 31 treatment days (including mixing, spraying and equipment cleaning), 69 re-entry days (including apple hand-thinning, anti-hail net opening and closing tasks) and 58 harvesting days. We performed both detailed observations of work characteristics on the whole day (including an ergonomic approach) and pesticide measurements for dermal contamination during each task (following the OCDE guidelines). Potential dermal exposure was measured with cotton pads placed onto the skin (11 body areas), and cotton gloves or hand rinsing for each task. Captan and dithianon, fungicides representative of pesticide use in apple-growing, were used as markers for exposure. Relative contribution of the different body areas to total exposure was assessed. In addition, to investigate potential sources of contamination, we measured dislodgeable residues in the environment of the workers by analyzing leaf and fruit samples and surfaces of work equipment. Results indicated that workers' dermal exposure was higher during re-entry tasks than treatments and harvests. The median dermal contamination during treatment was 4.03 mg of active ingredients per day, levels ranging from 0.95 mg to 64.19 mg. Most of the contamination was observed on the hands, especially during mixing. We will focus our presentation on levels and main determinants of pesticide exposure during treatment tasks.

O1A.2 EXPOSURE TO BENZIMIDAZOLE FUNGICIDES IN AGRICULTURE AND NON-HODGKIN LYMPHOMAS, OVERALL AND BY SUBTYPES, IN THE AGRICULTURE AND CANCER (AGRICAN) COHORT

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10.1136/OEM-2019-EPI.7

Purpose Increased risks of Non-Hodgkin's Lymphomas (NHLs) have been reported among farmers in several meta-analyses, with exposure to pesticides as the main explanation. Few studies investigated associations by NHL subtypes and considering specific pesticides. From the French agricultural cohort AGRICAN, we assessed the role of benzimidazole