Exposure assessment

NATURAL LANGUAGE PROCESSING AS A TOOL FOR DEVELOPING AND UPDATING JOB EXPOSURE MATRICES FOR CHEMICAL EXPOSURES IN THE GENERAL POPULATION

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Workplaces are dynamic environments, in which temporal changes in conditions and exposures frequently occur. Such changes are rarely captured by existing Job Exposure Matrices (JEMs), which are typically developed using information available at a certain point in time. As such, they are unable to take into account potential future changes, which could negatively impact the reliability of JEMs when used outside their development period. Moreover, the process of developing JEMs for emerging or new exposure factors is a laborious, time-consuming process. Within the Exposome Project for Health and Occupational Research (EPHOR; https://www.ephor-project.eu/), we have been exploring the use of Natural Language Processing (NLP) as a vehicle for streamlining the update of existing JEMs and the development of new JEMs. Specifically, we will develop named entity recognition (NER) tools to automatically detect mentions of exposure-related concepts in literature, thus increasing the efficiency of locating relevant information for JEM update and development. Accordingly, we have developed a novel annotated corpus, i.e., 50 literature articles concerning workplace exposure to diesel exhaust, in which exposure assessment experts used guidelines to annotate all mentions of six different named entity categories (substance, occupation, industry/workplace, job task/activity, measurement device and sample type) occurring in the abstract, methods and results sections. The corpus will be used to train machine learning NER algorithms. Each article was annotated independently by two experts, and Inter-Annotator Agreement (IAA) scores were calculated to assess annotation quality. Exact matching scores (requiring agreement of semantic category and exact annotation span) ranged from 0.38 to 0.79 F1 for individual categories (average: 0.56). Relaxed matching scores (requiring agreement of category and partially overlapping spans) ranged from 0.63 to 0.87 F1 (average: 0.72). These results suggest that annotation quality is sufficient for machine learning. We will present the annotation scheme, guidelines and preliminary analysis of the results.

Cardiovascular disease

OCCUPATIONAL NOISE EXPOSURE AND CORONARY ARTERY CALCIFICATION

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Objective Coronary artery calcification is a major feature of ischaemic heart disease. Occupational noise exposure has been related to increased risk of ischaemic heart disease. We examined if coronary artery calcification was associated with occupational noise exposure.

Methods Lifetime occupational exposure was assessed by a quantitative job exposure matrix based on 1343 personal occupational noise dosimeter measurements. Associations between cumulative occupational noise exposure (dB-years) and coronary artery calcification score (none=0; low=1–100; moderate=101–400; severe≥401) were examined with ordered logistic regression among patients with a cardiac CT scan between 2005–2018. Analyses were adjusted for age (2-year intervals), sex, household income, employment status, probability of smoking and BMI, cohabitation and relevant medications.

Results A total of 23,697 patients were included. No coronary artery calcification was detected in 37% of the participants, whereas 14% had a score ≥401. The fully adjusted ORs (95% CI) of increasing coronary artery calcification score with occupational noise exposure (88–105 dB-years in the lowest quartile (ref.) and 113–121 dB-years in the highest) were 1.00 (ref.), 1.09 (1.02,1.18), 1.14 (1.06,1.23), 1.09 (1.01,1.20), p trend 0.013.

Conclusion These cross-sectional findings suggest that occupational noise exposure may contribute to ischaemic heart disease through coronary artery calcification.

Injuries

CANNABIS USE AND THE RISK OF WORKPLACE INJURY: FINDINGS FROM A LONGITUDINAL STUDY OF CANADIAN WORKERS

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Introduction Social and legislative changes in cannabis use worldwide have led to renewed interest in the potential impacts of cannabis use on occupational safety. Previous
studies examining the relationship between cannabis use and workplace injury have yielded mixed findings, likely due to methodological shortcomings, including cross-sectional study designs and broad measures of exposure that lack consideration for timing of use. Using data from a national longitudinal study of Canadian workers, the objective was to examine the relationship between cannabis use, including workplace use, and the risk of workplace injury.

Materials and Methods Surveys were conducted yearly from 2018 to 2020. Two exposures were examined: 1) general cannabis use (never, former, past-year) and past-year workplace cannabis use (no use, non-workplace use, workplace use), with workplace use referring to use two hours before work, use during work and/or use during breaks. The outcome was past-year workplace injury (yes/no). Workers participating in adjacent surveys were included in analyses (n=2,745). Relative risks (RR) and 95% confidence intervals (CIs) were estimated between each exposure and workplace injury, using exposures measured at the survey immediately preceding the outcome. Models were adjusted for various sociodemographic, health, and work variables.

Results When examining general cannabis use, compared to never use, no relationship was seen for former use (RR 1.09, 95% CI 0.84–1.42), while past-year use was associated with a 30% increased risk of workplace injury (95% CI 0.99–1.72). When examining workplace cannabis use, compared to no past-year use, there was no difference in risk of workplace injury for past-year non-workplace use (RR 1.11, 95% CI 0.87–1.41). However, workers reporting past-year workplace use were at an almost two-fold increased risk of experiencing a workplace injury (RR 1.86, 95% CI 1.30–2.66).

Conclusions It is important to distinguish non-workplace and workplace use when considering workplace safety impacts of cannabis use.

Exposure assessment

Exposure assessment for sub-concussive head impacts among former English professional football players: Results from the heading study

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Objective To develop exposure estimates for sub-concussive head impacts (SCHI) for use in retrospective epidemiological studies among former professional association football players.

Methods Playing and heading history data were available from questionnaires of ex-professional association football players (n=163) participating in the Health and Ageing Data in the Game of football (HEADING) study (https://www.lshtm.ac.uk/research/centres-projects-groups/heading-study). We use linear mixed effect regression to model the number of headers and other head impacts as a function of potential exposure affecting factors including decade of play (playing position, level of play, league) and context of event (games vs training). Models are elaborated with player identifier as the random effect and potential exposure affecting factors as the fixed effects. Model selection is based on a stepwise approach.

Results Results from models based on 1463 observations representing individual playing periods defined by club and decade of play suggest the number of head impacts to differ significantly between playing positions, event context, decades and level of play. Number of head impacts was higher among defenders and utility players when compared with players in other positions. Professional play was also associated with an increased number of head impacts compared to apprentice, amateur and semi-professional play, with the average number of reported head impacts declining throughout the observation period (1949–2015). The model explained 40% of the total variability in reported number of head impacts.

Conclusion Currently further models for blows and head-to-head collisions are being developed. Validation exercises including comparisons of bias and precision against observations not included in the modelling processes are also underway. At the conference we will report the results of the final models alongside those of the validation exercises. The model results will be used to estimate cumulative exposure to SCHI in epidemiological studies of former association football players.

Carcinogens/Cancer

O-135 Exploring the etiology of rare cancers using a large multi-ore mining cohort

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Introduction Cohort studies may be limited in their ability to investigate rare cancers because of their size, length of follow-up, or access to cancer registry data. This study examines exposure patterns for nasal, nasopharyngeal, laryngeal, salivary gland, and bone cancer using a large multi-ore mining cohort.

Materials & Methods From 1928–1988 underground miners in Ontario, a region where gold, uranium, nickel, and other ores are mined, were required to undergo an annual medical exam, and record their mining work history to receive certification. These data were used to create the Mining Master File (MMF) cohort. Cancers were identified through linkage with the Ontario Cancer Registry (1964–2017). Cancer risk among miners was compared to the general population using Standardized Incidence Ratios (SIR) and between groups of miners in the cohort using Poisson regression.

Results The cohort consisted of 61,397 male miners. Nasal cancer was somewhat elevated (48 cases, SIR=1.44, 95% confidence Interval (CI)=1.06–1.91) but the observed excess