

**Objectives** A feasibility study has shown that a scientifically rigorous and comprehensive epidemiological study of workers involved in the manufacture or production of tungsten carbide with a cobalt binder is feasible, and should include workers from sites in the United States and in Europe. Objectives include: (i) to investigate the total and cause-specific mortality experience of current and former workers as compared with the corresponding national and local populations from which the workforces were drawn, with adjustment for potential confounding factors; (ii) to characterise as completely as possible the current and past working environment of the study participants; and (iii) to determine the relationship between level and duration of exposures and mortality from lung cancer with analytic adjustment for important potential co-exposures, including tobacco smoke. The study is funded by the International Tungsten Industry Association.

**Methods** The study cohort will be enumerated using human resources data, with cross-checks for completeness against pension, payroll, occupational health and other sources. All available occupational hygiene data will be extracted to facilitate a study-wide exposure assessment.

**Results** Initial meetings have been held with the two UK factories to establish the scope and quality of demographic and industrial hygiene data. In parallel with this an application has been submitted to an ethics committee and the National Information Governance Board, the latter seeking to obtain an exemption from having to gain positive consent for study participants. A worker leaflet explaining the study has been drafted for inclusion in the ethical submission. Work to determine the optimum way to extract the data from the factories, is currently underway.

**Conclusions** This large study will represent multiple companies, countries and manufacturing processes and will be larger, more robust and more definitive than any hard-metal manufacturing epidemiological study done to date.

#### 56 INCIDENCE OF MESOTHELIOMAS IN QUÉBEC AND CANADA FROM 1984 THROUGH 2007: TRENDS AND ESTIMATE OF FUTURE BURDEN

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**Objectives** We compared the incidence rates of pleural (MPL) and peritoneal (MPR) mesotheliomas between Quebec and the rest of Canada to describe past and estimate future temporal trends of MPL in Quebec until the year 2032.

**Methods** New cases occurring between 1984 and 2007 were counted in the Canadian Cancer Registry according to the international classification of diseases for Oncology, 3rd version (ICD-O-3). Equivalent ICD-O-1 coding was used to identify mesothelioma cases before 1992. Age-standardised rates were compared between sexes and regions. Poisson regressions were carried out to assess the effects of birth cohorts and to estimate future rates of MPL.

**Results** The age-standardised incidence rates of MPL averaged 2.12 and 0.42 for 100000 person-years among Quebec men and women respectively. Age-adjusted rates of MPL were 1.45 (95% CI = 1.37–1.54) times higher in Quebec men and 2.00 (95% CI = 1.76–2.27) times in women than among Canadian men and women. The age-adjusted rate of MPR was 1.36 (95% CI = 1.09–1.68) times higher among Quebec residents than in the rest of Canada. A significant slowdown in the increase of MPL was observed after 1995. Younger cohorts

experienced a lower incidence of MPL. The incidence of MPL should peak between 2008 and 2012 (at 2.79/100000 in Québec and 1.79/100000 in Canada). In Quebec, there would be an absolute excess of some 700 new male cases and 160 female cases over a 5-year period.

**Conclusions** The observed higher and continuously increasing rates of MPL in Québec warrant a stricter surveillance of mesothelioma incidence and asbestos exposure to ensure that rates effectively drop down to background levels.

#### 57 AN INTERNATIONAL HISTORICAL COHORT STUDY OF WORKERS IN THE HARD-METAL INDUSTRY

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**Objectives** In 2006, IARC found limited evidence in humans and sufficient evidence in animals that tungsten carbide (WC) with cobalt binder (WCCo) acted as a lung carcinogen (Group 2A). Our historical cohort study was designed to overcome certain limitations of earlier epidemiology studies by including a rigorous exposure assessment component, a nested case-control study of lung cancer and use of external and internal cohort rate comparisons. The primary research objectives include:

To investigate the total and cause-specific mortality experience of current and former workers as compared with corresponding national and regional populations and internally-derived control groups, with adjustment for potential confounding factors and focus on lung cancer.

To characterise the past and current working environment of subjects relative to work area, job title/function and potential for exposure to WCCo, as well as the component exposures: tungsten, tungsten carbide (without cobalt), carbon black, and cobalt;

To determine the relationship between level and duration of exposures and lung cancer mortality with adjustment for potential co-exposures, including information obtained on tobacco smoking habits via a nested case-control study.

**Methods** Our cohort comprises 10 manufacturing sites in the United States and nine sites in Europe, and represents three companies, five countries (US, Austria, Germany, Sweden and UK) and multiple manufacturing processes. The study will include separate and pooled analyses. The epidemiological and exposure assessment components of the study are coordinated by the University of Pittsburgh and the University of Illinois at Chicago, respectively. The study is funded by the International Tungsten Industry Association; the US record collection phase was supported in part by the Pennsylvania Department of Health.

**Results** We will report on current progress in the US component of the study and in our efforts to coordinate the international study. Progress in the European studies will be reported separately by the respective investigators.

#### 58 AN INTERNATIONAL HISTORICAL COHORT STUDY OF WORKERS IN THE HARD-METAL INDUSTRY - GERMAN COMPONENT

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**Objectives** To determine the relationship between exposure to hard-metal dusts and lung cancer mortality. This international cohort study is coordinated by the University of Pittsburgh and funded by the International Tungsten Industry Association (Marsh *et al* 2013, EPICOH abstract). The German component comprises three Kennametal manufacturing sites in North Rhine-Westphalia and Bavaria.

**Methods** We enrolled all current and former workers at two Bavarian sites (start of production 1960 and 1971 respectively). At the largest plant in North Rhine-Westphalia (start of production 1926) we will enrol all blue-collar workers who were employed for at least 6 months. We will collect and analyse measurement data, work history, and medical information like smoking and urine data. We will apply an electronic data collection system to protect personal data. To investigate total and cause-specific mortality for the period 1980–2011, we aim to determine each subject's vital status and, if applicable, cause of death. External comparisons (SMRs) to the German population and state populations will be performed. Cox models will be used for internal analyses.

**Results** Our preliminary estimates of the numbers of participants at the two Bavarian plants are 2,711 and 1,577. At the North Rhine-Westphalian plant we have enrolled 3,700 workers (less than half of the overall workforce). Some current workers refused to be enrolled in the study. 3.7% of 676 and 0.2% of 417 at Bavarian plants and 0.9% of 637 at North Rhine-Westphalian plant. Basic data of these workers will be documented.

**Conclusions** The data collection process in North Rhine-Westphalia was restricted due to the large number of paper files. Otherwise it would not be feasible to meet the budget and time schedule of the international pooling project. Vital status and cause of death tracing are challenging in Germany. We will try to optimise procedures in cooperation with the responsible institutions.

#### 59 AN INTERNATIONAL HISTORICAL COHORT STUDY OF WORKERS IN THE HARD-METAL INDUSTRY - AUSTRIAN COMPONENT

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**Objectives** Researchers at the University of Pittsburgh and the University of Illinois at Chicago are coordinating an international historical cohort study of workers in the hard-metal industry. Funding is provided in part by the International Tungsten Industry Association. From Austria they approached a large industrial plant in Reutte, Tyrol, and the Institute of Environmental Health at the Medical University of Vienna to coordinate the Austrian part of the study that is financially supported by the national workers insurance company.

**Methods** As a first result of the cooperation between Reutte and Vienna a cross-sectional study was designed based on a questionnaire directed to all present workers and to past workers with still valid addresses. This questionnaire served two purposes: (1) to announce the aim of the cohort study and (2) to obtain more

detailed data on smoking history and general health history than is available in the company records.

**Results** In spite of repeated advertising of the questionnaire by the Reutte management only approximately 10% of all addressees (233 persons in total) responded. Active workers were over-represented while only 78 (mostly only recently) retired workers completed the questionnaire. Also, current white collar (office) workers were overrepresented (58 persons).

**Conclusions** Although a respiratory disease or hypertension were each reported by about 10% of respondents the subjective health status was generally good. Better health was reported by office workers while working in departments with the highest dust exposure was not associated with poorer health. Increasing age did not consistently lead to higher symptom rates while smokers reported poorer health not only for respiratory but also for rheumatic and psychiatric symptoms.

We will also report on the progress of our ongoing work on the international epidemiology study.

#### 60 CANCER MORBIDITY OF LEAD EXPOSED WORKERS IN KOREA

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**Objectives** To compare cancer patterns in lead exposed workers with the Korean general population, and to explore the relationship between cancer and lead exposure in an occupational setting.

**Methods** Using from the Korean annual medical surveillance for exposure to lead, a cohort comprising 75,184 lead exposed workers working between January 1<sup>st</sup>, 2000 and December 31<sup>st</sup>, 2004 was compiled. This cohort was merged with the Korea National Central Cancer Registry (KNCCR) in order to evaluate the cancer morbidity for these workers between 2000 and 2008.

**Results** There were 793 cases cancer and, the incidence of stomach cancer (SIR 1.17, 95% CI = 1.01–1.36) was found to be elevated in lead chromate workers. Excesses were observed for kidney (2.15.1.19–3.88) and bladder cancers (2.29.1.149–4.58) in lead exposed workers  $\geq 20$  years of job duration, kidney cancer (2.25.1.21–4.18) in workers with  $\geq 10$  ug/dl of blood lead level and lung cancer in female workers with  $\geq 10$  ug/dl blood lead level.

**Conclusions** Our study showed excess of lung cancer in female workers, stomach cancer in lead chromate exposed workers and a possible dose-response relationship between kidney cancers and lead exposure.

#### 61 AN INTERNATIONAL HISTORICAL COHORT STUDY OF SWEDISH WORKERS IN THE HARD-METAL INDUSTRY

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In 2006, IARC found limited evidence in humans and sufficient evidence in animals that tungsten carbide (WC) with cobalt binder (WCCo) acted as a lung carcinogen (Group 2A). A Swedish historical cohort study was established as part of the international cohort. Three Swedish sites are included,