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DAY 1 - SCIENTIFIC SESSION I
Covid-19 as an Occupational Disease

1. Covid-19 as an Occupational Disease: Where are We Now and Where are We Going? *David Michaels, USA*
2. Responses of OHS regulators and inspectors to the Covid-19 pandemic *Gregory R. Wagner, USA*
3. COVID-19 and the Impact in Work, Health and Safety in Ecuador: Findings 18 months into the Pandemic *Homero Harari, USA*
4. Covid-19 in Italy: challenges of data collection, analyses and prevention *Francesco Forastiere, Italy*
5. Managing migrant workforce at Indian construction sites: OSH challenges and mitigation during various phases of COVID-19 pandemic *Krishna Nirmalya Sen, India*
6. Challenges in Conducting Biomonitoring Fieldwork in Israel during the COVID Pandemic *Tamar Berman, Israel*
7. Caring for those who care: Occupational health and safety for all health workers *Ivan D. Ivanov, Switzerland*
8. Workers' Compensation and the Implications of Long COVID-19 in Wisconsin *Komi Modji, USA*
9. Public Policy Challenges to Occupational Safety and Health Protection During a Pandemic *Emily A. Spieler, USA*

Covid-19 as an Occupational Disease: Where are We Now and Where are We Going?

David Michaels[1]; Gregory R. Wagner[2]

[1] Milken Institute School of Public Health, George Washington University, Washington, DC USA; [2] The Harvard T.H. Chan School of Public Health, Boston, MA USA

Background: The Covid-19 pandemic has drawn world-wide attention to the importance of the work environment as both a contributor to the spread of infection and a venue to implement both mitigating and preventive measures. It has also highlighted deficiencies in both policy and organizational efforts to address workplace spread of infection at national, local, and enterprise levels.

Methods/Approach: This session will survey lessons learned thus far in addressing the workplace component of the pandemic, examining selected policies and programs implemented to track and prevent SARS CoV-2 transmission in countries across the globe.

Results: The challenges of protecting workers exposed to SARS CoV-2 have been and remain significant. While progress has been made, much work remains to be done.

Conclusions: Lessons from current activities, our successes and failures, will help us prevent worker exposures and make workplaces safer when future pandemics arise.

*** Presenting author profile:**
Michaels David
David Michaels PhD, MPH is an epidemiologist and professor at the Milken Institute School of Public Health, of George Washington University. He was administrator of the US Occupational Safety and Health Administration (OSHA) 2009-2017, the longest serving in the agency's history. Since the COVID- 19 pandemic began, Michaels has focused on improving the protection of workers exposed to SARS-CoV- 2 and served on the Biden Transition COVID Advisory Board.

Responses of OHS regulators and inspectors to the Covid-19 pandemic

Gregory R. Wagner[1] David Michaels[2]

[1] Harvard T.H. Chan School of Public Health, Boston, USA; [2] George Washington School of Public Health, Washington, D.C., USA

Background: Early in the Covid-19 pandemic, the importance of disease transmission in workplaces in addition to health care facilities became obvious. Disease outbreaks or increased rates of infection were documented in food processing facilities, public transportation, construction sites, and grocery stores, among other venues, resulting from transmission between workers and the public they served. While most health care facilities have infection control policies and practices in place, many were not adequate to prevent transmission to workers. Government agencies and policy makers were even less equipped to address risk in other workplaces.

Methods/Approach: In early 2021, around one year following the onset of the pandemic in most countries, a group of investigators surveyed international governmental leaders in OHS regulation and enforcement to explore, document, and learn from the range of national (and in the US state-based) responses to the pandemic.

Results: Fifteen OHS authorities from Asia, Europe, North America, and Australia responded to the survey. Survey responses were synthesized to identify common themes and key messages.

As scientific information and in-country experience accumulated, OHS authorities in most jurisdictions adjusted their strategies. In particular, coordination with public health authorities increased, on-site inspections were instituted, and most authorities provided more diverse guidance materials.

Conclusions: Identifying and compiling data on workplace transmission of COVID-19 remains a challenge for OHS authorities. Generating enterprise-specific data, including inspection results, that would be useful in addressing the pandemic and making the data publicly available is a critical issue for improving ongoing response.

*** Presenting author profile:**

Wagner Gregory

Dr. Wagner focuses his research and teaching on the science behind occupational policies and regulations and strategies to improve health protections at work. At Harvard he chairs the Policy Working Group of the Center for Work, Health, and Wellbeing and is affiliated scientist for the Center for Health and Happiness. He previously served as Senior Advisor to the Director of the US NIOSH/CDC and US Deputy Assistant Secretary of Labor for Mine Safety and Health.

COVID-19 and the Impact in Work, Health and Safety in Ecuador: Findings 18 months into the Pandemic

Homero Harari[1], Florencia Harari[2], Judith Venegas[3] and Raúl Harari[4]

[1] Selikoff Centers for Occupational Health, Icahn School of Medicine at Mount Sinai, New York, USA; [2] School of Public Health and Community Medicine, Institute of Medicine, University of Gothenburg and Sahlgrenska University Hospital, Gothenburg, Sweden; [3] School of Chemical Sciences, Central University of Ecuador, Quito, Ecuador; [4] IFA Ecuador – Institute for the Development of Production and Work Environment, Quito, Ecuador

Background: Ecuador has been one of the hardest-hit countries in Latin America. As of August 2021, the official statistics show over 457,000 cases of COVID-19 and a death toll of over 21,000 deaths.

Methods/Approach: We reviewed national statistics and conducted interviews with key stakeholders from the public and private sectors. In addition, we analyzed the policies and response from the Ecuadorian Government to mitigate the COVID-19 pandemic in the workers' health and safety at a national level.

Results: The impact of the COVID-19 pandemic on worker's health and safety has been primarily visible through the precarious working conditions faced by healthcare workers. In general, the initial official response to the pandemic was focused on using personal protection equipment. However, the real impact is still difficult to estimate. The national policies implemented to mitigate the effects of the pandemic, negatively impacted employment and working conditions. Currently, only 30% of the working population has a formal job, leaving 70% unprotected from essential social benefits. Around 11% of the existing formal jobs were lost.
Most importantly, COVID-19 is not considered an occupational disease. Finally, the lack of official government guidance based on reliable scientific information has resulted in new issues such as the extended use of disinfectants.

Conclusions: National policies aimed at protecting workers' health and safety were ineffective and led to further precarious working conditions in Ecuador.

*** Presenting author profile:**
Harari Raul
Dr. Homero Harari is an Assistant Professor at the Department of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai in New York. He works as an Occupational Hygienist at the Selikoff Centers for Occupational Health. His research is focused on the quantitative assessment of occupational and environmental exposures in vulnerable populations in the United States, Ecuador and Mexico.

Covid-19 in Italy: challenges of data collection, analyses and prevention

Francesco Forastiere[1]

[1] National Research Council (CNR-IRIB), Palermo, Italy; Visiting Professor, Environmental Research Group, School of Public Health, Faculty of Medicine, Imperial College, London, UK

Background: The new coronavirus disease 2019 (COVID-19) has posed an unprecedented new global challenge, causing large-scale loss of life and a major impact on the economy and society. Health care systems faced a dual challenge of both coping with a growing demand for care for COVID-19 patients and maintaining continuity of care for patients with chronic diseases or serious acute conditions. This work aims to present available data on the direct and indirect impact of the COVID-19 outbreak on access to drug therapies, emergency room visits and hospital admissions in Italy.

Methods/Approach: A literature review was conducted regarding papers (published or in a pre-print form) on the Covid-19 situation in Italy.

Results: The pandemic has severely affected the organization of health services, secondary prevention services such as screening programs, and the care of patients with chronic diseases in need of timely and optimal care.
Many patients with chronic diseases require regular access to a wide range of medical services (e.g., home care, specialist visits), which have been interrupted during the pandemic exposing patients to a high risk of acute exacerbations and disease complications. Access to the data analyses was severely limited in many situations.

Conclusions: Italy was the first Western country to experience the COVID-19 emergency and one among those with the highest number of cases and deaths The results indicate the need to strengthen the epidemiologic expertise and public intervention in health care. The data should be made available for larger use and investigation.

*** Presenting author profile:**
Forastiere Francesco
Francesco Forastiere, environmental epidemiologist, has been acting as public health officer at the Department of Epidemiology, Lazio Region of Italy. He is editor of the Italian Journal of Epidemiology (Epidemiologia & Prevenzione).

Managing migrant workforce at Indian construction sites: OSH challenges and mitigation during various phases of COVID-19 pandemic

Krishna Nirmalya Sen[1]; Anders Englund[2]

[1] Larsen & Toubro Limited MMH SBG, Kolkata, India; [2] Medical Director (Retd.), SWEA, Sweden

Background: In India, the construction industry employs around 55 million people, contributing nearly 9 to 11% of GDP where workmen are mostly migratory in nature. The outbreak of COVID-19 and subsequent restrictions led to suspension of projects for several weeks and months, particularly during the first wave and partially in the second wave. The COVID-19 pandemic has put forward additional risks to the occupational health and safety of construction workers.

At the onset of outbreak, construction workers had to encounter unprecedented challenges due to sudden loss of income and suspension of public transport during national lockdowns and the associated restrictions, which presented further difficulties for the workers who had decided to leave for their native places.

In addition to the challenges towards physical health and safety, aspects of worker's mental and social health came under the scanner.

Methods/Approach: Some large enterprises initiated proactive and humane approaches to deal with the challenges, supported by government guidelines.

These included screening the workers, restricting visitors and enhanced sanitization measures in living areas, incoming vehicles and for construction and project materials. Also, limiting the number of people in the living areas and dining places, enhanced medical check-ups, counselling, COVID-19 testing and quarantine and isolation and vaccination plans were initiated. Detailed planning to ensure social distancing at workplaces was also a major step.

Results: Over 90% of workers remained in the camps, helping prompt resumption of operations after the 1st wave. Implementation of strict control measures, regular health monitoring and quarantine and isolation protocols were found very effective in controlling the spread of COVID-19 among large numbers of workers who were living in temporary camps.

Conclusions: Timely initiation of appropriate control measures, participation of the employees in the prevention efforts and compliance with the protocols including vaccination, have effectively curtailed the impact of COVID-19 in project sites.

*** Presenting author profile:**

Sen Krishna Nirmalya

Dr Sen is the head of Environment, Health and Safety at L&T MMH SBG in India. He has experience of over three decades in managing and leading Occupational Safety and Health in several large constructions projects from various segments in India and abroad. He presently serves as the Chair of the ICOH SC in Construction, President of ASSP India Chapter and Chair of OHS Expert Panel of Indian Chamber of Commerce.

Challenges in Conducting Biomonitoring Fieldwork in Israel during the COVID Pandemic

Tamar Berman[1]

[1] Department of Environmental Health, Israel Ministry of Health

Background: Human biomonitoring is an important tool for evaluating internal exposures of the general population to environmental contaminants. We planned on beginning fieldwork for the National Biomonitoring Program in Israel in March 2020, with the aims of measuring exposure to heavy metals, pesticides, and environmental tobacco smoke (ETS) and evaluating iodine status in Israeli adults and children. The COVID pandemic raised significant challenges: 1) logistical challenges related to conducting interviews and collecting urine samples while maintaining social distancing 2) recruitment challenges, as people were less willing to provide biological samples, especially in minority populations.

Methods/Approach: Despite significant challenges, we collected urine samples and questionnaire data in ~400 children and adults during June 2020 to July 2021 and measured urinary iodine, heavy metals, and iodine.

Results: Preliminary results indicate that children in Israel are iodine deficient and that parental smoking in the major source of exposure to ETS. Lower maternal and paternal education are associated with higher levels of exposure to ETS in children. Parental smoking is a major source of lead exposure in children.

Conclusions: This presentation will focus on the challenges faced, with focus on lessons learned on building trust and recruiting in minority populations. The presentation will also address opportunities provided by conducting HBM research during the pandemic and will include first results from the study. This data may provide insights on changes in environmental exposures during the pandemic, for example changes in exposure to environmental tobacco smoke in children during lockdowns.

* **Presenting author profile:**
Berman Tamar
Dr. Tamar Berman is Chief Toxicologist for Environmental Health at the Israel Ministry of Health where she leads the National Biomonitoring Program.

Caring for those who care: Occupational health and safety for all health workers

Ivan D. Ivanov[1]

[1] World Health Organization, Geneva, Switzerland Collegium Ramazzini sponsor: Melissa McDiarmid

Background: The COVID-19 pandemic has revealed the lack of robust systems for managing occupational health and safety in most healthcare facilities through the world. In addition to occupational infectors with SARS-CoV-2 resulting in disease and death, health workers also suffered from mental disorders and stress, workplace violence and harassment, fatigue and burnout and other effects of working under extreme conditions without adequate protection.

Methods/Approach: Besides measures for infection prevention and control, few countries and health facilities had preexisting policies, programmes and services for occupational health and safety. The pandemic increased the demand for comprehensive occupational health policies and programmes for health workers, including prevention and control of occupational health and safety risks, medical surveillance, psychosocial support, management of return to work, vaccinations, prevention of violence and harassment and other interventions.

Results: The World Health Organization and the International Labour Organization are urging countries to develop and implement occupational health and safety programmes for health workers at national, subnational and facility levels, to introduce regulatory measures for health and safety at work in the health sector and to invest in scaling up the protection of health and care workers.

Conclusions: This presentation outlines strategic directions for strengthening occupational health and safety of health workers in the context of decent work, quality of care and environmental sustainability in the recovery from COVID-19 pandemic.

*** Presenting author profile:**

Ivanov Ivan

Dr. Ivanov is head of the global occupational health programme of the World Health Organization where he leads public health efforts to protect health and safety of health workers, to promote healthier, safer and more resilient workplaces and to expand health coverage of workers.

Workers' Compensation and the Implications of Long COVID-19 in Wisconsin

Komi Modji[2], Collin Morris[2], Barbara Grajewski[2], Tracy Aiello[1], Carrie Tomasallo[2], Jonathan Meiman[2].

[1] Department of Workforce Development, Madison, Wisconsin; [2] Wisconsin Department of Health Services, Madison, Wisconsin
Collegium Ramazzini sponsor: Henry Anderson

Background: Occupationally acquired COVID-19 may have lasting impacts on health, but few studies have characterized the burden of Long COVID among workers. The purpose of this analysis is to describe COVID-19 workers' compensation claims and Long COVID across industries and occupations in Wisconsin.

Methods/Approach: This is a descriptive analysis of Wisconsin COVID-19 workers' compensation (WC) claims data during March 1–December 31, 2020. COVID-19 claims were identified using standardized detailed claim information (DCI) codes and free-text searches in injury description fields. Industry level full-time equivalent (FTE) rates were calculated using denominators from unemployment insurance data. According to Centers for Disease Control and Prevention, Long COVID was defined as disease duration ?4 weeks. The strength of association was measured by chi-square.

Results: In 2020, 3,910 / 25,267 claims (15.5%) were COVID-19 claims, which corresponded to 3,880 claimants. Major-level industry groups with the highest number of COVID-19 claims per 100 FTE were Healthcare and Social Assistance (1.08), Management of Companies and Enterprises (0.38), and Public Administration (0.16). Within the healthcare industry, the highest category was Nursing Care Facilities (3.03). Major-level occupation groups with the highest number of COVID-19 claims per 100 FTE were Healthcare Support (0.56), Healthcare Practitioners and Technical Occupations (0.62), and Personal Care and Service (0.41).
Among 1,351 paid claimants, 23.2% were considered Long COVID. Older age, presence of comorbidities, African-American race, and disease severity were significantly (chi-square, p-value <0.01) associated with Long COVID. The median Long COVID claim payment was $1,976 versus $1,052 for normal recovery cases. Healthcare, personal care and service, and protective service occupations were the major occupations groups affected by Long COVID with highest rate by 100,000 workers.

Conclusions: Most Wisconsin industries and occupations have been impacted by COVID and Long COVID. Analyses of WC claims can provide insights on the burden of occupationally acquired Long COVID.

*** Presenting author profile:**
Modji Komi
Dr. Modji is an Epidemiologist with Bureau of Environmental and Occupational Health at Wisconsin Department of Health Services, whose work is primarily focused on COVID-19 occupational surveillance, outbreaks monitoring and guidance to businesses and local and tribal health departments.

Public Policy Challenges to Occupational Safety and Health Protection During a Pandemic

Emily A. Spieler[1]

[1] Northeastern University, Boston, Massachusetts, USA

Background: The coronavirus pandemic has exposed deficiencies in many OSH public policies and programs necessary to protect workers from a rapidly spreading infectious disease. This presentation will briefly summarize some of the pandemic-specific challenges to achieving effective OSH regulation and enforcement. In addition to political barriers to effective interventions, these include: the difficulty of modifying workplace regulations to reflect continually evolving scientific understanding of the characteristics of disease transmission; the challenge of developing adequate, effective and continuous communication of strategies based on this changing scientific information to workers and employers; the enforcement challenges due to risks to enforcement personnel during on-site inspections of worksites with significant prevalence of disease; the tension between broad community mandates and the need for workplace specific protections, including masking, testing, isolation & quarantine, and vaccination; the need to prove workplace causation to obtain benefits in some social insurance systems in the context of high community prevalence of disease; the additional problems of accommodation for individuals with disabilities; and numerous issues associated with physical return-to-work for workers who have not been inside workplaces during the earlier phases of the pandemic. Identifying and describing these challenges, and considering responses, is essential to improve worker protections during future pandemics.

Methods/Approach: Review of multi-country literature and studies regarding effects of the pandemic in workplaces and governmental responses.

Results: Varied responses to the pandemic in different regulatory jurisdictions illustrate the challenges to effective protection of workers during a pandemic.

Conclusions: A review of the responses to the pandemic enables more effective planning for future pandemics.

*** Presenting author profile:**
Spieler Emily A.
Dr. Spieler is Edwin W. Hadley Professor of Law and Dean Emeritus at Northeastern University School of Law (Boston). She specializes in labor and employment law and policy, with a particular focus on the rights of workers to safe workplaces and the rights of injured workers to just compensation and return to work, and she works actively with trade unions and workers' organizations, both locally (e.g. Massachusetts Coalition for Occupational Safety and Health) and nationally.

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DAY 1 - SCIENTIFIC SESSION II
Work of the Fellows

1. The Ramazzini Institute studies on glyphosate-based herbicides: results and state-of-the art of the project. *Daniele Mandrioli, Italy*
2. Hot days for health care workers - Combining heat and infection control measures - Climate change and Covid-19 Stephan *Bose-O'Reilly, Germany*
3. Emerging preparedness for major accidents: updates about the 9/11 health consequences and more recent events *Roberto G Lucchini, USA*

The Ramazzini Institute studies on glyphosate-based herbicides: results and state-of-the art of the project.

Daniele Mandrioli[1]; Simona Panzacchi[1]; Eva Tibaldi[1]; Federica Gnudi[1]; Andrea Vornoli[1]; Laura Falcioni[1]; Luciano Bua[1]; Francesca Truzzi[2]; Giovanni Dinelli[2]; Fiorella Belpoggi[1]

[1] Ramazzini Institute (RI), Bologna, Italy; [2] University of Bologna, Bologna, Italy,

Background: The Ramazzini Institute (RI), with the support of other independent Institutes and Universities in Europe and United States, has launched in 2017 a pilot study to assess experimental procedures and in 2019 started the most comprehensive study (main project) ever on glyphosate(G) and glyphosate-based herbicides (GBHs)– the world's most used weedkiller and one of the most high profile chemicals in the world. The study has been named the Global Glyphosate Study.

Methods/Approach: Glyphosate alone and Roundup Bioflow, a commercial brand of GBHs, were administered in drinking water at 1.75 mg/kg bw/day to F0 dams starting from the gestational day (GD) 6 (in utero) up to postnatal day (PND) 120. Effects of glyphosate or Roundup exposure were assessed on genotoxicity and target organs (liver, kidney, intestine). We tested the cytotoxic effects of glycine, glyphosate, and its formulation Roundup Bioflow at different doses using MTT and Trypan Blue assays in human Caco2 and murine L929 cell lines

Results: The full results of the pilot study on genotoxicity and pathology will be presented. The study design of the long-term integrated phase will be presented and its multiple arms include: genotoxicity, prenatal- developmental toxicity, neurotoxicity, multi-generational effects, endocrine disruption and microbiome effects, and, in the long term perspective, carcinogenicity, on Sprague Dawley rats.Glyphosate and its formulation Roundup Bioflow, but not glycine, caused dose-related cytotoxic effects in in vitro human and murine models (Caco2 and L929).

Conclusions: Results on the Pilot Phase of the Global Glyphosate Study showed adverse effects on reproduction-development, microbiome and genotoxocity at exposure levels that are currently considered safe and legally acceptable (US ADI 1,75mg/Kg/bw). The the long-term effects and the possible endocrine disruptive effects of GBHs are one of the main focuses of the integrated study. Glyphosate and Roundup Bioflow demonstrate in vitro cytotoxicity similar to other organophosphate pesticides (malathion, diazinon, and chlorpyriphos).

*** Presenting author profile:**
Mandrioli Daniele
Daniele Mandrioli, MD, PhD is the Director of the Cesare Maltoni Cancer Research Center of the Ramazzini Institute, Bologna, Italy. He conducts research on environmental toxicants and carcinogens and evidence-based methods in toxicology and epidemiology. Dr. Mandrioli's research on environmental toxicants and carcinogens includes the design and development of toxicological and epidemiological studies, investigations on the role of aneuploidy in carcinogenesis and reproductive toxicity.

Hot days for health care workers - Combining heat and infection control measures - Climate change and Covid-19

Stephan Bose-O'Reilly[1]; Julia Schoierer[1]; Lena Lagally[1]; Theresa Gutknecht[1]; Hanna Mertes[1]; Katharina Deering[1]; Yvette Jegodka[1]; Dennis Nowak[1]

[1] Institute and Clinic for Occupational, Social and Environmental Medicine, University Hospital, Munich, Germany

Background: Due to climate change, Germany is experiencing an increase in heat waves, posing serious health risks. Heat, especially longer periods of heat, affect the human organism negatively. Health care providers are double burdened by heat, by working on hot days AND under personal protection equipment (PPE). Our aim was to investigate the double burden of working on hot days under PPE for health care workers.

Methods/Approach: We assessed the complaints and needs of health care workers with an online survey during a heat period in August 2020 in Germany with funding from the German "Ministry for the Environment" Co-HEAT project (#67DAS213).

Results: Hospitals and care facilities are affected. Heat escalates the disease burden of risk groups, which increases the workload for nursing staff. Compliance with infection control measures is an organizational difficulty and a personal challenge for professionals, as the online survey conducted showed. The emotional and physical well-being of many employees is severely restricted by PPE. The majority notice increased sweating, shortness of breath, lack of concentration and the fear of making mistakes. Protection from heat was limited or non-existing at many workplaces.
Education and sensitization of all those involved are central to the integration of heat and infection protection measures. A target group-specific, low-threshold offer must be made so that protective measures are understandable and can be implemented quickly. Within the Co-Heat project, brochures, posters and videos were developed and distributed, aimed at the relevant groups; supplemented by online seminars. They contain practical recommendations regarding protective clothing, hygiene, ventilation behavior and patient handling during heat and increased infection protection.

Conclusions: The combination of heat and infection protection is challenging, the integration of further aspects into recommendations for health adaptation to heat events related to current and future challenges is necessary. Employers need to protect their workers better from heat stress.

*** Presenting author profile:**
Böse-O'Reilly Stephan
Dr. med. Stephan Bose-O´Reilly is a Paediatrician, Master of Public Health with a special degree in Environmental Medicine. At the University Hospital, LMU Munich he is leading the unit for Global Environmental Health and Climate change. His main interest is to prevent children from disease by helping to optimize the policy – science interface; especially in his zone of knowledge - children's environmental health.

Emerging preparedness for major accidents: updates about the 9/11 health consequences and more recent events.

Roberto G Lucchini[1,2]; Iman Nuwayhid[3]; Leslie London[4]; Rima Habib[3]; Rajen Naidoo[5]

[1] Florida International University, Miami, Florida, USA; [2] University of Brescia, Italy; [3] American University of Beirut, Beirut, Lebanon; [4] University of Cape Town, Cape Town, South Africa; [5] University of Kwazulu Natal, Durban, Cape Town, South Africa

Background: Response to disasters and the investigation of their immediate and long-term impact on health population health differ by the social, economic, and political contexts. We analyze four different events and extract key lessons for emergency preparedness and disaster management.

Methods/Approach: This presentation reviews the response to the 9/11 disaster in 2001 and provides updates from the World Trade Center Health Program (WTCHP). It also analyzes three events occurred in: i) Beirut, Lebanon, where an explosion of ammonium nitrate occurred at its port on August 4, 2020; ii) Miami Beach, Florida, where the Champlain Tower residential building collapsed on June 24, 2021; iii) Durban, South Africa, where a fire caused by protest-related arson caused a large chemical warehouse to burn down on July 12, 2021

Results: The WTCHP is revealing emerging impacts on cognitive decline among the responders, signaling the need for long term follow up. Across the four disasters, prevention, response and environmental monitoring was suboptimal. One year after the Beirut explosion, no action has been taken to investigate and control the physical and mental health consequences among responders and impacted community. The same situation is occurring in the immediate aftermath of the chemical fire in Durban where access to critical exposure information needed to identify risk is denied. In Florida, there was also suboptimal preparedness. The scientific and health communities may be missing important exposure-outcome relationships needed to address these recent disasters.

Conclusions: The observation of the health consequences from the WTCHP strengthen the need of long term health surveillance in populations impacted by disasters. It also reinforces the need of adequate emergency preparedness, which is still largely insufficient, if not ignored, as shown by the cases of most recent disasters in Lebanon, USA, and South Africa.

*** Presenting author profile:**
Lucchini Roberto
Dr. Lucchini is an MD specializing in Occupational Medicine. Former Director from 2012-2020 of the General Responder Data Center of the World Trade Center Health Program at the Icahn School of Medicine at Mount Sinai, NYC. His areas of expertise include the neurodevelopmental and neurodegenerative impacts of metal exposure, health effects of climate change on outdoor and indoor workers, Global Occupational and Environmental Health in Low and Middle Income Countries, with special emphasis on education and training program.

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DAY 1 - SCIENTIFIC SESSION III
Pesticides and Infertility

1. Age- and gender-specific endocrine disrupting effects of pesticides on fertility *Aleksandra Fucic, Croatia*
2. In vivo bioassay as an important tool to investigate infertility mechanisms of pesticides *Fiorella Belpoggi, Italy*
3. Male infertility associated with exposure to pesticides: experience from andrology clinics *Evangelini Evgeni, Greece*

Age- and gender-specific endocrine disrupting effects of pesticides on fertility

Aleksandra Fucic[1]

[1] Institute for Medical Research and Occupational Health, Zagreb, Croatia

Background: The quantity and various mixtures of pesticides enable the production of large amounts of food; however, estimations and types of mixtures with regard to their global application are only approximate. During the last few decades, there has been concern about infertility problems, both in men and women. Significant efforts have been invested in investigation of its etiology and bridging this significant social and demographic issue by in vitro fertilization.

Methods/Approach: In this review, studies published between the years 2000 and 2020 were included.

Results: Exposure of the general population to pesticides, in addition to occupational exposure, is present via air, water and food due to leakage of pesticides into water systems, spraying and contaminated food.
Unfortunately, new formulas that would not affect human health are still not on the market and the overall success of biological control by, for example, insect predators and parasitoids against herbivorous insects has resulted in no satisfying success. Special concern has been raised on transplacental exposure to pesticides and its effect on the development of reproductive organs or possible impacts on brain development and sexual behavior. As all pesticides are endocrine disruptors, additionally to transplacental exposure, significant time frames of exposure are mini-puberty, pre-puberty and puberty, during which the development of reproductive organs may be affected. During the reproductive period of life, significant reductions in sperm quality and ovulation disturbances have been detected in populations occupationally or environmentally exposed, which was not always accompanied with disturbances of sex hormone levels.
Most pesticides are xenoestrogens but some are also aromatase inhibitors or tend to couple with androgen receptors.

Conclusions: Infertility is still not part of the medical surveillance of occupationally exposed populations. Similarly, the number of studies on infertility after exposure to pesticides is far too low in comparison with the size of the affected populations.

*** Presenting author profile:**
Fucic Aleksandra
Aleksandra Fu?i? has 30 years of research experience in genotoxicology and biomonitoring. Her main scientific interests are carcinogenesis mechanisms after exposure to chemical and physical agents including transplacental exposure and life long health risks. She has published over 100 papers and several books. She is a Fellow of Collegium Ramazzini. Dr Fu?i? took part in many international and national projects, European biomonitoring programs and reports.

In vivo bioassay as an important tool to investigate infertility mechanisms of pesticides

Fiorella Belpoggi[1]
[1] Ramazzini Institute, Bologna, Italy

Background: We are observing the dramatic impairment of our ecosystem and biodiversity and a parallel increase in degenerative diseases. In this respect, it has been demonstrated that environmental pollution impairs fertility in all mammalian species. This means that any pollutant affecting hormonal homeostasis and/or the reproductive apparatus inevitably harms reproductive performance. (Canipari et al, 2020).

Methods/Approach: Effects on fertility of pesticides, both in men and women, are particularly difficult to be detected with regard to exposure assessment and the presence of multiple exposures to substances already defined as endocrine disruptive chemicals (EDCs) or suspected of being such. Experimental studies represent an important tool to study EDCs and their mechanisms.

Results: Our recent in vivo studies on SD rats described ED effects of glyphosate (G) . Glyphosate-based herbicides (GBHs) are the most widely used pesticides worldwide, and G is the active ingredient of such herbicides, including the formulation known as Roundup. Specifically, in our work (Panzacchi et al, 2019), low-dose gestational exposure to glyphosate and Roundup® resulted in lengthened anogenital distance (AGD). AGD is a marker of the prenatal hormone milieu in rodents and humans. Similar effects in a human population have been recently detected (Lesseur, 2021).

Conclusions: Glyphosate is set for re-approval in the European Union in late 2022 and the full risk posed by glyphosate- based herbicides (GBHs) is still unclear. The Ramazzini Institute and other independent Institutes and Universities in Europe and USA, launched in 2017 a pilot study and in 2019 started the most comprehensive study ever on G and GBH (https://glyphosatestudy.org/). Proven endocrine disruptive effects of a chemical can lead to a ban on that specific chemical under European law. The already consolidated methodology of the RI could allow to detect ED activity and help to assess appropriate regulatory actions.

* **Presenting author profile:**
Belpoggi Fiorella
Dr Belpoggi is Scientific Director of the Ramazzini Institute. Over the past 30 years, she led some of the main research studies of the Cesare Maltoni Cancer Research Centre of the Ramazzini Institute, such as the ones on benzene, MTBE and aspartame. In 2019, she is the project leader of the global glyphosate.

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Male infertility associated with exposure to pesticides: experience from andrology clinics.

Evangelini Evgeni[1]

[1] Cryogonia Cryopreservation Bank, Athens, Greece

Background: Pesticides are substances used to prevent or eradicate unwanted insects in order to enhance food production and help agricultural commodities. In countries where agriculture constitutes a significant sector of the economy, a wide exposure to these chemicals has been identified via three major routes: environmental, dietary and occupational. The latter has been linked to the most adverse effects on male fertility. The contaminant substances may vary regarding their chemical structure, their action mechanisms or the extent of toxicity they may exert on human cells and tissues. Acting as endocrine disruptors, they interfere with various hormone processes in the human body, seriously affecting human reproduction

Methods/Approach: In this review, studies published between the years 2000 and 2020 were included, in order to investigate the potential effect of pesticides on male fertility, documented in andrology clinics worldwide. The interest was focused on men residing in rural areas producing olive oil, citrus fruits and vines, especially farmers, stockbreeders or agronomists.

Results: A deleterious effect of pesticides in spermatogenesis is evident in men whose profession is linked with agricultural activities, presenting various rates of oligoasthenoteratozoospermia or azoospermia. The majority of relevant studies demonstrate a decrease on semen quality, depicted on sperm concentration, motility, morphology, semen volume, DNA integrity, seminal oxidative stress status, as well as indicators evaluating couple fertility potential (e.g. time to pregnancy, number of children born per family, miscarriage rates). Male age, timing and duration of exposure, genetic predisposition and transgenerational effects are factors that may further influence the extent of these discrepancies.

Conclusions: Pesticides may adversely affect male fertility. Still, large scale studies including specifically determined subgroups are warranted, in order to identify the most widespread chemicals, the most vulnerable subjects, the life stages of differential exposure-response and clarify the underlying action mechanisms.

*** Presenting author profile:**
Evgeni Evangelini
Dr. Evgeni has been working since 1995 in the field of Laboratory Seminology, as a founding member and director of the andrology laboratory of the largest certified sperm bank in Greece. As part of her scientific activities, she actively participates in educational seminars, as a speaker at conferences and as a writer of scientific articles and books. Part of her research studies is included in the 6th Edition of the WHO laboratory manual for the examination and processing of human semen (2021), constituting the first Greek participation in the new world reference limits for basic semen parameters.

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DAY 1 - SCIENTIFIC SESSION IV
Work of the Fellows

1. Italian pool of asbestos workers cohorts: investigation of asbestos related neoplasms after long time since first exposure. *D.Ferrante, Italy*
2. Dust Inside: Fighting and living with asbestos-related disasters in Brazil. Thoughts on the contribution of ethnography to understand and tackle global health disasters. *Arthur L, Italy*
3. e-Toolkit for the Elimination of Asbestos-Related Diseases in Developing Countries *Ken Takahashi, Australian*
4. Computer aided detection (CAD) of radiological silicosis - a new application of an evolving AI technology. *Rodney Ehrlich, South Africa*

Italian pool of asbestos workers cohorts: investigation of asbestos related neoplasms after long time since first exposure.

D.Ferrante[1,£]; E.Chellini[2]; E.Merler[3]; V.Pavone[4]; S.Silvestri[1]; A.Angelini[1,2]; L.Miligi[2]; G.Gorini[2]; V.Bressan[3]; P.Girardi[3]; L.Ancona[6]; E.Romeo[6]; F.Luberto[7]; C.Scarnato[4]; A.Baldassarre[8]; S.Menegozzo[9]; E.Oddone[10]; S.Tunesi[1,11]; P.Perticaroli[12]; A.Pettinari[12]; F.Cuccaro[13]; S.Mattioli[14]; F.Barone-Adesi[16]; T.Cena[1]; P.Legittimo[14]; A.Marinaccio[17]; D.Mirabelli[11]; M.Musti[15]; R.Pirastu[18]; A.Ranucci[1]; C.Magnani[1,£] and the working group (*The working group: M.N.Ballarin[3]; C. Brentisci[11]; B.Cortini[2]; S.Curti[14]; M.Gangemi[11]; F.Gioffrè[3]; L.Mangone[7]; F.Marinelli[14]; P.Marinilli[4]; C.Panato[3]; F.Roncaglia[7]; C.Storchi[7]; A.Stura[11]; M.Vicentini[7]; S.Verdi[2]; A.M. Nannavecchia[19]; L.Bisceglia[20].*

[1] Unit of Medical Statistics and Epidemiology, Department of Translational Medicine, University of Eastern Piedmont, Novara, and CPO-Piemonte, Novara, Italy; [2] Occupational & Environmental Epidemiology Unit – Institute for Cancer Research, Prevention and Clinical Network (ISPRO), Florence; [3] Mesothelioma Register of the Veneto Region, Local Health Unit. Padua; [4] Department of Public Health, Prevention and Security Area Work Environments, Local Health Authority, Bologna; [5] Cancer Prevention and Research Institute (ISPO), Florence; [6] Department of Epidemiology, Lazio Regional Health Service, Rome; [7] Epidemiology Service, AUSL and IRCCS Reggio Emilia; [8] Occupational Medicine Unit, Careggi University Hospital, Florence, Italy; [9] National Cancer Institute IRCCS Fondazione Pascale, Napoli; [10] Department of Public Health, Experimental and Forensic Medicine, University of Pavia, Pavia; [11] Unit of Cancer Epidemiology, CPO Piemonte and University of Turin, Turin; [12] Prevention Department, ASUR Marche, Senigallia; [13] Unit of Epidemiology and Statistics -Local Health Unit of Barletta-Andria-Trani, Barletta; [14] Department Medical and Surgical Sciences, University of Bologna, and Unit of Occupational Medicine, S.Orsola-Malpighi University Hospital, Bologna; [15] Interdisciplinary Department of Medicine, Occupational Medicine "B. Ramazzini", University of Bari, Bari; [16] Department of Translational Medicine, University of Eastern Piedmont, Novara; [17] Italian Workers' Compensation Authority (INAIL), Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Unit of Occupational and Environmental Epidemiology, Italian Mesothelioma Register, Rome; [18] Department of Biology and Biotechnologies "Charles Darwin", Sapienza Rome University, Rome; [19] Cancer Institute IRCCS Giovanni XXIII, Bari; [20] Regional Health Agency of Puglia, Bari

[£] Study coordinator

Background: Asbestos is a known human carcinogen, with evidence for malignant mesothelioma (MM), cancers of lung, ovary, larynx and possibly other organs (IARC, 2012). Asbestos was banned in a large number of developed countries, but a worldwide ban has not been enforced yet, as asbestos is still produced and used in large amount, particularly in developing countries. The study aims to investigating dose response, acceleration of incidence rates with increasing exposure, MM rates after long latency, the effect of cessation of exposure, the risk for ovarian cancer and other neoplasms, and other scientific questions still under debate. The asbestos ban enforced in Italy in 1992 gives an opportunity to measure long-term cancer risk in formerly exposed workers.

*** Presenting author profile:**
Magnani Corrado
Corrado Magnani (retired) was Professor of Medical Statistics at the University of Eastern Piedmont at Novara and Head of the Unit of Cancer Epidemiology of the teaching hospital of Novara. His research activity focused on the occupational and environmental causes of cancer. Recent activity includes studies on the effects of occupational and environmental exposure to asbestos, on the epidemiology of mesothelioma, on the risk factors of leukemia and other cancers in children and on lymphoma in adults. He is fellow of the 'Centro Scansetti' of the University of Torino and of the 'Ramazzini Collegium'.

Methods/Approach: Forty three previously studied Italian asbestos cohorts (asbestos cement, rolling stock, shipbuilding, and others) are included. Cumulative exposure was individually estimated. SMRs and multivariate regression analyses were conducted for the major causes, by cumulative dose, duration, latency, industrial sectors, age, sex, region and calendar period.

Results: The study included 51801 subjects (5741 women): 55.9% alive, 42.6% died (cause known for 95%) and 1.5% lost to follow-up. Mortality was significantly increased for all deaths (SMR: men: 1.05; women: 1.17), all malignancies combined (SMR: men: 1.17; women: 1.33), pleural and peritoneal malignancies (SMR: men: 13.28 and 4.77, women: 28.44 and 6.75), lung (SMR: men: 1.26; women: 1.43) and ovarian cancer (SMR=1.38) and asbestosis (SMR: men: 300.7; women: 389.6). A dose response relation was demonstrated for all diseases with increased risk. Pleural MM rate increase showed a plateau after 40 years latency.
Anticipation of incidence rates with increasing exposure was confirmed for MM and lung cancer

Conclusions: The study that is in progress with a second follow-up update including more cohorts and workers, confirmed to be an important tool to monitor long term effects of occupational asbestos exposure.

Dust Inside: Fighting and living with asbestos-related disasters in Brazil. Thoughts on the contribution of ethnography to understand and tackle global health disasters.

Arthur L. Frank[1];Agata Mazzeo[2]

[1] Dornsife School of Public Health of Drexel University, Philadelphia, PA, USA; [2] University of Bologna, Bologna, Italy

Background: There are global health disasters which persist unrecognized because of unperceived health dangers,invisible pollutants and legal, but toxic,production. Concurrently there are communities of citizens and workers who, in distinct socio-cultural contexts,mobilize to highlight these disasters, which directly affect their lives. The paths of grassroots activism undertaken by the disaster survivors in the name of social justice then coincide with paths of care for their suffering.

Methods/Approach: Data emerged from fieldwork in Osasco,Brazil, the third site of a multi-sited ethnography across Italy and Brazil,both of which have been crucial players in the past global asbestos market and have banned asbestos in 1992(Italy) and Brazil(2017). Some trajectories linking Casale Monferrato and Osasco have been considered to investigate the transnational processes of global asbestos disasters caused by asbestos-cement production at the largest Eternit plants in Italy and Brazil, active until the late Eighties and early Nineties, respectively. The study included ethnographic and historiographic research and the analysis of epidemiologic data.

Results: The study showed the importance of a contextual and holistic approach to explore how transnational disaster processes are locally experienced.with increasing health inequities and social disparities,over time.
Anthropological analysis illustrates the socio-cultural dimensions of suffering, risk categories, epidemiological evidence and biomedical knowledge considered as historically situated "products" of dynamic processes.

Conclusions: Dr. Mazzeo's research represents an opportunity to think about the contribution of anthropology to understand and tackle global health issues and offers insights in the study of "invisible" disasters as well as the active role of members of the exposed communities in decision-making and knowledge production about issues concerning their lives, and in the case of workers, their family members as well.

*** Presenting author profile:**
Frank Arthur
Dr. Frank is Chair Emeritus and Professor of Environmental and Occupational Health at the Drexel School of Public Health and a Professor of Medicine. He has studied asbestos diseases for more than 50 years. Dr. Mazzeo is Adjunct Professor of History of Anthropology and Medical Anthropology at the University of Bologna. She has conducted asbestos research in Italy and Brazil.

e-Toolkit for the Elimination of Asbestos-Related Diseases in Developing Countries

Ken Takahashi[1,2]; Kim Brislane[1]

[1] Asbestos Diseases Research Institute, WHO-CC for Elimination of Asbestos Related Diseases, Concord NSW, Australia; [2] University of Occupational and Environmental Health, Kitakyushu, Japan

Background: The Asbestos Disease Research Institute (ADRI) is on a mission to improve the diagnosis and treatment of asbestos-related diseases (ARD) and at the same time contribute to effective measures to prevent exposure to asbestos. Due to Australia's ensuing total ban on international travel, ADRI's international cooperative activities had to shift from the delivery of in-person and online training workshops to the development of training materials on asbestos/ARD that can be utilized by developing countries.

Methods/Approach: Cooperating with a wide range of international experts, administrators and activists, the ADRI is in the final stage of compiling the 'e-Toolkit for the Elimination of ARDs in Developing Countries.' This 2021 edition toolkit is a complete revision of the 2013 edition Toolkit produced jointly by two WHOCCs in terms of scope, content and format, but inherits the core principle that "the most effective means to eliminate ARD is to stop using asbestos" - in perfect line with the Collegium Ramazzini's position statements. The new format is fully digital ('e-toolkit') incorporating originally developed educational/science videos with abundant hyperlinks to internal and external sources, and is made accessible free-of-charge on the ADRI-WHOCC website (https://www.adricc.org/).

Results: So far contributions have been made by 50+ experts from 15+ countries and growing. Chapters comprise 1) Asbestos and ARDs – Past, Present and Future with Country Reports; 2) Diagnosis and Treatment of ARDs; 3) Patient Support and Care; 4) Reporting, Coding and Registration of ARDs; 5) Preclinical Research on ARDs; 6) Industrial Hygiene on Asbestos; and 7) Asbestos Waste Management; and Asbestos Management in Natural Calamities.

Conclusions: The challenge to balance the context of 'for the sake of developing countries' with 'best practice' surfaced particularly for medicine- and science-centric topics, but were met as much as practically possible. The planned timing for full release is end of 2021.

*** Presenting author profile:**
Takahashi Ken
Prof. Takahashi is the Director of the Asbestos Diseases Research Institute and Head of the WHO-CC for Elimination of Asbestos Related Diseases in Australia.

Computer aided detection (CAD) of radiological silicosis - a new application of an evolving AI technology.

Rodney Ehrlich[1]; Stephen Barker[2]; David Rees[3]; Jim te Water Naude[4]; Barry Kistnasamy[5]; Julian Naidoo[6]; Annalee Yassi[2]

[1] University of Cape Town, Cape Town, South Africa; [2] University of British Columbia, Vancouver, Canada; [3] University of the Witwatersrand, Johannesburg, South Africa; [4] Diagnostic Research Inc., Cape Town, South Africa; [5] Compensation Commissioner for Occupational Diseases, Department of Health, Johannesburg; [6] Wits Health Consortium, Johannesburg, South Africa

Background: Computer aided detection (CAD) using artificial neural networks is an AI application in the diagnosis of tuberculosis, specifically in screening and triage. Two questions are of interest in Southern Africa, where large numbers of active and former gold miners are being examined. Can CAD be developed to detect silicosis? How well does CAD function in a population with a mix of silicosis and tuberculosis, which may mimic or mask each other radiologically?

Methods/Approach: We conducted two validation trials of commercial CAD systems. The first CXR sample (n=330) was curated from a compensation database with adjudication outcomes as the reference. The second (n=501) was drawn from a field study of ex-miners who self-presented for examination, with external readers as the reference. Agreement analysis was based on Receiver Operating Characteristic (ROC) curves. To compare CAD systems, we chose the point on the ROC curve where sensitivity=90% (the WHO recommendation for TB screening) and examined the corresponding specificity.

Results: The first trial showed CAD of three of four systems achieving very high agreement with compensation adjudication outcomes in distinguishing TB and silicosis from normal, but not in distinguishing TB from silicosis. In the second trial with external readers, two out of three participating systems achieved moderate- to-high performance in identifying TB from a mix of abnormal and normal CXRs (best system: sensitivity 90.2%, specificity 72.5%). Only one CAD system read for silicosis, achieving high agreement with the reference (best outcome: sensitivity 91.1%, specificity 82.6%).

Conclusions: CAD shows promise in screening former gold miners for both silicosis and TB. The validation trials need to be appropriate to the target context in source and mix of images. Monitoring use in practice, with a feedback loop to ongoing development of the CAD system, is the next step.

*** Presenting author profile:**
Rodney Ehrlich
Emeritus Prof. Ehrlich is Senior Research Scholar in the School of Public Health and Family Medicine, University of Cape Town, South Africa. His research interests include the clinical features and epidemiology of silicosis and tuberculosis in miners and the institutional aspects of worker's compensation for the huge number of former gold miners in Southern Africa.

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DAY 2 - SCIENTIFIC SESSION I
Toxicity of Fluoride

1. Developmental Neurotoxicity of Fluoride *Linda Birnbaum, France*
2. Prospective Cohort Studies of Prenatal Fluoride Exposure and Children's Intellectual Abilities *Bruce Lanphear, Canada*
3. Use of epidemiology data to estimate safe fluoride exposure during pregnancy *Philippe Grandjean, USA*

Developmental Neurotoxicity of Fluoride

Linda Birnbaum[1]; Ana Soto[2, 3]

[1] National Institute of Environmental Health Sciences and National Toxicology Program; Scholar in Residence, Nicholas School of the Environment, Duke University, Durham, NC, USA; [2] Tufts University School of Medicine, Boston, MA USA; [3] Centre Cavaillès, École Normale Supérieure, Paris, France

Background: There is mounting evidence of the developmental neurotoxicity of fluoride. This has created a conflict with public health recommendations to fluoridate drinking water to provide protection against cavities. Given that topical treatment is more effective than ingestion, should we still be encouraging water fluoridation? In fact, have caries decreased given the use of fluoridated water? And how much does exposure to fluoridated water increase the general population exposure to fluoride. What should the recommendations be to pregnant women and their infants?
Preventing caries can be accomplished by topical fluoride application, while the loss of IQ is irreversible. This is a high price to pay for maintaining a public health policy with unintended adverse outcomes.

Methods/Approach: We will provide an overview of the topic, including the Systematic Review of Fluoride Exposure and Neurodevelopment, conducted by the US National Toxicology Program when Dr. Birnbaum was the director. Two experts will provide results of studies. Then we will be joined by an experienced voice in this debate for a robust discussion to help Fellows decide whether action by the Collegium would be a useful investment.
Lanphear and Grandjean have contributed important epidemiological studies on this subject. (Grandjean also risk assessments)
C. Vyvyan Howard is a medical toxicological-pathologist and has argued for discontinuing fluoridation.

Results: The speakers will discuss:
1. Should fluoridation of water be seen as a caries versus neurotoxicity dilemma?
2. Given the long delay between evidence of harm and public health policy changes, what is sufficient evidence? What about applying the precautionary principle to this problem?
3. Does new evidence of additional sources of exposure, such as drinking black tea, also provide an argument for discontinuing fluoridation of water?

Conclusions: We expect that these presentations and discussion will help the Fellows to decide whether action by the Collegium would be a useful investment.

*** Presenting author profile:**
Soto Ana
Dr. Ana Soto is a theoretical biologist (theory of carcinogenesis; principles for a theory of organisms) and an experimental biologist (pioneer of the Endocrine Disruptor field, developmental origins of cancer).

Prospective Cohort Studies of Prenatal Fluoride Exposure and Children's Intellectual Abilities

Bruce Lanphear[1]

[1] Simon Fraser University, Vancouver, British Columbia, Canada

Background: New research from both cross-sectional and longitudinal studies suggests that fluoride is a developmental neurotoxicant. Two prospective birth cohort studies – the ELEMENT Study in Mexico and the MIREC Study in Canada – examined the association between maternal urinary fluoride concentrations and intellectual ability (IQ) in their children at levels commonly found in pregnant women in North American. Fluoride is added to salt in Mexico and to drinking water in Canada to prevent dental caries.

Methods/Approach: Full Scale IQ (FSIQ) was measured in children using the Wechsler Abbreviated Scale of Intelligence at 6 to 12 years in the ELEMENT Study (n=211) and the Wechsler Primary and Preschool Scale of Intelligence-III at 3 to 4 years in the MIREC Study (n=512). Multiple linear regression was used to examine covariate- adjusted association between maternal urinary fluoride concentration and FSIQ scores in their children.

Results: An Increase in maternal urinary fluoride of 1 mg/L was associated with a 5.0 decrease in FSIQ scores among children in the ELEMENT Study and a 4.5 decrease in FSIQ score among boys in the MIREC Study; no significant reduction in FSIQ scores was observed for girls in the MIREC Study. Adjustment for lead exposure did not appreciably alter the results.

Conclusions: Women should avoid fluoride intake during pregnancy.

*** Presenting author profile:**
Lanphear Bruce P.
Dr. Lanphear is a professor of health sciences at Simon Fraser University.

Use of epidemiology data to estimate safe fluoride exposure during pregnancy

Philippe Grandjean[1, 2]

[1] Southern Denmark University, Odense, Denmark; [2] Harvard T.H. Chan School of Public Health, Boston MA USA

Background: A substantial number of cross-sectional, mainly ecologic, epidemiology studies suggest that children born in communities with elevated fluoride concentrations in the drinking water have deficient cognitive development, as measured by IQ. Only recently have prospective data become available with individual measures of maternal fluoride exposures (urine-fluoride, U-F) during pregnancy and subsequent neuropsychological examination of the child.

Methods/Approach: Data from the ELEMENT cohort in Mexico and the MIREC cohort in Canada included creatinine-adjusted U-F from all mothers during pregnancy. Cohort children were assessed for IQ at age 4 (n=211) and between 6 and 12 years (n=287) in the ELEMENT cohort, and 3-4 years (n=407) in the MIREC cohort. Covariate- adjusted regression coefficients and their standard errors were calculated to assess the association of maternal U-F concentrations with children's IQ measures. In the absence of observable thresholds, the regression results were used to calculate the U-F benchmark concentration (BMC) for a benchmark response of 1 IQ point, and its lower confidence limit, the benchmark concentration level (BMCL).

Results: The assumption of a linear dose-response relationship was confirmed, without a difference between the cohorts, but boys showed lower BMC values than girls. The joint cohort data showed a BMC of 0.31 mg/L for maternal U-F, with a BMCL of 0.19 mg/L for an IQ loss in the youngest boys and girls in the two cohorts, and 0.33 mg/L, with a BMCL of 0.20 mg/L, for the MIREC cohort and the older ELEMENT children.

Conclusions: The joint data show a BMCL in terms of the creatinine-adjusted U-F concentration in the pregnant women of approximately 0.2 mg/L. These results suggest that current limits for fluoride in drinking water and other beverages are much too high and that prevention of elevated fluoride exposure in pregnant women is a public-health priority.

*** Presenting author profile:**
Grandjean Philippe
Dr. Grandjean is Professor of Environmental Medicine at Southern Denmark University and also Adjunct Professor at Harvard University. He worked with international colleagues to generate a joint assessment of developmental neurotoxicity of fluoride in children.

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DAY 2 - SCIENTIFIC SESSION II
Work of the Fellows

1. How many life-years/QALYs and healthcare expenditures could we save to prevent a case of catastrophic illness, including cancer? *Wang JD, Taiwan*
2. The study of priority setting for occupational carcinogens in industries in Thailand *Somkiat Siriruttanapruk, Thailand*
3. The Electronic Vaping Associated Lung Injury (EVALI) Outbreak *David C. Christiani, USA*

How many life-years/QALYs and healthcare expenditures could we save to prevent a case of catastrophic illness, including cancer?

Wang JD[1], Lai WW[1], Yang SC[1], Wang FM[2], Hwang JS[3], Ku LJ[1], Liu LF[1]

[1] National Cheng Kung University College of Medicine and Hospital, Tainan, Taiwan; [2] National Cheng Kung University College of Social Science, Tainan, Taiwan; [3] Academia Sinica Institute of Statistical Sciences, Taipei, Taiwan

Background: Under the progressively aging population and continual development of new healthcare technology, the number of prevalent cases with chronic non-communicable diseases is projected to double by 2030 in Taiwan, which threatens the sustainability of healthcare system.

Methods/Approach: We developed methods to estimate lifetime survival function through a rolling-over algorithm, and integrate with functions of quality of life/costs/disability/employment proportions and then sum up throughout life.
Using big data collected administratively, we have quantified life expectancy (LE), quality-adjusted life expectancy (QALE), loss-of-LE, loss of QALE, and lifetime healthcare cost for cancer and major catastrophic illnesses.

Results: The health benefits and lifetime costs that could be saved from prevention of cancer are as follows: lung (13.1QALY, 26200 USD), liver (14.1QALY, 23200 USD), oral (11.8QALY, 46800 USD), esophagus (18QALY, 24800 USD), colorectal (6.9QALY, 41400 USD), stomach (10.0QALY, 27500 USD),
nasopharyngeal (15.3QALY, 50000 USD), bladder (6.1QALY, 55800 USD), kidney (8.0QALY, 58000 USD), renal pelvis & ureter (7.6QALY, 66300 USD), prostate (2.7QALY, 40600 USD), breast (7.2QALY, 69900 USD), cervix (6.0QALY, 45600 USD), ovary (11.9QALY, 53900 USD), quadriplegia & hemiplegia (13.7 LY, 81500 USD), severe trauma (13.7 LY, 45500 USD), Rheumatoid arthritis (6.9LY, 68400 USD),
schizophrenia (8.7LY, 45400 USD), ischemic stroke (9.0 QALY, 35000 USD), hemorrhagic stroke (14.5 QALY, 35200 USD), Alzheimer disease (early onset 8.7 LY, 38000 USD; late onset 1.7LY, 33800 USD), end-stage renal disease (hemodialysis 12.0QALY, 237800 USD; peritoneal dialysis 11.1QALY, 204400 USD), acute myocardial infarction (percutaneous coronary intervention 3.7LY, 49100 USD; no revascularization 5.1LY, 44100 USD). For caring comatose patients with prolonged mechanical ventilation, the costs for underlying diseases of cancer, stroke, and injury were 144, 152, and 159 thousands USD per QALY, respectively.

Conclusions: We have quantified lifetime health benefits and costs from prevention of cancer and other catastrophic illnesses, which can be multiplied with the incidence rates from epidemiologic research for health policy decision and health promotion.

*** Presenting author profile:**
Wang Jung-Der
Dr. Jung-Der Wang is an Honorary Chair Professor of the National Cheng Kung University. After graduating from Harvard School of Public Health in 1982, he has devoted his life for public health. He has documented more than 20 different occupational & environmental diseases in Taiwan and developed methods and conducted empirical studies to improve cost-effectiveness and sustainability of universal coverage system of National Health Insurance of Taiwan.

The study of priority setting for occupational carcinogens in industries in Thailand

Somkiat Siriruttanapruk[1]; Rachaneekorn Chomsuan[1]; Piboon Issarapan[1]; Thanawadee Chantian[1]; Churaiwan Sirirat[1]

[1] Ministry of Public Health, Nonthaburi, Thailand

Background: Apart from asbestos, other carcinogens have never been studied under in occupational cancer surveillance system in Thailand. Since several carcinogens have been used in industries, it is necessary to prioritize chemicals for proper monitoring and management. The aim of the study was to conduct priority setting of carcinogens by using existing data from the national chemical management system and other relevant information.

Methods/Approach: The study design applied the Hanlon method for priority setting. The first step was to select 10 chemicals by using the criteria as follows: 1) being listed as a carcinogen according to IARC group I, and 2) high amount of use in industries. Afterwards, the chemicals were ranked according to 3 criteria: 1) number of factories using the chemicals and number of exposed workers, 2) possible technical know-how for hazard management and 3) policy support.

Results: During 2018-2020, benzene was the carcinogen being used in industries with the highest amount of import (average 2,915 tons/year) and export (average 755,245 tons/year). The chemical with high numbers of factories for production was dioxin (1,058 factories). Approximately 157,187 workers were exposed to trichloroethylene in their workplaces (657 factories). According to the scoring for priority setting, top 3 of selected carcinogens included 1) trichloroethylene, 2) formaldehyde, 3) arsenic and chromium (same score).

Conclusions: By using this method, at least 10 chemicals were identified for further development of occupational cancer surveillance in the country. The next step for action includes health risk assessment in target workplaces, setting up health surveillance, and implementation of preventive and control measures. Meanwhile, improvement of chemical database management is necessary.

*** Presenting author profile:**

Siriruttanapruk Somkiat

Dr. Somkiat Siriruttanapruk is a senior advisor (Occupational and Environmental Health) of the Department of Disease Control, Thailand. Currently, he and his team are working on the project of the development of occupational health surveillance, including occupational cancer surveillance. Because of the COVID-19 situation, he is also responsible for the COVID-19 prevention and control in workplaces.

Recommended Monitoring of the Inhalational Exposure to Nanoparticles in Workers Using Oxidative Stress Markers

Daniela Pelclova[1]; Vladimir Zdimal[2]; Stepanka Dvorackova[3]

[1] Department of Occupational Medicine, Charles University and General University Hospital in Prague, Prague, Czech Republic; [2] Institute of Chemical Process Fundamentals CAS, Prague, Czech Republic; [2] Department of Machining and Assembly, Department of Engineering Technology, Department of Material Science, Faculty of Mechanical Engineering, Technical University in Liberec, Czech Republic

Background: Human health data regarding exposure to nanoparticles are extremely scarce and in the practice, the biomonitoring of workers´ exposure is not performed. Importantly, experiments bring warning data concerning oxidative stress and cellular damage. Especially little is known about complex mixtures of nanoparticles and interactions with the physical load and the lifestyle.

Methods/Approach: Aerosol exposures were monitored during the working operations using a suite of real-time and integrated instruments: plant I – nanoTiO2 and Fe-oxides pigments production; plant II - nanomaterials research and machining.
In plant I, 48 workers and 65 controls were examined in 2012 and 2013; in plant II, total 61 researchers were examined in 2016, 2017 and 2018, with comparable 62 controls.
Panels of oxidative stress biomarkers derived from free radical oxidation of lipids, nucleic acids, and proteins were analyzed in exhaled breath condensate (EBC) and in urine by LC-ESI-MS/MS: malondialdehyde, 4-hydroxy-trans-hexenal, 4-hydroxy-trans-nonenal, aldehydes C6-C13, 8- isoProstaglandinF2?; 8-hydroxy-2-deoxyguanosine, 8-hydroxyguanosine, 5-hydroxymethyl uracil; o- tyrosine, 3-chlorotyrosine, and 3-nitrotyrosine. Additionally, plasma samples were analyzed in plant II.

Results: Median mass concentration in all workshops ranged from 0.083 to 1.840 mg/m3, total particle number concentration from 1.98x104 to 5.4x105/cm3. Nanoparticles accounted for 40-96%. Markers of nucleic acids and proteins oxidation were elevated already in the pre-shift samples ($p<0.05$) of the workers relative to controls. Markers of lipid oxidation showed a significant post-shift increase ($p<0.05$).

Conclusions: Markers of lipids oxidation reflected acute exposures (cross-shift), while markers of oxidation of nucleic acids and proteins showed chronic oxidative stress. Among the fluids examined, EBC appeared the most valuable source, followed by plasma; least sensitive was urine. Long-term nanoparticle exposures caused lung function impairment. Monitoring of both acute and chronic effect using EBC biomarkers of oxidative stress (such as malondialdehyde and 8-hydroxy-2-deoxyguanosine) combined with spirometry measurement are preferred.

Acknowledgements: Progres Q25/LF1 and Q29/LF1

*** Presenting author profile:**
Pelclova Daniela
Prof. Pelclova, MD, PhD., EAPCCT, is the emeritus head of the Department of Occupational Medicine in Prague. She is focusing for more than a decade on the nanomaterials exposure during different working operations and on sunscreens use containing nano-TiO2.

The Electronic Vaping Associated Lung Injury (EVALI) Outbreak

David C. Christiani[1,2]

[1] Harvard TH Chan School of Public Health, Boston, MA USA; [2] Massachusetts General Hospital/ Harvard Medical School, Boston, MA USA

Background: In 2019, there was a cluster of cases from two states who presented with acute, severe respiratory distress after using e-cigarette (vaping) products. Within months, the outbreak of acute lung injury cases with infiltrates and hypoxemic respiratory failure spread to all US states and territories.

Methods/Approach: Review of literature and presentation of data from case series and exposure studies.

Results: Although the majority of the outbreak has been explained by exposure to vaping THC and CBD, a substantial number of cases (10-15%) reported nicotine vaping only. In addition, our studies of electronic nicotine vaping have shown passive exposure changes in autonomic responses (such as Heart Rate Variability, HRV) and animal studies are revealing a range of toxic effects from additives and even the basic vehicle used in many products, propylene glycol.

Conclusions: The use of electronic (e)-cigarettes was considered a beneficial solution to conventional cigarette smoking cessation, initially. However, paradoxically, e-cigarette use is rapidly growing among nonsmokers, including youth and young adults. In 2019, this rapid growth resulted in an epidemic of hospitalizations and deaths of e-cigarette users (vapers) due to acute lung injury; this novel disease was termed E-cigarette or Vaping Product Use-Associated Lung Injury (EVALI). Pathophysiologic mechanisms of EVALI likely involve cytotoxicity and neutrophilic inflammation caused by inhaled chemicals, but further details remain unknown. The undiscovered mechanisms of EVALI are a barrier to identifying biomarkers and developing therapeutics. Furthermore, adverse effects of e-cigarette use have been linked to chronic lung diseases and systemic effects on multiple organs. In this comprehensive review, we discuss the diverse spectrum of vaping exposures, epidemiological and clinical reports, and experimental findings to provide a better understanding of EVALI and the adverse health effects of chronic e-cigarette exposure. The outbreak represented a new environmentally induced epidemic

* **Presenting author profile:**
Christiani David
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DAY 2 - SCIENTIFIC SESSION III
Rapid Poster Presentations

1. Endocrine disruption: a crustacean perspective *Davide Degli Esposti, France*
2. Human Metal Exposure and Adverse Health Effects *Gunnar F. Nordberg,Sweden*
3. On radar and radio exposure and cancer in the military setting *Michael Peleg, Israel*
4. t(14;18) Translocations in Dioxin-Exposed Workers *Daniel Hryhorczuk, USA*
5. Association between air pollutants and hippocampal volume as assessed through magnetic resonance imaging in adult population: A systematic review and meta-analysis *Erica Balboni, Italy*
6. Health Evaluations that are Transparent, Timely and Lead to Health-Protective Actions: Workshop Report- *Nicholas Chartres, USA*

Endocrine disruption: a crustacean perspective.

Davide Degli Esposti[1], *Sarah Bancel*[1], *Arnaud Chaumot*[1], *Olivier Geffard*[1]
[1] INRAE, UR RiverLy, Ecotoxicology Team Centre de Lyon-Villeurbanne, Villeurbanne, France

Background: Endocrine disrupting chemicals (EDCs) are important anthropogenic chemical pollutants that affects the entire ecosystem. Research on EDCs mainly focuses on vertebrates, leading to proposal specific ED biological targets (often nuclear receptors), translated into in vitro screening tools employed in chemical risk assessment. While arthropods represent the vast majority of animal species, there is still a lack of knowledge on their endocrine systems, due to a great divergence from that of vertebrates. Among arthropods, crustaceans are among the most diverse species and are essential for the good function of aquatic ecosystems. Some of these species, such as the freshwater amphipod Gammarus fossarum, are currently recognized as sentinel species in the context of national biomonitoring campaigns to assess the chemical quality of aquatic ecosystems. Some ecotoxicological biomarkers developed in this species has been translated in standardized tests that can be used at a large spatial scale to assess bioavailable chemical contamination.

Methods/Approach: We will present an overview of past and current work on the development of Gammarus fossarum as a model organism to investigate EDCs in freshwater ecosystems based on published and unpublished experimental results.

Results: We will show how i) an (eco)physiological characterization of the amphipod reproductive cycle helped identifying molt cycle delay as a specific phenotype associated with endocrine perturbation; ii) next generation sequencing coupled with phylogenetic analyses allow the identification of nuclear receptors regulating the steroid dependent endocrine signaling pathway in G. fossarum; iii) proteomics and molecular network analysis helped identifing endoplasmic reticulum stress as a new mode of action involved in testicular toxicity in male amphipods.

Conclusions: While species-specific phenotypes and molecular pathway perturbations informed about the organism's health status, the toxicological and ecotoxicological data issued by different standardized assays and molecular investigations may help to assess the potential dangers issued from chemical contamination for ecosystems, biodiversity and human populations

* **Presenting author profile:**
Davide Degli Esposti
Davide Degli Esposti is a molecular biologist, research scientist in molecular ecotoxicology with main research interests on endocrine disrupting chemicals and species vulnerability to metal exposures.

Human Metal Exposure and Adverse Health Effects

Gunnar F. Nordberg[1], Max Costa[2]

[1] Umea University, Umea, Sweden; [2] New York University, New York, NY USA

Background: Both occupational and environmental exposures to metals and their compounds may give rise to clinical diseases. We examined the present occurrence of adverse human health effects from human metal exposures in various countries.

Methods/Approach: 130 medical doctors and scientists made extensive literature searches and evaluated information from their own research and information published in the literature. They evaluated data on 38 specific metals and their compounds and they also reviewed 30 other topics of importance for the evaluations.

Results: The Handbook on the Toxicology of Metals, 5th edition, presents the risk assessments. In general, clinically diagnosed occupational metal poisonings are rare in high-income countries. An exception is the recent recognition in the electronics industry of a severe interstitial lung disease with alveolar proteinosis, sometimes leading to death. Airborne, poorly soluble, indium compounds such as indium tin oxide cause this disease. Classical chronic poisoning by mercury vapor with erethism, tremor and other symptoms is rare in high-income countries, but frequently occurs in artisanal small-scale gold mining in low – and lower-middle- income countries. 1-2 million disease adjusted life years (DALYs) are lost due to mercury poisoning under these circumstances, which also causes poisoning cases due to arsenic, lead and cadmium. These poisoning cases are in addition to one million illnesses, 56000 deaths and more than 9 million DALYs estimated to be due to exposure to foodborne arsenic, methylmercury, lead and cadmium. Globally, several hundred thousand deaths and many millions of DALYs are estimated to occur from zinc and iron deficiency.

Conclusions: Obviously, there is a need for intensified efforts in risk assessment and preventive action.

*** Presenting author profile:**

Nordberg Gunnar

Gunnar F. Nordberg MD, PhD, Emeritus Fellow Collegium Ramazzini, is an emeritus professor at Umea University, Sweden where he was Professor and Chairman at the Department of Environmental Medicine. He worked at other universities in Scandinavia, USA and International Agencies and published more than 290 papers and 24 books including Risk Assessment of Human Metal Exposures-Mode of Action and Kinetic Approaches, 2018. Chief Editor, Handbook on the Toxicology of Metals, 5th Ed, Elsevier 2021/2022.

On radar and radio exposure and cancer in the military setting

Michael Peleg[1], Mora Deitch[2], Or Nativ[3] and Elihu D Richter[3]

[1] Rafael ltd. and Technion, Israel Institute of Technology, Haifa, Israel; [2] Bar Ilan University, Ramat Gin, Israel; [3] Hebrew University-Hadassah School of Public Health and Community Medicine, Jerusalem, Israel

Background: In previous work we found a higher than expected proportion of hematolymphoid (HL) cancers; 40% of the patients in the series suffered HL cancer vs 23% expected, using the parameter of percentage frequency (PF) in as case series exposed to high intensity whole body radiofrequency radiation. The same cancer characteristic of high HL PF was found in four previous reports on RFR-exposed groups together with increased general cancer rates.

Methods/Approach: We report a new group of 38 young cancer patients who served previously in military units that use radar and/or radio communication equipment with powerful whole-body exposure to RFR. The duration of exposure was mostly one to three years, the ages of diagnosis were young, with a median of 23 years, so latencies were short.

Results: The PF of HL cancers was 44.7%, 95% CI (28.6% - 61%), versus 23% expected for the age and sex profile group, p 0.002; 17 out of 38 patients had HL cancers. The PF of Hodgkin lymphoma cancers was 26.3% (95% CI 13.4 - 43) versus 11.8% expected, p<0.01%, 10 patients out of 38. For a subgroup of 6 patients, the number of soldiers in the units was known, and we were able to roughly estimate the general cancer risk ratio (RR) after 8 years as RR= 8, 95% CI (2.9, 17), p<0.002, with only 0.75 cases expected by the CR data. In this subgroup, there were 3 HL cancer cases and 3 non-HL cases. Only 3 out of 22 patients who responded to this question were told during their army service that they belong to a service category exposed to RFR and need to apply precautions.

Conclusions: The consistent association of RFR and highly elevated HL PF and HL cancer risk here suggests a cause- effect relationship between RFR and HL cancers in military/occupational settings.

*** Presenting author profile:**
Richter Elihu D.
Associate Prof Richter of the Unit of Occupational and Environmental Medicine, has a long standing interest in health effects of ionizing and non-ionizing radiation. His first case series of cancer associated with radiofrequency radiation was published in 2018.

t(14;18) Translocations in Dioxin-Exposed Workers

Daniel Hryhorczuk[1,2]; Irina Dardynskaia[1]; Carsten Hirt[3]; Oleg Dardynsky[2]; Wayman Turner[4]; Peter Ruestow[5]; Scott Bartell[6]; Kyle Steenland[7]; Oleksandr Zvinchuk[8]; Andrea Baccarelli[9]

[1] University of Illinois at Chicago School of Public Health, Chicago, IL USA; [2] University of Illinois College of Medicine, Chicago, IL USA; [3] Greifswald University, Greifswald, Germany; [4] Exponent, Atlanta, GA USA; [5] City of Chicago Department of Public Health, Chicago, IL USA; [6] University of California at Irvine School of Public Health, Irvine CA USA; [7] Emory University Rollins School of Public Health, , Atlanta, GA USA; [8] Obstetrics and Gynecology, Kyiv, Ukraine; [9] Columbia University Mailman School of Public Health, New York, NY USA

Background: The t(14;18) translocation is the initiating event in the causative cascade for follicular lymphoma. Increasing serum concentration of 2,3,7,8-TCDD has been previously associated with an increased frequency of t(14;18) translocations in environmentally-exposed individuals. We investigated whether this translocation is associated with occupational exposure to dioxins.

Methods/Approach: We recruited 323 former workers at a herbicide producing chemical plant and 150 population controls to participate in a health assessment. Blood samples were obtained from 218 workers and all 150 controls. Serum dioxins were analyzed using HRGC/ID-HRMS. t(14;18) translocations were quantitated using real- time PCR.

Results: The workers had significantly higher geometric mean serum levels of 2,3,7,8-TCDD (26.2 vs 2.5 ppt) and TEQ (73.8 vs 17.7 ppt) than controls. There were no significant differences in the prevalence or frequency of t(14;18) translocations in the workers compared to controls. Among former workers with current or past chloracne who were t(14;18) positive, the frequency of translocations significantly increased with quartiles of 2,3,7,8-TCDD and TEQ.

Conclusions: Chloracne appears to modulate the association between dioxin exposure and increased frequency of t(14;18) translocations.

*** Presenting author profile:**
Hryhorczuk Daniel
Dr. Daniel Hryhorczuk is a Professor Emeritus of Occupational and Environmental Health Sciences and Epidemiology at the University of Illinois School of Public Health and a Fellow of Collegium Ramazzini

Association between air pollutants and hippocampal volume as assessed through magnetic resonance imaging in adult population: A systematic review and meta-analysis

Erica Balboni[1,2], Tommaso Filippini[1], Marco Vinceti[1,3]

[1] Environmental, Genetic and Nutritional Epidemiology Research Center (CREAGEN), University of Modena and Reggio Emilia, Modena, Italy; [2] Medical Physics Unit, Azienda Ospedaliero-Universitaria di Modena, Modena, Italy; [3] Department of Epidemiology, Boston University School of Public Health, Boston, MA USA

Background: Growing epidemiological evidence suggests that air pollution may increase the risk of cognitive decline and neurodegenerative disease. A hallmark of neurodegeneration and important diagnostic biomarker is volume reduction the key brain structure of hippocampus. Few epidemiological articles examined the association of hippocampal volume with air pollution, with inconsistent results. We aimed to investigate the possibility that outdoor air nitrogen dioxide (NO2) and particulate matter with diameter ?2.5 ?m (PM2.5) and ?10 ?m (PM10) adversely affect hippocampal volume.

Methods/Approach: We considered studies that assessed the relation between outdoor air pollution and hippocampal volume by structural magnetic resonance imaging in adults and children, searching in Pubmed and Scopus databases from inception through July 13-2021. For inclusion, studies had to report the correlation coefficient along with its standard error or 95% confidence interval-CI between air pollutant exposure and hippocampal volume, to use standard space for neuroimages, and to consider at least age, sex and intracranial volume as covariates or effect modifiers. We meta-analyzed the data with a random-effects model, considering separately adults and children.

Results: We retrieved four eligible studies in adults and two in children. In adults, the pooled summary? regression coefficients of the association of PM2.5, PM10 and NO2 with hippocampal volume showed respectively stronger (summary? -7.59, 95% CI -14.08 to -1.11), weaker (summary? -2.02, -4.50 to 0.47), and no association (summary? -0.44, -1.27 to 0.40). The two studies available for children, both carried out in preadolescents, did not show an association between PM2.5 and hippocampal volume. The inverse association between PM2.5 and hippocampal volume in adults appeared to be stronger at higher mean PM2.5 levels.

Conclusions: Our results suggest that outdoor PM2.5 and less strongly PM10 could adversely affect hippocampal volume in adults, a phenomenon that may explain why air pollution has been related to memory loss, cognitive decline, and dementia.

*** Presenting author profile:**
Vinceti Marco
Dr. Vinceti is full professor of Public Health at the Department of Biomedical, Metabolic and Neural Sciences at University of Modena and Reggio Emilia where he works in the study of health effects of environmental and dietary risk factors, specifically regarding risk of chronic diseases as neurodegenerative diseases and cancer.

Health Evaluations that are Transparent, Timely and Lead to Health-Protective Actions: Workshop Report

Nicholas Chartres[1], *Jennifer Sass*[2,3], *David Gee*[4]

[1] University of California San Francisco, San Francisco, CA USA; [2] Natural Resources Defense Council, Washington DC USA George Washington University, Washington, DC USA; [3]. Brunel University, London, UK

Background: In February 2021, over one hundred scientists and policy experts participated in a web-based Workshop to discuss the ways that scientific uncertainty is used to delay critical protections for human health and the environment from hazardous toxic exposures. The Workshop was an outgrowth of the 'Late Lessons from Early Warnings' project at the European Environment Agency (EEA), published as two Volumes in 2001 and 2013. These books documented dozens of hazardous chemicals for which risk reduction measures were delayed for decades after scientists and others issued warnings about the harm likely to be caused by those chemicals.

Methods/Approach: Each day was organized as follows:
Session 1 - Coaxing Causality from Complexity
Session 2 - Lessons Learned from Divergent Evaluations of Some Physical and Chemical Agents
Session 3 – Systematic Reviews of Chemicals
Session 4 - Future Needs

Results: From the Workshop, we identified recommendations to minimize divergent evaluations of the evidence, and to guide and inform the development of transparent, timely, and reliable chemical evaluations. These overarching recommendations are:

- Ensuring broad meaningful stakeholder engagement
- Protecting high risk communities
- Increasing transparency
- Ensuring timeliness
- Addressing financial conflicts of interest from the research process

Conclusions: The above recommendations provide a cornerstone for producing reliable evaluations and recommendations of the evidence on environmental exposures that are applicable to various policy and regulatory settings at the local, state, federal and international levels.

Note: The Proceedings of the Workshop, with speaker presentations and daily summaries, is publicly available: https://prhe.ucsf.edu/sites/g/files/tkssra341/f/wysiwyg/Proceedings_Final_05_10.pdf

*** Presenting author profile:**
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Jennifer Sass is a Senior Scientist in the Health and Environment program of the Natural Resources Defense Council (NRDC), and professorial lecturer at George Washington University.

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DAY 2 - SCIENTIFIC SESSION IV
Conflict of Interest Disclosure in Epidemiology

1. INEP Position Statement to a toolkit for preventing methodological misuse *Juan Pablo Ramos-Bonilla, Colombia*
2. Conflict-of-interest (COI) and its impact on the research question *Juan Pablo Ramos-Bonilla, Colombia*
3. Financial conflict-of-interest as a source of bias in epidemiology *Daniele Mandrioli, Bologna*
4. What do we know about disclosure? *Lisa Bero, USA*
5. Misusing Bradford Hill's viewpoints and distorting science *Carl Cranor, USA*

Conflict-of-interest (COI) and disclosure in epidemiology: from an INEP Position Statement to a toolkit for preventing methodological misuse

Juan Pablo Ramos-Bonilla[1]; Daniele Mandrioli[2]; Lisa Bero[3]; Carl Cranor[4]

[1] Universidad de los Andes, Bogotá, Colombia; [2] Ramazzini Institute, Italy; [3] University of Colorado Anschutz Medical Center, Aurora, CO USA; [4] The University of California, Riverside, CA USA

Background: The International Network for Epidemiology in Policy (INEP) was founded in 2006 as the Joint Policy Committee of the Societies of Epidemiology. INEP's mission is to work at the interface of research and policy, serving the public interest by maintaining and protecting public health. INEP recognizes and highlights the misuse of data and potential corruption of the science practiced by epidemiologists. The topic of conflict-of-interest (COI) was selected in 2014 because the misuse of epidemiological science has been successful and continues to grow to the detriment of public health.

Methods/Approach: Information published on the topic of COI between 2004 and 2020 was collected, analyzed, and distilled into a compendium of its many facets, and was distilled into a Position Statement on Conflict-of-Interest and Disclosure in Epidemiology, launched in January, 2021 (https://epidemiologyinpolicy.org/coi-d-position- statement). Flowing from it is a Toolkit for Detecting Misused Epidemiological Methods (https://doi.org/10.1186/s12940-021-00771-6) published in August.

Results: The Position Statement provides guidance and strategies for COI management, including its prevention through identification, avoidance, disclosure, and recusal. The resulting Toolkit details 33 methods/techniques, arguments, and tactics by which epidemiology continues to be misused. Rather than conducting impartial analysis, scientists in a COI may produce and disseminate misinformation and suppress data so that the association of cause-and-effect is obscured and denied. COI can affect scientific journal authors, reviewers, editors, and involve corporate sponsors of journals.

Conclusions: INEP urges the adoption of its Position Statement by its member organizations, academic institutions, other public health professionals, and individual epidemiologists. Scientists should thereby be better able to protect the public's health. Because the effects of COI can include the undermining of scientific integrity, the erosion of public trust in epidemiology, and harm to workers, the public, and the environment, its prevention is key.

*** Presenting author profile:**
Dr Colin L Soskolne
Dr. Colin L. Soskolne is Professor emeritus, School of Public Health, University of Alberta, Edmonton, Canada. He is a Fellow in both the American College of Epidemiology and the Collegium Ramazzini. Since his retirement in 2013, he served the International Network for Epidemiology in Policy (INEP) in various leadership roles. He received the International Society for Environmental Epidemiology 2021 Research Integrity Award.

Conflict-of-interest (COI) and its impact on the research question.

Juan Pablo Ramos-Bonilla[1]

[1] Universidad de los Andes, Bogotá, Colombia

Background: At the beginning of 2021 the International Network for Epidemiology in Policy (INEP) released its Position Statement on conflict-of-interest (COI), which was expanded with a recent Commentary entitled "Toolkit for detecting misused epidemiological methods (Soskolne et al., Environ. Health 2021 20:90). This presentation is focused on the potential impact that COI can have on the research question.

Methods/Approach: For both INEP's Position Statement and the Commentary, information published on the topic of COI between 2004 and 2020 was analyzed, including position statements and guidelines for COI from different scientific societies and peer-reviewed articles addressing this area.

Results: The potential bias from COI on research goes beyond the bias it can induce on the methods applied or the analysis and interpretation of the results when conducting studies. COI can modify the research question and, more troubling, prevent the formulation of research questions that can potentially affect vested interests. Furthermore, unless the researcher acknowledges that COI had an influence on the research question, it is extremely difficult to identify this as an outcome of COI.

Conclusions: If the current pattern of decreasing government (i.e., public) funding for research continues, one of the negative consequences could be a lack of understanding of the health effects derived from toxic substances and other determinants that powerful interests do not want to see being investigated. The negative consequences for the advancement of knowledge, the pursuit of truth, public policy, and regulatory interventions that protect public health are recognized and highlighted.

*** Presenting author profile:**

Ramos-Bonilla Juan Pablo

Dr. Juan Pablo Ramos-Bonilla, Associate Professor, Department of Civil and Environmental Engineering, Universidad de los Andes, Bogotá, Colombia. He is a Fellow of the Collegium Ramazzini, and member of the Board of Directors of the International Society of Exposure Science (ISES). He is also a member of the Ethics Committees of both ISES and Universidad de los Andes, and an Expert Advisor to the International Network for Epidemiology in Policy (INEP).

Financial conflict-of-interest as a source of bias in epidemiology.

Daniele Mandrioli[1]

[1] Ramazzini Institute, Bologna, Italy

Background: The International Network for Epidemiology in Policy (INEP) Position Statement on Conflict-of-Interest (COI) and Disclosure in Epidemiology, launched on January 5, 2021 (https://epidemiologyinpolicy.org/coi-d- position-statement) provides guidance and strategies for COI management. The policy recommends avoiding bias related to financial COI through identification, avoidance, disclosure, and recusal.

Methods/Approach: Literature addressing COI as a source of bias in epidemiology was reviewed. This included meta-research studies, systematic reviews, current evidence-based methodologies in use in epidemiology, and empirical studies of COI as a source of bias.

Results: In many fields, in both human and non-human studies, including epidemiology and toxicology, there is sufficient evidence that financial COI can affect study outcomes. Financial COIs introduce bias at all levels of the research and publication process through, for instance, author financial ties, review sponsorship, and journal funding. To date, on the other hand, there is insufficient evidence that so-called "non-financial COIs" constitute a systematic source of bias.

Conclusions: Systematic Reviews and Evidence-Based Methodology in epidemiology need to account for financial COI when assessing Risk of Bias and the quality of evidence of the study. INEP urges the adoption of its Position Statement, recommending identification, avoidance, disclosure, and recusal of financial COI by its member organizations, academic institutions, other public health professionals, and individual epidemiologists. It also recommends using its Position Statement as a basis for further work toward addressing the more effective management of financial COI in epidemiology.

*** Presenting author profile:**
Mandrioli Daniele
Daniele Mandrioli, MD, PhD is the Director of the Cesare Maltoni Cancer Research Center of the Ramazzini Institute, Bologna, Italy. He conducts research on environmental toxicants and carcinogens and evidence-based methods in toxicology and epidemiology. Dr. Mandrioli's research on environmental toxicants and carcinogens includes the design and development of toxicological and epidemiological studies, investigations on the role of aneuploidy in carcinogenesis and reproductive toxicity, and the analysis of different chemical regulations and their implications for public health. Dr. Mandrioli's work on systematic reviews and evidence-based methodology aims to translate to toxicology the evidence-based approach already in use in clinical medicine. In particular, with his focus on developing new methods for an integrated evaluation of human and non-human evidence of toxicity, he studies the effects of COI on the outcomes and risk of bias of the studies.

What do we know about disclosure?

Lisa Bero[1]

[1] University of Colorado Anschutz Medical Center, Aurora, CO USA

Background: The International Network for Epidemiology in Policy (INEP) Position Statement on Conflict-of-Interest (COI) and Disclosure in Epidemiology, launched on January 5, 2021 (https://epidemiologyinpolicy.org/coi-d- position-statement) provides guidance and strategies for COI management. The policy recommends avoiding bias related to COI through identification, avoidance, disclosure, and recusal. Disclosure alone is a commonly used strategy to manage COI, but the INEP Position Statement recommends disclosure as only part of the solution.

Methods/Approach: Literature on disclosure of COI, from a variety of scientific fields, was reviewed. This included meta- research studies, sociological, and psychology literature, and empirical studies of disclosure statements.

Results: Although disclosure is the most frequently used strategy to manage COI, it does not prevent bias in research. Current commonly used disclosure declarations are not meaningful, and accurate disclosure is not enforced. Although experiments have shown that COI disclosures in research articles make readers more critical of the content, they do not lead readers to discount the findings. Other experiments have shown that disclosing COI makes those providing advice and expert opinion more biased.

Conclusions: Disclosure is necessary, but not sufficient, to reduce bias related to COI. INEP urges the adoption of its Position Statement, recommending identification, avoidance, disclosure, and recusal by its member organizations, academic institutions, other public health professionals, and individual epidemiologists. It also recommends using its Position Statement as a basis for further work toward addressing the more effective management of COI.

* **Presenting author profile:**
Bero Lisa
Lisa Bero is an international leader in research integrity and meta-research. She has studied the influence of industry interests on the design, conduct, and publication of research across a variety of scientific fields. She is the Senior Editor, Research Integrity for the Cochrane Library, where she is initiating Cochrane's research program on research integrity. She is also Public Health and Health System Network Senior Editor and was Co-Chair of the Cochrane Governing Board 2014-18. She is Professor, Medicine and Public Health and Chief Scientist, Center for Bioethics and Humanities, University of Colorado Anschutz Medical Center, USA.

Misusing Bradford Hill's viewpoints and distorting science.

Carl Cranor[1]

[1] University of California, Riverside, CA USA

Background: The International Network for Epidemiology in Policy (INEP) Position Statement on Conflict-of-Interest (COI) and Disclosure in Epidemiology, launched on January 5, 2021 (https://epidemiologyinpolicy.org/coi-d- position-statement), provides guidance and strategies for COI management. The policy recommends avoiding bias related to COI through identification, avoidance, disclosure, and recusal. Adverse effects from not controlling COI distort the science needed for addressing particular issues and, unfortunately, influence broader views of science.

Methods/Approach: One prong of this presentation considers how Austin Bradford Hill's 1965 seminal guide for assisting causal inferences from statistical associations has been misused in U.S. tort litigation. His recommendations have been legally recognized as a "methodology" that experts may use to support testimony for causation in civil litigation. A second prong notes that the U.S. pesticide industry, quite surprisingly, tries to reject the use of epidemiological studies in legal venues for assessing the adverse effects from pesticide exposures.

Results: A survey of 80 U.S. federal court decisions referencing Hill's considerations, viewpoints, or aspects (not "criteria,") reveals several misuses of Hill's thoughtful, careful recommendations. Some notable misuses of his considerations from court decisions are presented. What unites the two prongs? Likely, both result from unarticulated conflicting interests operating to distort the range of scientific studies that could reveal adverse health effects.

Conclusions: We should recognize a much broader panoply of data that can assist understanding. Myriad lines of evidence can be scientifically relevant to judgments about toxicity, not simply statistically significant human data, or mainly animal data. There is no obvious hierarchy of evidence among them, and legal venues should not limit scientific studies, or endorse hierarchies.
Scientists use good causal inferences to structure their reasoning, integrate different lines of evidence, and determine whether and how the different lines of evidence contribute to the conclusions about adverse effects. They should be permitted to do so in legal venues.

*** Presenting author profile:**
Cranor Carl F.
Professor Cranor's generic research interests are in legal and moral philosophy. For forty years he has focused on the morality, legality, and justice of exposure to toxic molecules that could threaten the public's health. He has written widely on philosophic issues concerning risks, science and the law, – the use of scientific evidence in legal decisions for regulating carcinogens and developmental toxicants, the idea of acceptable risks, and protection of susceptible populations.