was last evaluated revealed whether evidence gaps have been addressed and highlighted remaining uncertainties.

Conclusions During the past decade, new research addressed many of the 2009 recommendations, and supported updated classifications for several priority agents. This supports future efforts to systematically apply the findings of monograph reviews to the identification of research gaps and priorities, including with regard to advances in understanding mechanisms of carcinogenesis and their application in evaluation criteria established in the updated IARC Monograph preamble.

Respiratory effects/Diseases

0-55 CLEANING AND DISINFECTING TASKS, PRODUCTS AND VOLATILE ORGANIC COMPOUND EXPOSURES ASSOCIATED WITH ASTHMA OUTCOMES IN HEALTHCARE SETTINGS

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Introduction Cleaning products are complex mixtures of chemicals, and their use is associated with elevated prevalence of asthma symptoms among healthcare workers. In this study, we evaluate the effects of cleaning and disinfecting tasks, products used, and quantitative volatile organic compound (VOC) exposures on asthma outcome clusters of cough/phlegm, mild asthma, undiagnosed asthma and uncontrolled asthma.

Materials and Methods Healthcare workers from nine select occupations working in New York City hospitals and nursing homes completed a questionnaire with modules on cleaning and disinfecting tasks and product use. Frequency of cleaning tasks and products were calculated and quantitative exposure to total and 12 specific or composite VOCs were assigned to participants based on predictive statistical models. Exposure-response relationships for asthma outcome clusters were explored using polytomous logistic regression adjusted for age, gender, race, smoking and allergic status.

Results Various cleaning and disinfecting tasks were significantly associated with at least one of four asthma clusters including tasks involved in cleaning fixed surfaces, disinfecting medical instruments, administration of aerosolized medications and dental tasks. Products significantly associated with asthma clusters included use of orthophthaldehyde, alcohol, bleach, acids, ammonia, enzymatic cleaners, detergents, glass cleaners and phenolics on surfaces or instruments. Most VOC exposures were significantly associated with at least one of four asthma clusters. Specifically, chloroform, methylene chloride and VOC 11 (sum of 11 specific VOCs) were significantly associated with mild asthma, undiagnosed asthma and uncontrolled asthma. Notably, VOC exposures were highly correlated and specific VOCs with the greatest influence on the asthma clusters remain unclear.

Conclusion These results confirm previous findings of the association between cleaning and disinfecting products and asthma outcomes and highlight the need for prudent actions to mitigate exposures. However, these single predictor models do not represent workplace conditions; multipollutant models are needed to investigate mixed exposures and their interactions.

Disease surveillance

0-56 INCIDENCE OF MALIGNANT MESOTHELIOMA IN LOMBARDY, ITALY: ACCURACY OF PREDICTIVE MODELS 2013-2020

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Introduction The Lombardy Mesothelioma Registry (RML) was established in Lombardy Region in 2000 as a regional operative center of the National Mesothelioma Registry (ReNaM-INAIL). It covers a population of 10 million inhabitants and records about a quarter of cases in Italy (60 million inhabitants). In 2016, the RML published incidence predictions over the period 2013-2029, based on age-cohort Poisson regression models applied to 2000-2012 data. Aim of this study is to verify the accuracy of the prediction models and to describe the characteristics of the affected subjects in the period 2013-2020.

Material and Methods The RML collects clinical information on MM cases (all sites) occurring among regional residents at the time of first diagnosis. Information sources include hospital admissions and pathology reports, local health units archives, reports of occupational diseases, and mortality data. In confirmed cases, previous exposure to asbestos is assessed through a standardized questionnaire administered by trained personnel. We extracted from RML databases the record of MM cases collected in the period 2013-2020.

Results Over the period 2013-2020 we had predicted 2102 cases in men (on average 263/year) and 1176 in women (147/year). We recorded 2390 cases in men (299/year) and 1140 (143/year) in women. During the same period, occupational exposure to asbestos was reported by about two-thirds of men and one third of women. Non-occupational exposure to asbestos was reported in <5% in men and about 10% in women.

Conclusions In the period 2013-2020 there was good agreement between predicted and observed MM cases in women, while we recorded 288 more cases than predicted (36/year) in men. The impact of asbestos in Lombardy is still high 30 years after the national ban in 1992, with a total of 7986 cases (5250 in men, 4027 in women) in the period 2000-2020.

Carcinogens/Cancer

0-57 OCCUPATIONAL EXPOSURE TO ENDOCRINE DISRUPTORS AND COLORECTAL CANCER RISK IN TWO CANADIAN COHORTS

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Introduction Sex hormones have been implicated in the etiology of colorectal cancer. Endocrine disruptors (EDCs) are
compounds that can interfere with sex hormone signalling and cause adverse health effects, including cancer. Exposure to EDCs is ubiquitous, but exposure in some workplaces occurs at much higher levels than in the general population.

Objective To determine whether occupational exposure to EDCs is associated with colorectal cancer risk.

Material and Methods A case-cohort study was nested in the Alberta’s Tomorrow Project (ATP) and in the Ontario Health Study (OHS). Incident cases of colorectal cancer were identified (NATP=202, NOHS=605); a sub-cohort of 3,464 participants was selected at baseline (NATP=565, NOHS=2,899). Occupational exposure to 17 EDCs was estimated via linkage to CANJEM, a job-exposure matrix, for participants’ longest-held job. Specifically, CANJEM provides a frequency-weighted intensity metric of exposure and it was used to categorize participants into never exposed, exposed and substantially exposed to each individual EDC. Multivariable logistic regression models were used to estimate odds ratios (OR) and 95% confidence intervals (CI) for colorectal cancer associated with occupational exposure to EDCs while controlling for confounders identified using a directed acyclic graph.

Results In ATP, exposure to arsenic (OR=2.86, 95%CI: 1.06–7.63), copper (OR=0.53, 95%CI: 0.29–0.92), lead (OR=0.58, 95%CI: 0.34–0.97) and substantial exposure to arsenic (OR=2.87, 95%CI: 1.01–8.00), phenol (OR=0.25, 95%CI: 0.08–0.61), and trichloroethylene (OR=0.45, 95%CI: 0.21–0.90) were associated with colorectal cancer. In OHS, exposure to polychlorinated biphenyls (OR=3.95, 95%CI: 1.82–8.55), styrene (OR=0.47, 95%CI: 0.26–0.79), and substantial exposure to aluminum (OR=1.32, 95%CI: 1.03–1.68), cadmium (OR=0.59, 95%CI: 0.38–0.87), lead (OR=1.29, 95%CI: 1.03–1.60), phthalates (OR=0.52, 95%CI: 0.25–0.96), and trichloroethylene (OR=1.43, 95%CI: 1.08–1.88) were associated with colorectal cancer.

Conclusion Of the 17 EDCs, five were associated with an increased risk, and seven with a decreased colorectal cancer risk; however, none of the associations were consistent between the two cohorts.

Risk assessment

LESSONS LEARNED FROM EVALUATING EPIDEMIOLOGICAL STUDIES FOR CANCER HAZARD IDENTIFICATION THE UPDATED REPORT ON CARCINOGENS (ROC) HANDBOOK

Introduction Although systematic reviews aim to increase transparency and rigor in health evaluations for public health decision-making, some methodologies have been criticized for being algorithmic, maladapted to the complexity and diversity of environmental and occupational epidemiology studies, or misused by reviewers without adequate expertise. Need for continual methods refinement has prompted both the development and updated RoC handbook.

Methods The RoC handbook provides guidance to conduct systematic reviews and integrate evidence to identify cancer hazards. Evaluating the informativeness of epidemiological studies focuses on the direction, magnitude, and impact of biases and study sensitivity. Updates to the RoC handbook, which will be peer reviewed and published as a living document, are based on its application to 7 RoC and 3 OEHHA cancer hazard evaluations and methodological advancements in epidemiology and systematic review.

Results New features of the updated handbook are interactive evidence maps to inform the review approach for each exposure-outcome pair and enhanced guidance to evaluate exposure misclassification and integrate evidence across studies. Assessing exposure misclassification considers (1) how well the exposure proxy approximates the exposure of interest, (2) how accurately and precisely the exposure (or proxy) is measured, and (3) differential recall bias or observational bias. Because cancer epidemiology studies employ a wide range of methods to assess exposure, the handbook provides direction to evaluate specific methods (e.g., environmental measurement, job exposure matrices). Evidence integration includes triangulation and systematic approaches to explore the impact of biases and confounding, effect modifiers, exposure metrics, and other sources of heterogeneity.

Conclusions The revised RoC handbook strives to balance the advantages of systematic and narrative reviews and focus on key issues in environmental and occupational epidemiology. In addition to providing transparency for our evaluations, we hope it can serve as a resource to scientists who appraise the epidemiologic literature.

Carcinogens/Cancer

INCREASING LUNG CANCER RISK AND OCCUPATIONAL BENZENE EXPOSURE: RESULTS FROM A POOLED CASE-CONTROL STUDY

Introduction Benzene is widely present in various industries and ubiquitously in the general environment. Benzene has been classified as a known human carcinogen, but there is limited evidence linking benzene exposure with lung cancer. However, if such an association exists, this could have large implications for occupational and environmental risk assessment. We aimed to systematically investigate the association between occupational benzene exposure and lung cancer.

Material and Methods Subjects from 14 case-control studies across Europe and Canada were pooled. We used a quantitative job-exposure matrix (BEN-JEM) to estimate benzene exposure based on occupation records. Logistic regression models were used to estimate lung cancer risk and various benzene exposure indices. We stratified analyses by smoking status and lung cancer subtypes, and rigorously adjusted for age, sex, smoking and other known occupational lung carcinogens.