

very late after injury. In this presentation studies on late health outcome will be briefly reviewed and a recently published study on long term outcome in rugby union players will be presented. In this study, outcome in relation to exposure to repeated head injury was investigated in retired Scottish international rugby players and controls in relation to general and mental health, life stress, persisting complaints, cognitive function, disability and markers of chronic life stress (allostatic load).

Although the estimated number of concussions was high in the retired rugby players (median=7; IQR 5–40), and subtle group differences were detected on two of the cognitive tests (verbal learning and fine co-ordination of the dominant hand), group differences in mental health, social or work functioning were not found late after injury, and there were not associations between the number of concussions and cognitive function.

There is a need for prospective group comparison studies on representative cohorts.

## Invited

### Occupational Medicine (SCOM/Modernet)

**0500 INVITED KEYNOTE: WHO WOULD HAVE THOUGHT IT? THE UNFORESEEN PROBLEMS OF DISRUPTIVE TECHNOLOGIES**

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Increasing exploitation of Britain's coal resources and the manufacture of steel in the 18<sup>th</sup> century led to the invention of the steam engine, liberating factories from dependence on water power and enabling transport by railway and steam ships. The application of these technologies and the ideas of Adam Smith on the use of capital led to the Industrial Revolution and Britain's dominance in world trade through the 18<sup>th</sup> and 19<sup>th</sup> centuries. However, in large part this was based on gross exploitation of human and other resources throughout Britain and its Empire.

The most obvious health consequences of coal affected miners; accidental deaths and lung disease. The latter became a matter of intense medical dispute right through to the late 20<sup>th</sup> century. Less obvious at first were the health consequences of air pollution, which made an impact on medical thinking only in the mid-20<sup>th</sup> century. Even less obvious were more subtle consequences of coal exploitation. The production of coke for making steel was found to cause lung cancer in coke oven workers. Secondary use of the volatile derivatives from coke and coal gas manufacture led to the organic chemical, rubber and plastics industries, from which mankind has derived enormous benefits but which in turn have led to health hazards among workers, from bladder cancers to leukaemias and neurological diseases.

Most serious of all have been the ecological consequences of the use of coal and its successor, oil, to which similar effects on workers can be ascribed. Of these, the most important is climate change which threatens the end of civilisation. This was not foreseen until the very late 20<sup>th</sup> century. Now we are facing similar threats from other disruptive and primarily beneficial technologies – the world-wide web, robotics,

artificial intelligence, genetic engineering and nanotechnology. Can we foresee these problems and act to reduce the risks?

## Invited

### Musculoskeletal

**0501 LIFETIME ACHIEVEMENT AWARD – INVITED KEYNOTE: WHY HAVE WE FAILED TO PREVENT BACK PAIN IN WORKING POPULATIONS?**

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Low back pain (LBP) is a major cause of disability globally, and has been linked consistently with occupational activities that load the spine mechanically. However, randomised controlled trials of ergonomic interventions have failed to produce expected reductions in the disorder. Moreover, social security statistics from Britain reveal an eightfold rise in incapacity for work attributed to LBP during 1950–95 at a time when the physical demands of work were reducing.

To shed further light on this apparent paradox, a study (CUPID) was set up to assess differences in the prevalence of musculoskeletal pain and associated disability among workers carrying out similar occupational tasks in different cultural environments, and to explore explanations for any variation. Data were collected by questionnaire from 47 occupational groups (nurses, office workers and others) in 18 countries, with a follow-up survey after a mean interval of 14 months in 45 of the groups.

Analysis of baseline data indicated major variation in the prevalence of disabling LBP, with somewhat higher rates in nurses than office workers, but much larger differences between similar occupations in different countries. The variation was not explained by established risk factors, but correlated strongly with differences in the prevalence of disabling wrist/hand pain. Moreover, baseline extent of regional pain at anatomical sites outside the low back strongly predicted the prevalence of disabling LBP and associated sickness absence at follow-up, explaining much of the variation between occupational groups. These observations, which accord with findings from successive European Working Conditions Surveys, suggest that large international differences in the prevalence of LBP do not depend on causes specific to the spine, but are driven by factors that increase propensity to musculoskeletal pain more generally. Furthermore, a study of migrants from South Asia to the UK indicates that such propensity is environmentally determined, and can increase soon after moving to a new country where rates of pain are higher.

Based on current evidence, it can be hypothesised that while mechanical loading may cause minor strains that trigger episodes of LBP, the severity and persistence of symptoms is driven more by culturally-determined psychosocial factors that affect musculoskeletal pain more generally. If so, while ergonomics has an important role in enabling people to work more comfortably and to remain productive when limited by back pain, the key to reducing the continuing high burden of LBP may lie in understanding what drives differences in general propensity to musculoskeletal pain.

## Invited Cancer

### 0503 INVITED KEYNOTE: OCCUPATIONAL CANCER THE 21ST CENTURY

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Occupational health research has identified numerous carcinogens particularly before the 1990s. Most occupational carcinogens were first identified through clinical observations and epidemiological studies rather than experimental studies. The most frequently quoted estimate of cancers due to workplace exposures is 4% and was estimated nearly 40 years earlier. There is a lack of current valid estimates at a global scale. There are significant trends in exposure to occupational carcinogens with a reduction of exposed workers and exposure levels in high income countries and increase in prevalence and high exposure levels in newly developed countries. New technologies and changing employment patterns are posing new challenges in the identification and control of occupational carcinogens. Working time and particularly shift work are among the major new areas for research and prevention. Epidemiological research in recent years has had significant difficulties in providing strong evidences on new carcinogens. This has been particularly the case in complex exposure scenarios such as exposure to pesticides. Different phases in epidemiological research can be identified. Case series and later SMR studies dominated in early periods. These were followed by the development of advanced exposure assessment methods and JEMs and their application in both cohort and case-control studies. In recent years studies in the wider area of molecular epidemiology have developed incorporating mechanistic information. Overall, the most productive studies in identifying carcinogens were the early and relative simple SMR studies that were done in a context of high exposures and limited work mobility. Use of classical epidemiological designs and particularly large cohort studies with advanced exposure assessment methods and the combination with new research approaches using powerful tools for exposure assessment, biomarkers and omic technologies will provide new evidence and allow quantitative risk assessment. Conduct of 'big data' type studies without advanced exposure assessment methods are unlikely to identify new occupational carcinogens. Occupational cancer research has been seriously underfunded and has been inefficient in promoting prevention of occupational carcinogens globally. This is a consequence of factors both within the occupational health community (repetitive non-innovative research; lack of efficient coordination in the occupational health community) but mostly due to wider factors and particularly the general hostile wider political environment concerning work conditions. Occupational exposure to carcinogens continues being in the 21st century a major cause of preventable disease and in many parts of the world the prevalence of these exposures is increasing.

### 0139 MORTALITY AND MESOTHELIOMA INCIDENCE AMONG CHRYSOTILE ASBESTOS MINERS IN BALANGERO, ITALY: A COHORT STUDY

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Chrysotile asbestos causes an increased risk of mesothelioma (MM), but the extent of this risk and the carcinogenic potency of chrysotile fibers is in discussion. We studied mortality and MM incidence among workers employed at the Balangero mine (Italy), the largest chrysotile mine in Western Europe, active from 1917 to 1985. The cohort included 974 male workers employed for at least 6 months and active on January 1st, 1946 or subsequently hired. Vital status and causes of death were ascertained. Past exposure to asbestos by working area and calendar period was estimated, based on historical measurements of fibre concentrations, and individual cumulative exposure was assessed by applying these estimates to the job history of cohort members.

Local reference rates were used to compute expected deaths from selected diseases and expected incident MM cases. Observed to expected ratios were calculated along with 95% confidence intervals.

Mortality was increased for all causes (SMR=1.28; CI95% 1.17–1.40), pleural cancer (SMR=4.30; CI95% 1.58–9.37) and asbestosis (SMR=375.06; CI95% 262.68–519.23). SMRs for lung cancer (SMR=1.14; CI95% 0.81–1.55) and peritoneal cancer (SMR=3.25; CI95% 0.39–11.75) showed a non-statistically significant increase. Six cases of pleural MM were observed and the SIR was 6.3 (CI95% 2.3–13.7). The analysis by duration and latency for pleural cancer showed an increased risk with increasing duration of exposure and the risk flattened out for latency greater than 40 years. Further analyses based on quantitative exposure indices are being conducted to contribute to the debate on chrysotile potency.

## Oral Presentation

### Intervention studies

#### 0021 EXERCISE PROTECTS AGAINST LOW BACK PAIN: SYSTEMATIC REVIEW AND META-ANALYSIS OF CONTROLLED TRIALS

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