S-229 MECHANISTIC EVIDENCE IN POPULATION STUDIES ON NIGHT SHIFT AND CANCER

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Introduction In 2007 IARC classified night-shift work as probably carcinogenic to humans (2A). A new evaluation in 2019, 12 years later, resulted in a similar conclusion. It was problematic that numerous cohort studies had poor exposure assessment and population studies examining key characteristics (KCs) of carcinogens were scarce and frequently small.
Objectives I will first summarise molecular epidemiology studies and identify problems that have hampered the interpretation of KC regarding night shift and cancer. I will then discuss strategies for future studies and focus on a new exposome protocol in night shift workers in Europe (EPHOR study).
Methods/Results In the EPHOR study, we will collect individual data and repeated biological samples in 800 night and day shift workers (Spain, Sweden, Denmark, The Netherlands). Exposures of interest measured mostly with personal sensors include light and light spectrum, physical activity, sleep, body temperature, noise, the timing of activities, and some chemical exposures. We will evaluate biomarkers related to immune response, inflammation, disruption of sex-steroid hormones, melatonin and cortisol, cardiometabolic status, markers of aging e.g. telomere attrition together with untargeted omics analyses. Other outcomes of interest include obesity, diabetes, and cognitive and mental outcomes.
Conclusions Some of the endpoints examined are KCs of carcinogens, others define the circadian pattern (e.g. melatonin) and others are important for non-cancer endpoints. The circadian patterns of several markers complicate interpretation since differences between day and night working hours may reflect normal variation. Interpretation of changes in time of peak of a marker (e.g. testosterone) is also complex since on some occasions this may affect functions while in others may just indicate adaptation to a changed schedule. With its large size, standardized procedures, and multiple endpoints examined including several KCs of carcinogens, we expect that the EPHOR study should provide new knowledge on the health effects related.

S-234 STRATEGIES FOR MONITORING OF THE INTERNAL EXPOSOME USING SELF-SAMPLING METHODS IN THE CONTEXT OF EU EPHOR PROJECT

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Introduction Working life exposures contribute significantly to non-communicable disease development. However, the challenge remains on how to map occupational exposures during the entire career and link exposures with health outcomes. In this context, the EU EPHOR project aims to characterize the internal exposome, by characterizing exposure biomarkers and biological pathways to link external exposure and health effects. While there is a range of strategies available to monitor the internal exposome, these conventional methods often require invasive collection of biological samples and/or high volumes. However, the ongoing COVID-19 pandemic forces us to look also at other approaches to obtain biological samples.
Objective We aimed to explore the use of self-sampling techniques in an occupational exposome context.
Methods We have conducted a semi-systematic literature review to identify self-sampling techniques used to generate high quality data on several biomarkers of exposure and effect. We are exploring the possibility of using these self-sampling techniques through a pilot study. A tiered analytical approach along with a biological sequence will be followed to efficiently analyze the samples (i.e. blood, urine, saliva, exhaled breath, exhaled breath aerosols and exhaled breath condensate) for a broad spectrum of biomarkers and omics. Additionally, non-invasive targeted and non-targeted exposome markers of acute lung function decline and inflammation will be developed through proteomic analysis of exhaled breath condensate (EBC), and exhaled breath VOCs using the ReCIVA Breath Sampler. These data will be integrated to generate signatures or 'fingerprints' of exposomes, at individual and group levels.
Results and Conclusion The developed methodology will be applied in 2 cohorts within the EPHOR project: shift-workers and workers with asthma or allergic rhinitis to assess the internal exposure and elucidate biological pathways in disease development.

S-236 SUICIDE AND JOB LOSS IN THE DIESEL EXHAUST IN MINERS STUDY II (DEMS II)

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Introduction The highest suicide rates in the U.S. have been found among males in construction, mining, and extraction occupations. In recent years, the rate has increased dramatically, which may reflect the lack of economic opportunities for miners.
Objectives We examined the impact of job loss, both permanent and temporary, on risk of suicide and overdose among a cohort of 11,817 male miners from the Diesel Exhaust in Miners Study II.
Methods We calculated directly standardized age-adjusted incidence rates per 100,000 person-years from 1947 through 2015 by calendar period. We fit Cox models to estimate hazard ratios (HRs) for suicide and overdose in relation to leaving work, age at leaving work, and intermittent time-off work. Separate models were fit for job loss pre- and post-1980 to examine effect modification by time period as the industry curtailed its workforce in the early 1980s.
Results The age-adjusted incidence suicide/overdose death rate was 64.7 (95% CI: 56.4, 73.9) per 100,000. Suicide deaths peaked between 1980 and 1989 at 67.2 before declining. Based on 248 suicides and overdoses, miners who left work were more likely to die by suicide/overdose compared to those remained at work (HR 1.59 (95% CI: 1.10, 2.29)). Effect modification by decade was present as the HRs for suicide/overdose and age at leaving work differed significantly between the stratified analyses (job loss pre-1980 vs. post-1980). Among miners who left work prior to 1980, HRs for

age at leaving work and suicide/overdose were null. Yet, among miners with post-1980 job loss, leaving work before age 30 and between ages 30–40 increased the risk of suicide/overdose compared with leaving work after age 55 (1.94 (1.05, 3.58) and 1.46 (0.78, 2.72), respectively).

Conclusions Our results suggest an elevated risk of suicide among male miners in the 1980s, and that the risk increases after leaving work.

S-243 DEATH BY ROBOTS? AUTOMATION AND WORKING-AGE MORTALITY IN THE UNITED STATES

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The decline of manufacturing employment is frequently invoked as a key cause of worsening U.S. population health trends, including increased mortality due to rising 'deaths of despair'. Increasing automation—the use of industrial robots to perform tasks previously done by human workers—is one major structural force driving the decline of manufacturing jobs and wages. In this study we examine the impact of automation on age-sex specific mortality. Using exogenous variation in automation to support causal inference, we find that increases in automation over the period 1993–2007 led to substantive increases in all-cause mortality for both men and women aged 45–54. Disaggregating by cause, we find evidence automation is associated with increases in drug overdose deaths, suicide, homicide and cardiovascular mortality although patterns differ across age-sex groups. We go on to examine heterogeneity in effects by safety net program generosity, labor market policies, and the supply of prescription opioids.

S-263 OMEGA-NET INVENTORY OF OCCUPATIONAL EXPOSURE ASSESSMENT TOOLS

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Introduction The Network on the Coordination and Harmonisation of European Occupational Cohorts (OMEGA-NET) was set up to enable optimization of using industrial and general population cohorts across Europe to advance aetiological research. High quality harmonised exposure assessment is crucial for such international occupational health research.

Objective To facilitate an integrated research strategy, a concerted effort is needed to catalogue occupational exposure information. This study aims to provide a comprehensive overview of exposure assessment tools that could be used for occupational epidemiological studies.

Methods An online inventory was set-up to collect meta data on exposure assessment tools (https://occupationalexposure-tools.net/). Occupational health researchers were invited via newsletters, editorials and individual mails to provide details on job-exposure matrices (JEMs), exposure databases, and occupational coding systems and crosswalks, with a focus on Europe.

Results Meta data on 38 JEMs and 9 national exposure databases had been collected up to May 2021. Most JEMs on which these data were entered were developed in the Netherlands and the Nordic countries. A wide variety of exposures was covered, with dusts and fibres (in 15 JEMs) being the most common types. Just a few JEMs covered biological factors (5) and employment conditions (1). Dusts and fibres were also the most common exposures in the databases (6 out of 9), followed by solvents and pesticides (both in 4 databases). Furthermore, information was collected on 24 occupational coding systems from more than 10 countries, indicating related systems as well as the availability of crosswalks or automated coding from free-text.

Conclusion This inventory forms the basis for a searchable web-based database of meta-data on existing occupational exposure information, so that researchers can find the available tools for assessing occupational exposures in their cohorts. This inventory remains open for further additions, to enlarge its coverage and include newly developed tools

S-264 TAKING A WORKING LIFE EXPOSOME APPROACH: WHY DO WE NEED IT AND WHICH CHALLENGES ARE WE FACING?

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The exposome concept was conceived in 2005 as a way to represent non-genetic drivers of health and disease. The exposome encompasses all non-genetic risk factors experienced during a person's life (the external exposome) and its relation to biological responses inside the human body (the internal exposome). This concept was born out of the recognition that – while there was a revolution in our understanding on the genetic drivers of disease – our understanding on environmental drivers was much more limited. About 70–80% of the disease burden could probably be explained by the exposome.

Fifteen years after the exposome concept was introduced, several advances have been made in the quantification of the exposome by using combinations of different technologies (sensors, bioassays), large exposure and health datasets, and advanced statistical methods. These advances enable moving away from the 'one exposure-one disease' approach.

Although occupational risk factors are known to have an important impact on non-communicable diseases, the application of the exposome approach to occupational health has been limited. This is surprising as i) our working life covers a significant proportion of our total lifespan; ii) occupational exposures occur often in complex settings; iii) working-life encompasses important vulnerable life stages including the reproductive period; and iv) occupational exposures are closely related to lifestyle/behaviour (e.g. diet, physical activity, smoking and alcohol consumption) and socioeconomic status.

Given the varying exposures and interrelations with other factors across the life course a (holistic) network approach is needed to fully understand the impact of the working life exposome on health. The exposome approach and associated tools start to allow building a (partial) picture of the occupational exposome, which may lead to new insights on how the occupational exposome affects health and provide new leads for prevention.