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SCIENTIFIC SESSION I
RFEMF: The environmental health challenge of the 21st century

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RFEMF: The environmental health challenge of the 21st century

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Background: In 2011, as reported in the Monograph 102 (2013), the IARC classified the mobile phone radiofrequency electromagnetic field (RFEMF) exposure as a possible human carcinogen (group 2B) based on an association between high mobile phone use and glioma of the brain and acoustic neurinoma. However, the epidemiological evidence was deemed not to provide sufficient qualitative and quantitative data for use as a guideline prompting action to safeguard public health. More adequate laboratory data were required, in particular long-term carcinogenicity bioassays in rodents reproducing the human exposure situation as closely as possible, and mechanistic studies in vivo and in vitro performed with a view to understanding how RFEMF may induce carcinogenic effects or other toxic effects. Almost 10 years have passed since it was published the IARC Monography and in this period much new data are now available to better understand the potential of the health risks caused by the mobile phone RFEMF.

Description: The Collegium Ramazzini dedicates a Special Session of the 2022 Ramazzini Days to the health risks related to the exposure to mobile phone RFEMF in order to share updates in important aspects of exposure, response and control.
Presentations are provided on the following topics: carcinogenicity bioassays (Daniele Mandrioli), epidemiologic evidence of carcinogenic potential (Michael Kundi), mechanistic studies of carcinogenicity (John Bucher), induced oxidative stress and male infertility (Kavindra Kesari), hypersensitivity (Erica Mallery-Blythe), societal impact and safety aspects (Tarmo Koppel), validity of assumptions underlying exposure limits (Ronald Melnick), similarity and differences in history of understanding effects of asbestos and RFEMF (David Gee), final comment (Melissa McDiarmid).

Expected Outcome Data presented will be used for the preparation of a Statement of the Collegium Ramazzini about the public health risks related to mobile phone RFEMF including fifth generation (5G) effects.

Potential follow up Dissemination of the Statement.

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Dr. Soffritti was Scientific Director of the Ramazzini Institute and is now Honorary President. His scientific research was oriented toward the identification of causes of cancer, particularly those of industrial and environmental origin. He designed and directed long-term carcinogenicity bioassays to study several agents including formaldehyde, methanol, pesticides, ionizing radiation, aspartame, and sucralose. He planned and conducted large experiments on RFEMF originating from mobile phone.

Results of the RFEMF carcinogenicity bioassays performed by the Ramazzini Institute and the National Toxicology Program

Daniele Mandrioli[1]

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Background: In 2011, IARC classified radiofrequency electromagnetic field (RFEMF) radiation as a possible human carcinogen (Group 2B). According to IARC, animal studies, as well as epidemiological ones, at the time showed limited evidence of carcinogenicity. In particular, an increased risk to develop brain tumors and vestibular Schwannoma was observed in two case-control studies.

Methods: The National Toxicology Program (NTP) and the Ramazzini Institute (RI) recently completed their long-term carcinogenicity bioassays on RFEMF. The study by the NTP found clear evidence of an increased risk of malignant Schwannomas of the heart in male rats with high exposure to radiofrequency radiation at frequencies in cell phones of the 2 and 3 Generations (2G, 3G) as well as some evidence of increased risks of gliomas in the brain and tumors of the adrenal glands; equivocal evidence of increased risk of tumors was found in mice or in female rats. The RI carcinogenicity study, aimed to evaluate the carcinogenic effects reproducing the environmental exposure to RFEMF generated by 1.8 GHz Global System for Mobile communication (GSM) antennae at radio-base stations for mobile phones, showed a statistically significant increase in malignant schwannomas of the heart in males and an increase in glial malignant tumour of the brain in females.

Results: The recent NTP and RI RFEMF studies presented similar findings in heart Schwannomas and brain gliomas, strengthening the reciprocal results. In conclusion, sufficient evidence of positive associations have been observed between RFEMF exposure and glial tumors of the heart (schwannoma) and brain (glioma) in long-term rodent cancer bioassays.

Conclusions: The results of the NTP and RI long-term bioassays, along with epidemiological and mechanistic evidence, suggest that glial tissues are a specific target of the carcinogenic potential of RFEMF and provide a solid evidence-base for risk assessment and preventive strategies related to RFEMF.

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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.

Epidemiological evidence for a carcinogenic potential of mobile phone radiofrequency electromagnetic radiation (RFEMF)

Michael Kundi[1]

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Background: Early epidemiological studies were predominantly about occupational exposure to RFEMF, radar or radio broadcast towers. Some studies indicated a relationship with brain tumors as well as leukemia. However, the studies had methodological limitations and no definitive conclusion could be drawn. When it became apparent that mobile phone use would involve large populations, studies of the relationship between mobile phone use and head and neck tumors were needed.

Description of Content: Odds-ratios for the different brain tumor types and exposure conditions were extracted and meta-analytically combined by DerSimonian-Laird random effects models. For glioma and acoustic neuroma and long-term or heavy mobile phone use the same method was applied on the reported as well as on the selection bias adjusted odds-ratios.

Implications for the Collegium: Two study groups, the Hardell-group from Sweden and the Interphone group, a consortium of researchers from 13 countries, performed large case-control studies on glioma, meningioma and acoustic neuroma and some smaller studies on parotid gland tumors and lymphoma. After the IARC classificatiion as a possible carcinogen in 2011, a number of further epidemiological studies have been conducted and published. Two studies focused on children, adolescents and young adults (the CEFALO and the MOBIKids study), brain tumors in adults were further investigated in France (CERENAT study), Korea and Sweden. All these studies used the case-control approach. A large cohort study in peri-menopausal women (the Million Women Study) started already in 1996 in UK and in the last report women were followed up on average for more than 14 years. In addition, several ecological studies were conducted and also a large number of descriptive studies, in particular time trend studies.

Contribution to possible follow up/action Considering biases from several sources, especially selection bias, the combined evidence from these studies points to an association between long-term and heavy mobile phone use and glioma as well as acoustic neuroma.

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Prof.Dr. Michael Kundi is retired as head of the Department of Environmental Health, Center for Public Health, at the Medical University of Vienna. He has studied physical, chemical and biological environmental hazards with epidemiological and experimental methods.

Mechanistic studies of radiofrequency electromagnetic field (RFEMF) radiation carcinogenicity

John Bucher[1]

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Background: Recent mechanistic investigations examine the translation of animal cancer data to human epidemiology findings with RFEMF radiation.

Description of Content: Recent published and submitted papers evaluated genotoxicity in rats and mice in the National Toxicology Program (NTP) RFEMF studies, and the translational relevance to humans of brain and heart tumors from rats in the Ramazzini Institute (RI) RFR studies. Smith-Roe et al (2020) studied DNA damage in cells from brain, liver and blood leukocytes or reticulocytes using the comet assay or micronucleus assay, from rats exposed to specific absorption rates (SAR) of 1.5, 3, or 6 W/kg from gestation day 5 through 19 weeks of age, and mice exposed to SARs of 2.5, 5 or 10 W/kg from postnatal day 5 through 14 weeks, to two modulations of RFEMF at 900 or 1900 MHz respectively. Evidence of DNA damage was reported in the frontal cortex of male mice, in leukocytes from female mice and the hippocampus of male rats. Brooks et al (submitted) studied the translational relevance of brain gliomas and heart schwannomas from rats exposed to estimated SAR of 0.001, 0.03 and 0.1 W/Kg RFR at 1,800 MHz, in lifetime studies at the RI. By using targeted next generation sequencing of a panel of 23 human glioma- related genes, they demonstrated that rat tumors were primarily negative for single nucleotide variants or insertions/deletions in the isocitrate dehydrogenase gene, which is commonly mutated in human gliomas, but were often positive for mutations in 6 other genes of relevance to human glial tumors.

Implications for the Collegium: Although far from definitive, the studies suggest that genotoxicity, possibly related to oxidative stress, may be involved in carcinogenesis from non-ionizing RFR exposures.

Contribution to possible follow up/action These studies provide limited mechanistic support for processes thought important in human cancers related to RFEMF exposures.

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Dr. Bucher received a PhD in Pharmacology and is currently a Retired Senior Scientist, National Toxicology Program and National Institute of Environmental Health Sciences, US National Institutes of Health.

Radiofrequency electromagnetic field (RFEMF) induced oxidative stress and male infertility

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Background: For decades, there have been rising cases of male infertility attributed to an array of environmental and mutagenic factors. Male infertility is prone to be affected by exposure to ionizing and non-ionizing radiations. It is globally accepted that non-ionizing radiations are present in the environment and exposure is a major electro-pollutant for health risk (especially, due to fifth generation (5G) telecommunication systems recently installed in the communities without conducting any scientific studies on the health effects of 5G). Therefore an increasing level of radiation from the first generation (1G) to 5G and now expected sixth generation (6G) in the near future causes us to raise concern about such electro-pollutants.

Description of Content: Wistar rats were used for exposure to RFEMF. Rats were exposed to cell phone and microwave radiations (900- 2450 MHz). After 1 -2 hours of exposure, both the control and sham exposed group of rats were sacrificed and several important parameters were measured, including antioxidants enzymes (SOD, GPx, CAT), creatine kinase, DNA strand breaks, reactive oxygen species (ROS).

Implications for the Collegium: Our results provide evidence related to the pathophysiology of the RFEMF exposure and its effects on male fertility patterns. This included that the size of the effect always depends on exposure doses like exposure duration, the position of subjects, power density, and field intensity. Studies reported significant ($P < 0.05$) effects of RFEMF on sperm and testicular parameters such as a decrease in sperm count, changes in sperm morphology, DNA strand break, an increase in apoptosis level, and changes in the levels of melatonin, creatine kinase, ROS. This report also discusses the protective measures in response to RFEMF radiations.

Contribution to possible follow up/action The study concludes that the non-ionizing radiations may induce oxidative stress with an increased level of ROS, which may lead to infertility.

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Dr. Kesari, appointed to the Departments of Applied Physics and Bioproducts and Biosystems, has a Doctorate in Biotechnology (Environmental Toxicology) from India and conducted postdoctoral research at the University of Eastern Finland, Kuopio. His main interest is the effects of electromagnetic fields on brain and reproduction. He has published over 100 papers, 28 book chapters, 6 books. His Hirsch index (h-index) as of July 2022 is 31 on Google Scholar, 26 on Scopus.

Electromagnetic hypersensitivity: Current concepts

Erica Mallery-Blythe[1]

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Background: Electromagnetic hypersensitivity (EHS) is an increasingly important public health concern. It is estimated that there are a greater number of people suffering with EHS in Europe than there are wheelchair users. Rises in incidence are likely to continue to accompany increasing ambient EMF exposures to citizens in everyday life. Medical awareness, diagnostics and understanding have unfortunately not accelerated at the same rapid rate as exposures and EHS patients remain severely neglected within multiple global health services.

Methods: Concepts regarding current medical and scientific understanding of EHS are outlined and research inadequacies discussed with particular attention to methodological flaws of provocation tests. Useful, practical, clinical primary care tools for diagnosis and management of EHS are proposed and the current pathways available to provide supportive management for persons with EHS explained. Brief discussion of obstacles to appropriate movement forward regarding medical awareness, management and preventative care as well as conclusions regarding strategic measures to improve patient care are explained. Finally a brief summary of relevant legal findings is shared and the importance of appropriately protective biological safety guidelines is outlined with the view that these will improve outcomes on 3 counts ie. 1. Reduction in incidence of EHS (and other EMF-related disease endpoints), 2.
Improvement in current EHS morbidity and mortality and 3. Reduced possibility for litigation relating to 1 and 2.

Results: By embracing the emergence of the novel spectrum of EMF related illness, Collegium Ramazzini proves to be one of the first medical education establishments who will be well positioned to create guidance to improve public health in this technological era as well as suggest and direct new research to illuminate this issue. The Collegium will be in a position to redirect industry and medical services towards a healthier human and planetary future.

Conclusions: Contribute to future work on this issue.

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Dr. Erica Mallery-Blythe, Founding Director of PHIRE is also currently: Special Expert and European Representative, International Committee on the Biological Effects of Electromagnetic Fields (ICBE-EMF); Medical Advisor, Oceania Radiofrequency Scientific Advisory Association (ORSAA); Medical Advisor, International Guidelines on Non-Ionising Radiation (IGNIR); Medical Advisor, Electrosensitivity UK (ES-UK); Honorary Member, British Society for Ecological Medicine (BSEM). Previous appointments: 1998-2007 UK National Health Service sp. Emergency Medicine, author and director of 2020 NIR Consensus Statement.

New disruptive technologies 5G and AI, their societal impact and safety aspects

Tarmo Koppel[1]

[1] Tallinn University of Technology. Tallinn, Estonia

Background: In the technology domain, there are two recently emerged disruptive technologies artificial intelligence (AI) and fifth generation (5G) wireless communications, which have already had deep impact on how society functions. The impact of these technologies is warmly welcomed by some and utterly condemned by some others.

Methods: The society has many facets, and the willingness to accept new technologies follows a bell curve, including early adopters, those who wait for everybody else to get on board and those who reject the technology. It is of human nature, for some to accept everything new, without asking questions, as it is in human nature, that some are ever skeptical of change, least of technological change. We are discussing the change bot qualitatively and quantitatively.

Results: Adoption of new technologies, such as AI and 5G wireless networks requires scientific discussion. The discussion needs to be unbiased and balanced, taking into account the multitude of facets surrounding the issues. As we can conclude from human history, it is impossible to stop the progress, by banning something, as it is unwise to ignore relevant questions safety and other factors that may have an irreversible effect on the society.

Conclusions: New technologies need to be analyzed through the aspects of both the possibilities and risks. Currently, the scientific community needs further elaboration on, 1) how the AI and wireless connectivity (5G) changes take place in the physical infrastructure, 2) how these changes impact the ways our society works, 3) how does it affect our well-being and safety. Such analysis needs to bring onto the table all the arguments, both pro and contra. The development of human society is almost always been a function of the compromise, where something is relinquished in order to gain something ack, which is perceived of greater value.

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Dr. Kopell's research focus is technological advancements – how these affect businesses, workers and the public, and what risks are related. This work is interdisciplinary covering areas of information technologies, risk management, human factors, health and safety and inolves both research and development. A variety of research methods are used, including surveys, interviews, monitoring, measurements and field investigations. Being an inventor, he receives great satisfaction from developing solutions and implementing and evaluating interventions in real-life situations.

Assumptions Underlying the FCC and ICNIRP Exposure Limits for RFEMF are Not Valid

Ronald Melnick[1]

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Background: In the 1990s, the Federal Communications Commission (FCC) and International Commission on Non-Ionizing Radiation Protection (ICNIRP) established exposure limits to radiofrequency electromagnetic field (RFEMF) radiation for the public and workers. These limits were based on results from acute behavioral studies involving 40- 60-minute exposures to small numbers of rats and monkeys. Arbitrary safety factors were then applied to an apparent threshold specific absorption rate (SAR) of 4 W/kg. The limits were also based on the assumptions that any adverse effects were due to excessive tissue heating and no effects would occur below the putative threshold SAR.

Methods: Extensive research on RFEMF conducted over the past 25 years demonstrates that those assumptions and other assumptions that underlie the FCC and ICNIRP exposure limits are not valid. Adverse effects observed at exposures below the assumed threshold SAR include non-thermal induction of reactive species, DNA damage, cardiomyopathy, carcinogenicity, sperm damage, and neurological effects, including electromagnetic hypersensitivity. Also, multiple human studies have found statistically significant associations between RFEMF exposure and increased brain and thyroid cancer risk. Yet, in 2020, and in light of this evidence, the FCC and ICNIRP reaffirmed the same limits that were established in the 1990s. Consequently, current exposure limits, which are based on false suppositions, do not adequately protect workers, children, hypersensitive individuals, or the general population from short-term or long-term RFEMF exposures.

Results: Because worldwide exposures of people and the environment to RFEMF are increasing, and because there are no adequate health effects studies for novel forms of radiation from 5G telecommunications, a strong supportive statement from the Collegium Ramazzini could have a profound impact on the development of health protective exposure limits based on scientific evidence rather than on erroneous assumptions, .

Conclusions: This presentation will contribute to the Collegium Ramazzini statement supporting science-based exposure limits to RFEMF that protect public health..

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Dr. Melnick became an independent consultant after retiring from the NTP/NIEHS. He led the design of NTP studies on radiofrequency radiation; spent one year in the White House Office of Science and Technology Policy working on interagency health risk assessments; and served on numerous scientific panels for IARC and EPA. Dr. Melnick is an Emeritus Fellow of the Collegium Ramazzini and was recipient of APHA 2007 David Rall Award for science-based advocacy in public health.

Cryptochromes and magnetoreception: universal foundation of biological response to EMF/RF?

Devra Davis[1]; Malka Halgamuge[2]; Theodora Scarato[1]; Blake Levitt[3]

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Background: All living things have a cryptochrome, the precise function of which is being elucidated. This paper synthesizes machine learning (ML) analysis of plant responses to electromagnetic frequency (EMF) and relevant experimental and field studies to hypothesize a shared underlying mechanism of response.

Description of Content: Two different established ML algorithms were applied to a data set of 169 different studies of plant response to EMF as a systematic way to identify relationships with plant growth, developmental dissemination, and regeneration. Additionally, experimental studies are reviewed on the responses of the evolutionarily conserved class of flavoproteins found throughout plants and animals, with two genes Cry1 and Cry2, that code the two cryptochrome proteins CRY1 and CRY2 in drosophila, hymenoptera and various avian species.

Implications for the Collegium: Very strong correlations were observed between the specific absorption rate (SAR) and frequency and SAR with power flux density and electric field strength. Experimental and field studies of avian and insect indicates powerful roles of the cryptochrome in navigation, time and light perception and magnetoreception. Removal of Cry1 and Cry2 from drosophila interferes with navigation, whereas flies overexpressing CRY were magnetically oversensitive (Ritz et al., 2010). In a behavioral assay of magneto-sensitivity, light flies avoided magnetic fields under all full-spectrum light, while this response was blocked by blue light (UV-A/blue light, <420nm).

Contribution to possible follow up/action
This analysis indicates that ML algorithms predict impacts of EMF on key plant health parameters from specific exposures. We conclude that ML can provide innovative and efficient radio frequency EMF (RFEMF) exposure prediction tools when applied to existing data sets. Combined with experimental studies on Cry1, 2, 3, and 4, this strengthens the case for the cryptochrome as a universal source for biological responses to EMF. Further studies are required to elucidate this hypothesized universal factor for EMF response.

Funding source Environmental Health Trust, Carroll Petrie Foundation, Jonas Family Foundation, Community Foundation of Jackson Hole, McAfee Security Australia

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Dr. Davis is President of Environmental Health Trust, where she has co-edited three Special Issues of Environmental Issues on wireless radiation, co-authored several cross- disciplinary basic research original papers and published Disconnect--the truth about cellphone radiation (2010).

From the 'magic mineral' to the 'Internet of Things': similarities and differences between the histories of asbestos and RFEMF

David Gee[1]

[1] Brunel University, London, UK

Background: Some striking similarities between the history of asbestos, from the first plausible "early warning" (1898) and the unfolding history of radiofrequency electromagnetic field (RFEMF) radiation (1999) include: much marketing hype; biased cost benefit analyses; the creation of "independent" industry research groups; conflicts of interest in scientists setting the exposure limits; inadequate but hegemonic "international" exposure limits that fail to adequately protect workers and consumers; the manufacture of scientific doubt; regulatory capture; a slow rise in liability claims; and expansion of irreversible harm from one biological end point to several.

Some differences between asbestos and RFEMF include the greater complexity and variability of the exposure and of the exposure/response links; the changing characteristics of RFEMF from 1-5 Generations (1-5G) telecoms systems; the national differences in RFEMF exposure limits between the US and most of Europe compared to Russia, China, Italy and Switzerland; the earlier arrival of clear evidence from large scale high quality animal studies ; the enormous economic and political power of the Telecomms industry and of military involvement; the lessons of asbestos for the insurance industry and its refusal to cover liabilities for RFEMF harm; the earlier use of International Scientific Appeals for precautionary preventive action; and the use of administrative law courts to overcome regulatory inadequacies and capture. The combination of these features indicates that RFEMF is following a very similar historical trajectory to that of asbestos. How can this historical repetition and subsequent harms be avoided?

Methods: Historical analysis based on the approach adopted in "Late lessons from early warnings" will be presented (EEA, 2001, 2013).

Results: A comparative analysis reveals striking similarities and differences between the historical trajectories of asbestos and RFEMF.

Conclusions: Those who do not learn from history are condemned to repeat it.

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Mr. Gee is retired Senior Advisor for Science, Policy, Emerging Issues at the European Environment Agency (EEA), Copenhagen. He is currently a Visiting Fellow at the Center for Pollution Research and Policy at Brunel University.

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SCIENTIFIC SESSION II
Work of the Fellows

1. Exposure to overhead high-voltage power lines and childhood leukemia risk: an Italian population-based case-control study *Marco Vinceti, Italy*
2. HBM4EU chromates study: A multi-national biomonitoring study to create policy relevant data for the better management of occupational exposure to hexavalent chromium *Tiina Santonen, Finland*
3. Association between occupational category and SARS-CoV-2 infection in a Brazilian municipality *Eduardo Algranti, Brazil*
4. Blood lead levels: A possible biomarker of chemical mixtures exposure from electrical and electronic waste informal recovery *Amalia Laborde, Uruguay*
5. PFAS exposure in the lower Cape Fear Basin of North Carolina, USA: New fluoroethers and legacy chemicals *Jane Hoppin, USA*

Exposure to overhead high-voltage power lines and childhood leukemia risk: an Italian population-based case-control study

Carlotta Malagoli[1]; Marcella Malavolti[1]; Sara Fabbi[1]; Paolo Zanichelli[2]; Barbara Notari[3]; Maurizio Poli[2]; Giovanni Palazzi[1]; Monica Cellini[1]; Tommaso Filippini[1,4]; Sergio Teggi[1]; Marco Vinceti[1,5]

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Background: Previous epidemiologic findings suggest a positive association between magnetic field exposure induced by high voltage power lines and childhood leukemia (CL). Contrasting results are still reported, possibly biased by exposure misclassification, relying on different assessment methods across studies, and by unmeasured confounders.

Description of Content: We further studied this relation in the Modena and Reggio Emilia provinces (Northern Italy), and through a modelling exposure assessment we identified the corridors along high voltage power lines with magnetic field intensity in the 0.1-0.4 μT ranges. Then we identified 182 cases of newly-diagnosed CL within these provinces from 1998 to 2019. We sampled four age-, sex-, province of residence- and calendar year- matched controls for each case. We computed the odds ratio (OR) and its 95% confidence interval (CI) of CL in a conditional logistic regression analysis according to distance between home address at the time of diagnosis of the case and the nearest high voltage power line and also to residential magnetic field modeled intensity.

Implications for the Collegium: OR of CL was 0.9 (95% CI 0.5-1.6), 0.9 (95% CI 0.4-2.0), 1.5 (95% CI 0.5-4.7) and 4.0 (95% CI 1.0-16.0) for children living respectively 200-400 m, 100-200 m, 50-100 m, and less than 50 m from the nearest high voltage power line compared to those residing further than 400 m. OR of CL associated with residence in the area with exposure >0.1 μT was 8.0 (95% CI 0.7-88.2).

Contribution to possible follow up/action Though the number of exposed children in this study was too low to allow firm conclusions, yielding in such cases high but very imprecise estimates, our results seem more suggestive of an excess risk of leukemia among children living close to electric power lines or exposed to higher magnetic fields intensity.

Funding source This study was supported by Modena Charity Associazione Sostegno Ematologia Oncologia Pediatrica - ASEOP

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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.

HBM4EU chromates study: A multi-national biomonitoring study to create policy relevant data for the better management of occupational exposure to hexavalent chromium

Tiina Santonen[1]; Henriqueta Louro[2]; Beatrice Bocca[3]; Radia Bousoumah[4]; Radu Corneliu Duca[5,6]; Aleksandra Fucic[7]; Karen S. Galea[8]; Lode Godderis[6,9]; Thomas Göen[10]; Ivo Iavicoli[11]; Beata Janasik[12]; Kate Jones[13]; Elizabeth Leese[13]; Veruscka Leso[11]; Sophie Ndaw[4]; Katrien Poels[6]; Simo P. Porras[1]; Flavia Ruggieri[3]; sMaria J Silva[2]; An Van Nieuwenhuyse[5,6]; Jelle Verdonck[6]; Wojciech Wasowicz[12]; Ana Tavares[2]; Ovnair Sepai[14]; Paul T.J. Scheepers[15]; and Susana Viegas[16]

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Background: Within the EU human biomonitoring initiative (HBM4EU, www.hbm4eu.eu), one of the three targeted, multi- national occupational biomonitoring studies was the study on the exposure to hexavalent chromium (Cr(VI)). The aim of this study was to generate policy relevant data on occupational exposure to Cr(VI) and related health risks.

Description of Content: The study covered nine European countries and a total of 399 workers with exposure to Cr(VI) in welding, bath plating and other metal surface treatment activities and 203 control workers. Different exposure biomarkers, including chromium in urine (U-Cr), red blood cells (RBC-Cr), plasma (P-Cr) and exhaled breath condensate (EBC- Cr) were used for Cr(VI) biological monitoring. In addition, several effect biomarkers were applied to evaluate

Implications for the Collegium: The highest internal exposures were observed in electrolytic bath plating. U-Cr showed its value as the first approach for the assessment of total Cr internal exposure. We found a good correlation between U-Cr and air- Cr(VI) in plating and welding activities, and between RBC-Cr or P-Cr and air-Cr levels in platers. Correlations between internal exposure, dermal contamination and the use of personal protection or local exhaust ventilation or the level of automation were also observed. Differences in effect biomarkers between exposed workers and controls suggested that even the current exposure levels may not fully protect the adverse effects of Cr(VI). In plating, exposure to PFASs, present in mist suppressants, were also observed.

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Tiina Santonen (MD, PhD, MSc in Applied Toxicology) is working as a research professor at the Finnish Institute of Occupational Health. She is specialized in occupational toxicology, biomonitoring and chemical risk assessment and has several publications in these fields. She is also heavily involved in regulatory chemical risk assessment and management activities in Finland and EU. She is a former member of EU Scientific Committee on Occupational Exposure Limits (SCOEL) and a current member of European Chemicals Agency's (ECHA) Risk Assessment Committee (RAC). Within the recent large EU biomonitoring initiative, HBM4EU, she has lead occupational biomonitoring surveys performed within WP8 and risk assessment activities within WP5.

Contribution to possible follow up/action Based on this study we made several policy relevant conclusions. The study supports the recent regulatory actions in EU to control exposure to Cr(VI). A potential need for further reducing exposure to Cr(VI) was identified. The study shows the value of biomonitoring in the management of Cr(VI) exposure and provides data for the setting of biological limit values for Cr (VI).

Funding source EU Horizon 2020, grant agreement No 733032. Co-funding from the author's organizations and/or Ministries.

Association between occupational category and SARS-CoV-2 infection in a Brazilian municipality

Fabricio S. Menezes[1]; Leila P. Garcia[2]; Maria Maeno[3]; Leandro C. Prearo[4]; Tatiana Toporcov[5]; Eduardo Algranti[3]

[1] Universidade Federal de Sergipe, Aracaju, SE, Brazil; [2] FUNDACENTRO, Centro Regional de Santa Catarina, Florianópolis, Brazil; [3] FUNDACENTRO, Centro Técnico Nacional, São Paulo, Brazil; [4] Universidade de São Caetano do Sul, São Caetano do Sul, Brazil; [5] Faculdade de Saúde Pública, Universidade de São Paulo, Brazil

Background: The purpose of the study was to investigate associations between occupational category and SARS-Cov-2 infection among workers in the municipality of São Caetano do Sul, SP, Brazil.

Description of Content: We conducted a case-control study with individuals registered on the "Corona São Caetano" platform. All subjects were tested by reverse transcription-polymerase chain reaction (RT-PCR) for SARS CoV-2. Cases and controls were randomly selected and frequency-matched by sex, age and month of sample collection for RT-PCR test. All participants were interviewed by phone using a structured questionnaire. The occupations were classified under the two-digit Brazilian Classification of Occupations from the Brazilian Institute of Geography and Statistics. Analyses were performed using conditional logistic regression models, with cases and controls paired by the date RT-PCR collection.

Implications for the Collegium: A total of 1,596 cases and 1,596 controls were included and we adjusted for sex, age, education, means of transport, and household crowding. Using "other higher education professionals" as reference, the following occupational categories were associated with SARS-CoV-2 infection: domestic worker, cleaner, janitor, beauty parlor worker (OR 1.49; 95%CI 1.00-2.22); cooker, waiter, baker, butcher and confectioner (Adj OR 1.88; 95%CI 1.14–3.11); mechanic of vehicles, maintenance worker, machine operator, assembler in industry, production worker, loading and unloading assistant, construction worker (OR 1.39; 95%CI 1.00-1.94);, physician, nurse, other healthcare professionals and caregivers (OR 1.90; 95%CI 1.34–2.68); and security, watchman, other protection services worker, policeman (OR 2.21; 95%CI 1.27–3.84). The effectiveness of the COVID-19 vaccines was 65% after one dose (OR 0.35; 95%CI 0.29–0.43) and 74% in double-dose vaccination (OR 0.26; 95%CI 0.19–0.35).

Contribution to possible follow up/action This study revealed occupational categories with the highest odds for SARS-CoV-2 infection in a Brazilian city. It also highlights the protection provided by vaccines among workers exposed to SARS-CoV-2. The results reinforce the argument that COVID-19, in certain situations, should be considered an occupational disease.

Funding source This work was funded by the University of São Caetano do Sul.

*** Presenting author profile:**
Eduardo Algranti
Dr. Algranti is a researcher at FUNDACENTRO in São Paulo. He was a former MRC Pneumoconiosis Unit fellow where he started his career as a pulmonologist with a special interest in occupational lung diseases. He established and ran an outpatient occupational respiratory diseases clinic at FUNDACENTRO from 1985 until 2020.

Blood lead levels: A possible biomarker of chemical mixtures exposure from electrical and electronic waste informal recovery

Maria Jose Moll[1]; Adriana Sosa[1]; Sergio Machado[1]; Carolina Juanena[1]; Dario Pose[1]; Amalia Laborde[1]

[1] University of the Republic. Montevideo, Uruguay

Background: It is estimated that millions of tons of electric and electronic waste (e-waste) are produced globally year year. This number may double in the next decades, and less than 20% of e–waste is being safely recycled. Most e-waste is being disposed in dumps, where poor families and informal workers earn their living by scavenging and recovering valuable metals using unsafe processes, such as open air burning. Burning cables and rubbish containing metals can release a cocktail of toxic substances into the environment, including lead. Lead is found in solder, printed wiring boards, cathode ray tube screens, radiation shields, batteries and cable insulation. Open fires used to recover the valuable metals generate smoke that contains lead, leaving lead residue in the ash and soil.

Description of Content: In a field intervention aimed at finding lead exposure sources, hot spots of e-waste burning were identified around poor homes and neighborhoods of Montevideo City. Children living in these houses were evaluated for blood lead levels (BLL) and attended to by the communitarian medical services with the support of pediatricians and toxicologists.

Implications for the Collegium: The results showed that 1 in 4 children with elevated BLL are exposed to this process around their homes. Sixty percent of children who lived around e-waste burning hotspots had BLL>5 μg/dl and more than 20% had BLL>10μg/dl.

Contribution to possible follow up/action
BLL analysis is more available than that for other toxic contaminants from e-waste. BLL may be a useful biomarker to identify exposure to other contaminants from e-waste and to monitor outcomes of public prevention policies.

*** Presenting author profile:**
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Dra. Amalia Laborde is the head professor of the Toxicology Department at the University of the Republic in Uruguay and chair of the Occupational and Environmental Unit at the Clinical Hospital Faculty of Medicine.

PFAS exposure in the lower Cape Fear Basin of North Carolina, USA: New fluoroethers and legacy chemicals

Jane Hoppin[1]; Nadine Kotlarz[1]; David Collier[1,3]; C. Suzanne Lea[1,3]; Katlyn May[1]; and Detlef Knappe[1]

[1] North Carolina State University, Raleigh, NC, USA; [2] East Carolina University, Greenville, NC, USA

Background: In 2017, residents of Wilmington, NC, learned that their drinking water had been contaminated by GenX, a fluoroether PFAS (per and polyfluoroalkyl substances) since 1980. As a result of this community concern, the GenX Exposure Study was started to evaluate GenX and other PFAS exposure for residents in the lower Cape Fear River Basin of North Carolina. This study included both users of municipal water sourced from the Cape Fear River and private well owners near the chemical facility in Fayetteville, NC.

Description of Content: We enrolled 497 residents ages 6 and older into the GenX Exposure Study from 2017-2019; 344 residents from Wilmington in 2017-18 and 153 residents from Fayetteville in 2019. We collected blood and tap water to measure for a suite of over 20 PFAS including both fluoroethers and legacy PFAS.

Implications for the Collegium: Multiple PFAS were detectable in the blood of all study participants. Among Wilmington residents, we identified three new fluoroether PFAS in the blood of study participants, Nafion byproduct 2, PFO4DoA, and PFO5DoA, as well as two additional fluoroethers (NVHOS, PFO3DoA) in >15%. In Fayetteville, only the fluoroether Nafion byproduct 2 was consistently detectable and in much lower levels than in Wilmington. GenX was not detected in either community. In addition to fluoroethers, legacy PFAS (e.g, PFOA, PFOS, PFHxS, and PFNA) were present at elevated levels in the blood of most study participants. The medians of these PFAS exceeded the US NHANES values in both communities. In summing the legacy PFAS, >40% of participants exceeded 20 ng/mL, the current level of highest concern for health effects.

Contribution to possible follow up/action
The GenX Exposure Study not only identified novel PFAS chemicals in the blood of drinking water consumers, but also identified a previously unidentified highly exposed community to legacy PFAS. Future study followup will evaluate potential future health concerns.

*** Presenting author profile:**
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Dr. Hoppin is Director of the Center for Human Health and the Environment at North Carolina State University, and principal investigator of the GenX Exposure Study. Her research focuses on environmentally exposed communities and works to understand exposures and their implications for human health. Dr. Hoppin received the prestigious James E Holshouer award for Excellence in Public Service from the University of North Carolina System Board of Governors in February 2022.

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SCIENTIFIC SESSION III
Emergency preparedness: should we develop an holistic approach based on lessons learned from different types of disasters?

1. Emergency preparedness for chemical/industrial accidents as partof a holistic preventive approach to disasters *Roberto G Lucchini, USA*
2. Emergency preparedness in LMICs – what can be learnt from past experience? *Leslie London, South Africa*
3. Failure of disaster management in Lebanon – the case of the August 2020 Port Explosion *Iman Nuwayhid, Lebanon*
4. Empowering vital multistakeholder health and exposure research after disasters and health emergencies *Aubrey Keith Miller, USA*
5. Emerging preparedness for major accidents: updates about the 9/11 health consequences and more recent events *Roberto G Lucchini, USA*

Emergency preparedness for chemical/industrial accidents as partof a holistic preventive approach to disasters

Roberto G Lucchini[1]; Leslie London[2]; Imam Nuwayhid[3]; Aubrey Keith Miller[4]; Kurt Straif[5]

[1] Florida International University, Miami, FL, USA; University of Brescia, Brescia, Italy; [2] School of Public Health and Family Medicine, University of Cape Town, Cape Town, SA; [3] Khaddit Beirut, American University of Beirut, Beirut, Lebanon; [4] National Institute of Environmental Health Sciences, Bethesda, Maryland, USA; [5] ISGlobal, Barcelona, Spain; Visiting Professor at Boston College, MA, Boston, USA.

Background: The COVID-19 pandemic has triggered the urgent need to revise all plans for emergency preparedness worldwide. This is a time when the overall approach to disasters of different types, including of industrial, infectious, natural, nuclear, terrorist and war conflict origin, must be rapidly and effectively revisited. This panel will provide updates on recent cases, highlighting successful examples, as well as sub-optimal or insufficient responses. Indications for emergency preparedness, stakeholders involvement, coordinated action, epidemiological health surveillance and care for physical and mental health consequences on responders and impacted communities will be actively discussed. A unified inclusive all-hazards/all-risks preparedness and response action framework is critically needed to yield protocols and tools suitable for both institutional emergency preparedness planning and citizen awareness and participation.

Description: Roberto G Lucchini and Kurt Straif will act as chairs and facilitators within the panel of experts and with the fellows of Collegium Ramazzini.
Leslie London, Iman Nuwahid, Aubrey Miller and Roberto G Lucchini will provide updates on recent cases and programs.

Expected Outcome This panel will provide the element towards a potential document to be proposed to the Collegium Ramazzini as a specific statements for the critical need to improve the protection of responders and communities from the increasing threats posed by disasters, especially considering those of natural origin but triggered from the climate modifications.

Potential follow up This panel session should lead to the identification of a specific working group composed by experts within the Collegium Ramazzini, who could collaborate in the preparation of an official statement.

*** Presenting author profile:**
Lucchini Roberto - E-mail: rlucchin@fiu.edu
Roberto Lucchini, MD specializes in Occupational Medicine. Former Director (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, the physical and mental health impacts of 9/11 exposure to chemicals and psychological trauma, and Global Occupational and Environmental Health in LMICs, with emphasis on education and training.

Emergency preparedness in LMICs – what can be learnt from past experience?

Leslie London[1]; Rajen Naidoo[2]

[1] University of Cape Town, Cape Town, SA; [2] University of Kwazulu-Natal, Durban, SA

Background: The COVID-19 epidemic both highlighted glaring gaps in health systems' capacity to respond effectively to rapidly changing risks but also positive responses that helped contain the epidemic. South Africa, an Upper-Middle Income Country, introduced a number of novel system responses to COVID-19 to ameliorate the impacts of the pandemic substantially. However, during the course of the epidemic, South Africa was also witness to an arson attack during a period of public unrest which led to a massive warehouse fire involving 4362 tonnes of pesticides that burned over the course of 10 days. The released pollutants included a wide range of pesticides, solvents and their combustion products, affecting communities downwind. However, unlike the case for COVID-19, the public health response to the warehouse fire was uncoordinated, delayed and incomplete.

Methods: This paper compares public authorities' responses to the two emergencies, explores reasons for such differences and what might be done differently in future disasters. We propose five key elements to reshaping emergency responses:
(a) effective, engaged intergovernmental/interagency collaboration structures; (b) strengthening information systems such that routine data can aide emergency responses: (c) building human resource capacity in key skill ahead of time to anticipate needs; (d) rapidly establish open and transparent information-sharing multistakeholder fora bringing a wide range of stakeholders together as equal partners and (e) strengthening community structures to empower citizens early in the emergency to identify risks and work with emergency responders to minimise harms, and with epidemiologist and public health officials to ensure coherent monitoring and surveillance.

Results: The Collegium Ramazzini may indicate the need to adopt more adequate measures for emergency preparedness, disaster management and epidemiological follow up of the exposed.

Conclusions: A specific statement could help shape emergency preparedness plans toward better health protection and prevention of environmental damages.

*** Presenting author profile:**
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Leslie London is at the School of Public Health and Family Medicine, University of Cape Town.

Failure of disaster management in Lebanon – the case of the August 2020 Port Explosion

Iman Nuwayhid[1, 2]; Ghadi Samia[1]; Sara Ali[1]

[1] American University of Beirut, Beirut, Lebanon; [2] Khaddit Beirut, American University of Beirut, Beirut, Lebanon

Background: The Beirut Port Explosion on August 4, 2020, at 6:07 pm, claimed more than 200 lives, injured more than 6000 persons, and destroyed several health facilities and tens of thousands of residential and commercial units. Military and civil defense personnel, NGOs, and thousands of youth volunteers, involved in cleanup, renovations, and provision of aid to the affected population, were exposed to multiple environmental and occupational hazards, be it chemical, biological, or safety.

Methods: The incident uncovered the absence of a national disaster management plan, exhibited in the failure to,
1) safely manage the potentially explosive 2500 tons of ammonium nitrate stored at the port since 2013,
2) properly respond to the fire that preceded the explosion,
3) contain the site of explosion and the affected surrounding areas, and
4) lead the recovery efforts.

The acute political and economic crises that hit Lebanon since October 2019 may partially explain this failure. This presentation reviews the efforts taken to build an effective and efficient disaster management plan since early 1990's, and explains how the confessional (consociational) political system and bad governance have undermined such efforts as well as plans to establish national air quality and other environmental monitoring systems. It also reports on how scholar-activists under Khaddit Beirut stepped in to document environmental exposures and how due to government paralysis NGOs led renovation, reconstruction, and community support efforts.

Results: The Collegium Ramazzini may indicate the need to adopt more adequate measures for emergency preparedness, disaster management and epidemiological follow up of the exposed.

Conclusions: A specific statement could help shape emergency preparedness plans toward better health protection and prevention of environmental damages.

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Iman Nuwayhid is with the American University of Beirut.

Empowering vital multistakeholder health and exposure research after disasters and health emergencies

Aubrey Keith Miller[1]

[1] National Institute of Environmental Health Sciences, Bethesda, Maryland, USA

Background: Responses to disasters and emerging health threats have revealed the need for improved capabilities to perform rapid data collection and research from such events as the Gulf Oil Spill; Flint, Michigan lead poisonings; Ebola and Zika outbreaks; COVID-19 pandemic; hurricanes; and wildfires. The collection of health data in the immediate aftermath of public health emergencies and disasters is essential for ensuring situational awareness, shaping the public health response, and establishing a baseline for ongoing investigations to support recovery and future preparedness, as well as for identifying health threats in impacted communities. Yet, the initiation of time-critical public health research efforts after disasters are often delayed by a host of long-standing logistical, process, and regulatory barriers, such as lack of available protocols, institutional review board (IRB) approvals, and insufficient recognition of the need for community engagement.

Methods: Responses to the Gulf Oil Spill, Hurricane Harvey, and COVID-19 health emergencies will be used to illustrate lessons-learned and the importance of environmental disaster research, particularly for at-risk communities. This discussion will highlight the ongoing efforts to build capacity among various stakeholders to support time-critical data collection and investigations through the NIH Disaster Research Response Program (DR2). The DR2 Program, started in 2014 in response to the Gulf Oil Spill, is working to drive improvements in environmental health disaster research capacity in the US and internationally. DR2 efforts to advance capabilities include developing publicly accessible surveys (e.g., mobile device applications), common data elements for rapid data integration of epidemiologic studies, support materials, pre-approved research protocols, IRB guidance, as well as providing information and training for those involved in these response efforts, including multi-stakeholder training.

Results: Advancing health research will improve response, recovery and future preparedness for global communities.

Conclusions: Advance capacity, resources, and networking of CR community contributions to increasing disasters and health emergencies globally.

*** Presenting author profile:**

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Dr. Miller is Deputy Director, NIEHS Office of NIEHS Scientific Coordination Planning and Evaluation He leads programs involving global environmental health, climate change, and disaster research among U.S. agencies and stakeholders. He contributed to many disasters including the Libby, Montana, Hurricane, WTC and anthrax attacks, Gulf Oil Spill, H1N1 influenza, Ebola, Zika, and COVID-19 infectious outbreaks. He co- chairs the NIH Climate Change and Health Initiative and directs the NIH Disaster Research Response (DR2) Program.

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

Roberto G Lucchini[1,2]

[1] Florida International University, Miami, FL, USA; [2] University of Brescia, Italy

Background: Response to disasters and the investigation of their immediate and long-term impact on population health differ by the social, economic, and political contexts. Different events are analyzed to provide key lessons for emergency preparedness and disaster management.

Methods: 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 more recent events which occurred in (i) Miami Beach, Florida, where the Champlain Tower residential building collapsed on June 24, 2021; and (ii) fire and explosions in Sitakunda, Bangladesh (June 2022) and Matanzas, Cuba (August 2022) The WTCHP is revealing emerging impacts on cognitive decline among the responders, signaling the need for long term follow-up. Across these disasters, prevention, response and environmental monitoring was suboptimal. No action has been taken to investigate and control the physical and mental health consequences among responders and the impacted community in the aftermath of the disasters in Bangladesh and Cuba. In Florida, there was also sub-optimal preparedness in terms of recognizing the immediate threat posed by exposure to airborne pollutants generated by the building collapse. The scientific and health communities are still missing important exposure-outcome relationships needed to address these recent disasters.

Results: The Collegium Ramazzini may indicate the need to adopt more adequate measures for emergency preparedness, disaster management and epidemiological follow up of the exposed.

Conclusions: A specific statement could help shaping emergency preparedness plans toward better health protection and prevention of environmental damages.

*** Presenting author profile:**
Lucchini Roberto - E-mail: rlucchin@fiu.edu
Dr. Lucchini is an MD specialized 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, and the physical and mental health of disasters like 9/11.

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SCIENTIFIC SESSION IV
The health & environmental impacts of Russia's war in Ukraine

1. Panel overview *Barry Levy1; Daniel Hryhorczuk, USA*
2. The impact of Russia's war in Ukraine on health and human rights *Barry S. Levy, USA*
3. The environmental health impacts of Russia's war in Ukraine *Daniel Hryhorczuk, USA*
4. Problems of diagnosis, treatment and rehabilitation of chemical stress and brain stress in the civilian population as a result of hostilities *Mykola Prodanchuk, Ukraine*

Panel overview

Barry Levy[1]; Daniel Hryhorczuk[2]; Mykola Prodanchuk[3]

[1] Tuft's University School of Medicine, Boston, USA; [2] University of Illinois School of Public Health, Chicago, USA; [3] L.I. Medved's Research Center of Preventive Toxicology, Food and Chemical Safety, Ministry of Health, Kyiv, Ukraine

Background: Russia's war of aggression in Ukraine has had devastating impacts on health, human rights, and the environment. In addition to the tens of thousands of military and civilian casualties, indiscriminate bombing of cities is destroying the built environment and the critical infrastructure that supports public health. Over 12 million Ukrainians have been forced to leave their homes and over 5 million have crossed borders to become refugees. The war has exposed the population to myriad environmental heath risks from conflict-related pollution of air, water, and soil and has damaged the natural environment. The impacts of the war extend beyond Ukraine, adversely affecting global energy needs, food security in low- and middle-income countries, and the global economy.

Description: Dr. Levy is an Adjunct Professor of Public Health at Tufts University School of Medicine and author of the recently published book "From Horror to Hope: Recognizing and Preventing the Health Impacts of War." He will provide an overview of the impacts of the war on health and human rights. Dr. Hryhorczuk is a Professor Emeritus at the University of Illinois School of Public Health. He will discuss the impact of the war on environmental health. Dr.
Prodanchuk is the Director of the L.I. Medved Research Center of Preventive Toxicology, Food and Chemical Safety of the Ministry of Health of Ukraine. He will discuss the combined effects of chemical and psychological stressors on the health of the population and the need to develop new research and clinical approaches to the investigation and management of these disorders.

Expected Outcome We propose that the Collegium issue a statement condemning Russia's invasion of Ukraine

Potential follow up Collegium members can provide their expertise to Ukrainian scientists and policymakers through collaborative research, participation in conferences, and direct consultation to help mitigate this humanitarian and environmental health crisis.

*** Presenting author profile:**
Hryhorczuk Daniel - E-mail: dhryhorc@uic.edu
The panel will be chaired by Dr. Daniel Hryhorczuk who is a Professor Emeritus of Environmental and Occupational Health Sciences and Epidemiology at the University of Illinois School of Public Health. He is an International Member of the Ukrainian Academy of Medical Sciences and for the past 30 years has worked on research and capacity building in environmental and occupational health in Ukraine.

The impact of Russia's war in Ukraine on health and human rights

Barry S. Levy[1]
[1] Tufts University School of Medicine, Boston, USA

Background: War has enormous impacts on health, human rights, and the environment. Health professionals have a unique set of skills and responsibilities to recognize, assess, and address these impacts -- and help to prevent war and promote peace. Russia's war in Ukraine has demonstrated the horrendous impacts of war and also the opportunities for health professionals to help address these impacts, such as by documentation and research, education and awareness- raising, and advocacy.

Methods: Russia's war in Ukraine has led to large numbers of civilian deaths, nonfatal injuries, and illnesses. Official reports have grossly underestimated the actual number of casualties. While official reports have focused on the direct consequences of explosive weapons, most morbidity and mortality has likely resulted from indirect consequences of the war – mainly population displacement and damage to health-supporting infrastructure, including food and water supply systems and healthcare and public health facilities.

Most morbidity has been due to communicable diseases, malnutrition, maternal and infant disorders, exacerbation of noncommunicable diseases, and mental and behavioral disorders. There have been numerous violations of human rights and international humanitarian law, including execution of unarmed civilians, rape of women, forced deportation, and targeting of healthcare facilities, schools, civilian neighborhoods, and farmlands. There has been widespread contamination of air, water, and soil with toxic chemicals; safety hazards from deployment of antipersonnel landmines and unexploded ordnance; and the threat of environmental contamination with radioactive materials from nuclear power plants.

Results: To consider war as a public health issue and explore the roles that the Collegium may play, such as in raising awareness of its impacts on health, human rights, and the environment.

Conclusions: Further action needs to be taken to protect civilians, provide them with humanitarian assistance, and bring about an end to this war and other armed conflicts.

*** Presenting author profile:**
Levy Barry S. - E-mail: blevy@igc.org
Dr. Levy, a physician and epidemiologist, has extensively studied the impacts of war and has written and spoken frequently on Russia's war in Ukraine. He is the author of the book "From Horror to Hope: Recognizing and Preventing the Health Impacts of War" (Oxford University Press, 2022) and editor of 20 other books on war, climate change, social injustice, and occupational and environmental health. He is a past president of the American Public Health Association.

The environmental health impacts of Russia's war in Ukraine

Daniel Hryhorczuk[1]

[1] University of Illinois School of Public Health, Chicago, USA

Background: Russia's invasion of Ukraine has resulted in severe and widespread damage to the built and natural environment and has inflicted both immediate and long-term consequences on human health, ecosystems, and the Ukrainian and global economy.

Methods: Indiscriminate shelling of residential areas is destroying the built environment and the critical infrastructure that supports it, including public systems for energy, water, sanitation, and waste management. Destruction of buildings generates pollution from pulverized building materials such as asbestos, metals, and combustion products. Hundreds of industrial facilities have been damaged resulting in release of clouds of toxic chemicals, including nitric acid and ammonia. Ammunition explosions and residues release toxic substances, such as heavy metals, explosive compounds, and propellants into the air, water, and soil. Flooding of coal mines can lead to pollution of ground and surface water with toxic chemicals, and in the case of the Yunkom mine, radionuclides. Russia's violent military takeover of the Zaporizhzhia Nuclear Power Plant poses a risk of catastrophic radiation release if hostilities cause direct damage to the reactors or loss of coolant from disruption of the supply of electricity. The war has caused landscape and habitat destruction from conflict-related fires, craters, passage of heavy vehicles, construction of trenches and bunkers. Naval activities in the Black Sea and Sea of Azov threaten the marine and coastal environment. Beyond the borders of Ukraine, the war has negatively impacted global energy and food security.

Results: In addition to the humanitarian crisis and destruction of the built and natural environment, the increased geopolitical risks caused by Russia's invasion of Ukraine will have adverse effects on the global economy with tradeoffs in protection of global health and environment.

Conclusions: The Collegium should condemn the Russian aggression and collaborate with Ukrainian scientists and policymakers to assess and mitigate the humanitarian and environmental health impacts of the war.

*** Presenting author profile:**

Hryhorczuk Daniel - E-mail: dhryhorc@uic.edu

Dr. Hryhorczuk is a Professor Emeritus of Environmental and Occupational Health Sciences and Epidemiology at the University of Illinois School of Public Health. He is an International Member of the Ukrainian Academy of Medical Sciences and for the past 30 years has worked on research and capacity building in environmental and occupational health in Ukraine.

Problems of diagnosis, treatment and rehabilitation of chemical stress and brain stress in the civilian population as a result of hostilities.

Mykola Prodanchuk[1]

[1] Ministry of Health, Kyiv, Ukraine

Background: As you know, there is a defensive war going on in Ukraine. In addition to other tragic consequences for people, including the civilian population, the war in Ukraine brought with it powerful chemical stressors. First of all, this applies to people who were in the war zone and were hiding in poorly equipped shelters, basements or industrial underground facilities.

Methods: At present, we have no reliable evidence that chemical weapons were used during such hostilities. However, during the intensive bombing, highly concentrated mixtures of chemicals were released into the air, both products of the explosion of traditional explosives and the more recently new types of unknown explosives. In addition, in many cases, there was the bombing of chemical and steel industry facilities, as a result of which technological chemicals were a source of the toxic mixture. As the duration of the exposure to such a mixture is not only acute but may last weeks and months it follows the need to have specialized healthy assistance.

Results: But in all these cases, in addition to chemical stressors, people experienced dreadful brain distress. The possible synergism of these two stresses can turn out to be of the summation or synergistic type. Such a combined type of health disorder is a real challenge for our doctors.

Conclusions: Therefore, we propose, together with toxicologists, as well as colleagues in the field of brain, psychology, neurology and psychiatry, to solve a purely methodological procedure (protocol) for assessing causality, which links the impact on human health of chemical environmental stressors, possibly, also in combination with brain distress, as well as, most importantly from a practical point of view, the formulation of clinical causality protocols that do not exist today: toxicological diagnosis, diagnosis of physical and cognitive damage, non-specific (post-syndromic) treatment, afferent and efferent detoxification therapy.

*** Presenting author profile:**

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Prof. Prodanchuk is a director of L.I.Medved's Research Center of Preventive Toxicology, Food and Chemical Safety where he conducts research in the field of preventive and regulatory toxicology, investigation of chemical disasters and mass poisoning of people.

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SCIENTIFIC SESSION POSTER I
Work of the Fellows

1. Activities of Japanese Association of Occupational Health Law and first issue of Journal of Occupational Health Law *Fujio Kayama, Japan*
2. Selenium and its association with oxidative stress and genotoxicity risk in a healthy Italian population: a cross sectional study *Teresa Urbano, Italy*
3. Association between selenium species and hippocampal volume in subjects with mild cognitive impairment Scientific Session Poster I - Work of the Fellows *Erica Balboni, Italy*
4. Residence in proximity of petrol stations and childhood leukemia risk *Marcella Malavolti, Italy*
5. Role of night luminance in the etiology of dementia: a case-control study in the Modenese population *Elena Mazzoleni, Italy*
6. A Systematic Review and Dose-response Meta-analysis on Fluoride Exposure and Neurodevelopmental Toxicity in Children *Federica Veneri, Italy*
7. Light at night exposure and risk of depression and other mental disorders: a systematic review *Tommaso Filippini, Italy*

Activities of Japanese Association of Occupational Health Law and first issue of Journal of Occupational Health Law

Fujio Kayama[1]; Takenori Mishiba[2]

[1] Jichi Medical University, Shimotsuke, Japan; [2] Kindai University, Osaka, Japan

Background: There is an increasing number of legal issues in occupational health such as dismissing workers due to mental disorders and lawsuits in workers' malignancies due to occupational chemical exposures. We strongly acknowledge the need to solve these legal disputes and to prevent these disputes by propagating related knowledge through education in occupational health law.

Methods: The Japanese Association of Occupational Health Law (JAOHL), established in 2020, aims at promoting occupational health law by exploring leading-edge jurisprudence and legal practice, and providing practical and accessible legal education in various occupational settings. The JAOHL full membership is currently at 900, including 530 medical professionals (occupational physicians and nurses, psychological counselors), 130 labor and social security attorneys, 90 human resources personnel, and 45 attorneys and jurists.
The first annual meeting in 2021 included 803 participants; the second annual meeting will be held September 17- 18, 2022 in Tokyo through online participation. The program consists of lectures, symposia, workshops, oral presentation, and seminars. Prof. Richard Johnstone, Queensland University of Technology, will present a plenary lecture on safety and health among gig workers in Australia. HIs presentation will be in English while the other presentations will be in Japanese.

Results: The first issue of Journal of Occupational Health Law will be published both in English and Japanese. Manuscripts related to legal and regulatory issues in occupational health, including judicial problems, and preventive medicine in occupational settings, are invited. Prof. Richard Johnstone, Prof. Diana Kloss, London South Bank University, and I are editors-in-chief; an editor, Prof. Takenori Mishiba, is an administrator.

Conclusions: We welcome your manuscripts of both work-related legal issues and regulations in chemical management. https://www.jaohl.jp/english/journal-guide/

Funding source personal

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Selenium and its association with oxidative stress and genotoxicity risk in a healthy Italian population: a cross sectional study

Teresa Urbano[1]; Tommaso Filippini[1,2]; Marcella Malavolti[1]; Silvia Fustinoni[3,4]; Bernhard Michalke[5]; Marco Vinceti[1,6]

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Background: Selenium is present in trace amounts and different chemical forms in living organisms, which may beneficially and adversely affect cellular redox status. 8-oxo-7,8-dihydro-2'deoxyguanosine (8-oxodG) is an oxidized derivative of deoxyguanosine and a sensitive biomarker of oxidative stress and genotoxicity in biological systems. In this study, we aimed to determine if selenium exposure in a population in Northern Italy may be associated with 8-oxodG levels in urine and if sex and other factors may influence such association.

Description of Content: We recruited 137 substantially healthy and non-smoking blood donors from the Reggio Emilia province at the Transfusion Medicine Unit of the Reggio Emilia Hospital. Their median age was 48.2 years, and the recruitment occurred 2017-19. We assessed selenium in urine and serum, and urinary 8-oxodG levels. We also speciated selenium in serum. We used cubic spline regression analyses to investigate the association between selenium matrices and urinary content of 8-oxodG/g creatinine.

Implications for the Collegium: Median urinary selenium and 8-oxodG levels were 22.02 μg/L and 3.21 μg/g creatinine, respectively. Median total serum concentrations were 116.50 μg/L in the 104 individuals for which a serum sample was available. We found that urinary selenium positively correlated with 8-oxodG levels in men, while in women an inverted U-shaped association emerged. Total organic selenium and selenoprotein P levels were positively associated with 8-oxodG until 100 μg/L and then the association became slightly inverse in both sexes. In males, glutathione peroxidase- bound selenium, selenomethionine and human serum albumin-bound selenium were positively correlated with 8- oxodG, while negative associations emerged for inorganic selenium species. In females, positive associations, though slightly positive, emerged for organic species.

Contribution to possible follow up/action
Our study highlights the different role played by selenium compounds, suggesting that organic selenium - but not its inorganic species - may exert genotoxic effects, and that sex considerably influences the risk of oxidative stress and genotoxicity associated with selenium exposure.

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Dr. Urbano is PhD Student in Clinical and Experimental Medicine (Public Health curriculum) at University of Modena and Reggio Emilia. She studies the health effects of environmental (e.g., trace elements and light-at-night) and dietary risk factors and their relation with risk of disease, such as neurological and carcinogenic.

Association between selenium species and hippocampal volume in subjects with mild cognitive impairment Scientific Session Poster I - Work of the Fellows

Vinceti[1]; Erica Balboni[1,2,3]; Tommaso Filippini[1,4]; Lauren A. Wise[2]; Luca Nocetti[3]; Marcel Eichmüller[5]; Manuela Tondelli[1,3]; Giulia Vinceti[1,3]; Giovanna Zamboni[1,3]; Annalisa Chiari[3]; Bernhard Michalke[5]

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Background: Selenium is a trace element with nutritional and toxicological properties. Its influence on human health is thought to depend on exposure dose and chemical form. The effects of selenium exposure on medical conditions that involve the central nervous system have been insufficiently studied. In a cohort of individuals with mild cognitive impairment, we have previously documented a positive relation between cerebrospinal fluid (CSF) levels of inorganic hexavalent selenium (selenate) and risk of dementia.

Description of Content: We assessed the relation between CSF levels of selenium species and volume of the hippocampus among the 33 cohort members aged 43-82 years who had undergone magnetic resonance imaging at baseline (2008-2014) using both linear and spline regression analyses. We also performed a surface-based analysis using SPHARM-PDM to evaluate differences in shape of the hippocampus in addition to its volume in relation to CSF levels of selenium species.

Implications for the Collegium: We found an inverse association between selenate and total hippocampal volume (? regression coefficient in multivariable linear regression analysis -3.05, 95% confidence interval -5.74 to -0.37), which was similar for the right and left hippocampus and emerged mainly at the highest exposure levels. We found little association between the other selenium forms and hippocampal volume. In the surface-based analysis, the left hippocampus showed considerably more pronounced shape differences in the ventro-medial region of the head.

Contribution to possible follow up/action This is the first study to analyze selenium species in relation to hippocampal volume and structure, suggesting that a selenium form with high toxicological potential may adversely affect a key structure involved in dementia onset and progression as the hippocampus, possibly the left one in particular. However, we cannot entirely rule out the influence of reverse causation or unmeasured confounding on these results.

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Residence in proximity of petrol stations and childhood leukemia risk

Marcella Malavolti[1]; Carlotta Malagoli[1]; Costanzini Sofia[1]; Giovanni Palazzi[1]; Monica Cellini[1]; Tommaso Filippini[1,2]; Segio Teggi[1]; Marco Vinceti[1,3]

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Background: Air pollutant concentrations close to petrol stations tend to increase, especially for benzene and other carcinogenic contaminants, depending on meteorological factors, features of nearby buildings and station activity. For this reason, it is suggested that petrol stations increase the risk of cancer, in particular, childhood leukemia.

Description of Content: We carried-out a population-based case-control study in two Northern Italy provinces, Modena and Reggio Emilia. We included 182 cases of childhood leukemia diagnosed in the period 1998-2019, and 726 age and sex-matched controls. We geocoded child residence and the 790 petrol stations located in the study area, of which we retrieved the annual refueling activity. Exposure was assessed based on both residential distance from the nearest petrol station and on the activity of all plants located up to 1000 m from the home. Risk ratio of leukemia was estimated by computing disease odds ratio (OR) through conditional logistic regression models adjusted for potential confounders.

Implications for the Collegium: We found an increased risk for childhood leukemia associated to residence in close proximity to petrol stations. Compared to those who live ? 1000m, OR was 2.30 (95% CI 0.53-9.97) for children living <50 m from nearest petrol station in bivariate analysis and 2.16 (95% CI 0.49-9.42) in multivariable analysis. The excess risk was higher when considering acute lymphoblastic leukemia (ALL) subtype (OR=2.83, 95% CI 0.61-13.21), and in children diagnosed after 5 years of age (OR=4.68, 95% CI 0.61-35.95) compared with < 5 years (OR=1.63, 95% CI 0.14-18.84).

Contribution to possible follow up/action Our study found an increased childhood leukemia risk for residence in close proximity (<50 meters) to a petrol station. Such excess risk was higher for the ALL subtype and for children diagnosed after 5 years.

Funding source This study was supported by Modena Charity Associazione Sostegno Ematologia Oncologia Pediatrica - ASEOP

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Role of night luminance in the etiology of dementia: a case-control study in the Modenese population

Elena Mazzoleni[1]; Tommaso Filippini[1,2]; Sofia Costanzini[1]; Giulia Vinceti[1,3]; Giovanna Zamboni[1,3]; Manuela Tondelli[3,4]; Chiara Galli[3,4,5]; Manuela Costa[4]; Sergio Teggi[1]; Annalisa Chiari[3], Marco Vinceti[1,6]

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Background: Dementia is a neurodegenerative disease characterized by severe cognitive impairment. Depending on the age of onset of symptoms, before or after age 65, it can be classified as early onset dementia (EOD) and late onset dementia (LOD). The purpose of this study is to assess the risk of dementia from exposure to outdoor artificial light at night (LAN).

Description of Content: Using a case-control design, we enrolled patients with EOD and LOD diagnosed in the province of Modena in the period 2017-2019 and a referent population from their caregivers. We geo-referenced the address of residence on the date of recruitment, provided it was stable for the previous years. We assessed LAN exposure through 2015- related nighttime luminance satellite images, and we calculated the risk of dementia associated with increasing LAN exposure (<10, 10-40, >40 nW/m2/steradian, a measure the intensity of light pollution) in a logistic regression model, adjusting for possible confounders such as age, sex, and education.

Implications for the Collegium: We recruited 58 EOD cases, 34 LOD cases and 54 controls. Average LAN exposure levels overlapped for EOD cases and controls, while LOD cases showed higher levels. Compared with the lowest exposure category, the risk of EOD associated with LAN was higher in the intermediate (OR=1.36, 95%CI 0.54-3.39), but not in the highest exposure category (OR=1.04, 95%CI 0.32- 3.34). In contrast, the risk of LOD was positively associated with LAN exposure, with ORs of 2.58 (95%IC 0.26-25.97) and 3.50 (95%IC 0.32-38.87) in the intermediate and highest exposure categories, respectively.

Contribution to possible follow up/action Although the precision of the estimates was affected by the limited sample size and the study design did not allow us to exclude the presence of residual confounding, these results suggest a possible role of LAN in the etiology of dementia, particularly its late-onset form.

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A Systematic Review and Dose-response Meta-analysis on Fluoride Exposure and Neurodevelopmental Toxicity in Children

Federica Veneri[1]; Maria Edvige Giannone[1]; Elena Mazzoleni[1]; Tommaso Filippini[1, 2]; Ugo Consolo[1]; Luigi Generali[1]; Marco Vinceti[1, 3]

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Background: The possible harmful effect of fluoride exposure on neurodevelopment in children is widely discussed, however, the magnitude of this relation is still controversial. The aim of this systematic review and meta-analysis was to characterize this relation through a dose-response approach.

Description of Content: We performed an online literature search in PubMed, Web of Science and Embase up to September 10, 2022. From each eligible study we extracted the effect size as a mean difference (MD) of intelligence quotient (IQ) scores and its 95% confidence intervals (CI). We performed a meta-analysis comparing the highest versus lowest fluoride exposure using a random-effects model, stratifying for type of exposure (fluoride in drinking water or urinary fluoride). Finally, we quantitively assessed such relation by performing a one-stage dose-response meta-analysis based on a cubic spline random-effects model.

Implications for the Collegium: Out of 1955 potentially relevant records retrieved through a systematic literature search, we identified 34 eligible studies for review; 32 were also included for meta-analysis. The analysis comparing the highest-versus-lowest exposure showed decreased IQ scores for both water and urinary fluoride with MD of -6.62 (95% CI -8.61, -4.63) and -3.58 (95% CI -7.28, 0.12), respectively. The dose-response analysis showed a decrease in IQ score from 1 mg/L, considerably steeper above 2.5 mg/L for water fluoride. The dose-response curve for urinary fluoride showed a weaker but constant decrease in IQ scores with increasing fluoride levels.

Contribution to possible follow up/action Overall, a substantial consistency in the effect direction emerged, with adverse effects of different magnitude on children's intelligence, arising from rather low fluoride exposure previously considered safe from a public health perspective. However, potential methodological limitations, such as heterogeneity in outcome measures and lack of consideration of possible confounders in some of the studies, may have affected these findings.

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Light at night exposure and risk of depression and other mental disorders: a systematic review

Stefano Tancredi[1, 2]; Teresa Urbano[1]; Marco Vinceti[1,3]; Tommaso Filippini[1,4]

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Background: In modern society, individuals are increasingly exposed to artificial light at night (LAN) i.e., different sources of light altering the natural day-night cycle. Emerging evidence suggests a possible association between LAN exposure and physiological and behavioral changes, with implications on mood and mental health at the population level. We performed a systematic review of observational studies to investigate if LAN exposure, may be associated with an increased risk of mental diseases in humans.

Description of Content: We reviewed the epidemiological evidence about the association between LAN exposure as assessed either via satellite photometry (outdoor LAN) or via measurements of bedroom brightness (indoor LAN), and risk of mental disorders. We systematically searched the PubMed, Embase and Web of Science databases up to September 1, 2022. Studies were included if they assessed the link between exposure to indoor or outdoor LAN and one or more mental disorders.

Implications for the Collegium: Ten eligible studies were included in this review: six studies had a cross-sectional design, two had a longitudinal design with a median follow-up of 24 months, and one was a case-cohort study. Studies were published between 2002 and 2022. Eight studies were conducted in adult populations, one in adolescents, and one in children. Mental disorders investigated include anxiety and mood disorders, depression, bipolar disorder, autism and mild cognitive impairment. Overall, we found moderate evidence of a positive association between LAN exposure and depressive symptoms and to a lesser extent other mental disorders, though the number of studies was limited and potential residual confounding such as socioeconomic factors, noise, or air pollution may have influenced the results.

Contribution to possible follow up/action

Although more robust evidence is needed, the epidemiological evidence produced so far seems to support an association between LAN and risk of depressive disorders.

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SCIENTIFIC SESSION POSTER II
Work of the Fellows

1. Effects of maternal PFAS exposure on SARS-CoV-2 IgG antibody levels during pregnancy *Jia Chen, USA*
2. Impact of public activity restriction on air pollution during pandemic Covid-19 in Indonesia *Budi Haryanto, Indonesia*
3. A system paradigm for the knowns and unknowns of risk *Domyung Paek, Korea*
4. The assessment of occupational health literacy (OHL) regarding pesticide poisoning among farmers in Thailand *Somkiat Siriruttanapruk, Thailand*
5. Developmental neurotoxicity for neonicotinoid pesticides overlooked by regulators *Jennifer Sass, USA*
6. Increased plasma glutathion due to adaptation to oxidative stress in nanoexposure? *Daniela Pelclova, Czech Republic*
7. Poly- and perfluoroalkyl substances (PFASs) in groundwater and drinking water in Israel *Berman Tamar, Israel*
8. Welder's lung with end stage pulmonary fibrosis – a case report *Xaver Baur, Germany*
9. Toxic Substances Control Act (TSCA) Implementation: How the Amended Law Has Failed to Protect Vulnerable Populations from Toxic Chemicals in the United States *Nicholas Chartres, USA*
10. What regulators might learn from the history of silica-caused autoimmune disease (if they paid ttention) *Paul D. Blanc, USA*
11. Draft Collegium Ramazzini Statement: Screening for occupational lung cancer *Steven Markowitz, USA*

Effects of maternal PFAS exposure on SARS-CoV-2 IgG antibody levels during pregnancy

Kirtan Kaur[1]; Corina Lesseur[1]; Lixian Chen[1]; Syam Andra[1]; Srinivasan Narasimhan[1]; Vishal Midya[1]; Yula Ma[1]; Erona Ibroci[1]; Frederieke Gigase[1]; Molly Leiber[1]; Whitney Liebv; Teresa Janevic[1]; Lotje D. De Witte[1]; Anna-Sophie Rommel[1]; Veerle Bergink[1]; Jia Chen[1]

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Background: Perfluoroalkylated substances (PFAS) are man-made, persistent organic compounds with immune-modulating potential. As pregnancy is already a state of immune suppression and SARS-CoV-2 infection can further alter the immune system, PFAS immunotoxicity during pregnancy is an important topic to be investigated.

Description of Content: Maternal plasma was collected from 72 SARS-CoV-2 IgG+ participants of the Generation C Study established at the beginning of the COVID-19 pandemic in New York City. Maternal SARS-CoV-2 IgG antibody levels were measured using ELISA. A panel of 16 PFAS congeners were measured in maternal plasma using an UHPLC- MS/MS-based targeted assay. Spearman correlations and linear regressions were employed to explore the association between maternal IgG antibody levels and plasma PFAS concentrations. Weighted quantile sum (WQS) regression was also used to evaluate the association between PFAS mixtures and antibody titers. Models were adjusted for gestational age at IgG titer, maternal age, SARS-CoV-2 vaccination status, pre-pregnancy BMI and race/ethnicity.

Implications for the Collegium: Our study population is ethnically diverse with an average maternal age of 32 years. Out of 16 PFAS congeners measured, nine were detected in more than 60% samples. Importantly, all nine congeners were negatively correlated with SARS-CoV-2 IgG antibody levels; n-PFOA and PFHxS, PFHpS, and PFHxA reached statistical significance ($p<0.05$) in multivariate analyses. When we examine the mixture effects using WQS, a quartile increase in the PFAS mixture index was significantly associated with lower maternal IgG antibody titers (beta [95% CI]= -0.35 [- 0.52, -0.17]). PFHxA was the top contributor to the overall mixture effect.

Contribution to possible follow up/action

Our study results support the notion that PFAS, including short-chain emerging PFAS, may act as immunosuppressants during pregnancy. Whether such compromised immune activity leads to downstream health effects, such as the severity of COVID-19 illness symptoms, adverse obstetric or neonatal outcomes remains to be investigated.

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Dr. Chen is a Professor in the Departments of Preventive Medicine, Pediatrics, and Oncological Sciences at Icahn School of Medicine at Mount Sinai. She has extensive experience in environmental and molecular epidemiology as well as toxicology. Her lab uses the latest molecular technologies to interrogate complex interactions between environment and epi/genome in relation to human health. She has been the PI of multiple NIEHS-funded projects on environmental impact on cancer, reproductive health, and neurodevelopment. She is particularly interested in the Developmental Origin of Health and Diseases.

Impact of public activity restriction on air pollution during pandemic Covid-19 in Indonesia

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Background: Air pollution in major cities, especially in developing countries, has reached a crisis point. The bad air quality is responsible for the death of 7 million people each year and presents a dilemma for millions worldwide that suffer asthma, lower respiratory diseases, cardiovascular diseases, and lung cancer. The transportation sector contributes the most (80%) to the air pollution followed by emissions from industry, forest fires and domestic activities. In Indonesia, vehicle emissions are expected to increase over the next few decades, as the vehicle population increases. The large number of vehicles together with lack of infrastructure results in major traffic congestions resulting in high levels of air polluting substances, which have a significant negative effect on public health. People living with poor air quality may be more susceptible to Covid-19, and airborne particulate matter may help to spread the virus. According to certain studies, there is a "deadly relationship" between air pollution and Covid-19 death.

Description of Content: The daily Covid-19 cases data from Ministry of Health and the daily air quality data from local Environmental Office of 2020-2022 were analyzed by implementing statistic correlation.

Implications for the Collegium: The Covid-19 lockdown or Public Activity Restriction (PPKM in Indonesia) has led to cleaner air, but will do little to address the issue of air pollution in the long run. The application of leeway for human mobility will take place when the number of Covid-19 cases declines, which will have the effect of increasing both the number of motorized vehicles on the road and air pollution.

Contribution to possible follow up/action
PPKM in Indonesia has a significant association with the air quality concentration, in which the transportation sector has dominantly contributed more air pollution than other sources.

Funding source By my own and need support funding if possible

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Dr. Haryanto, Full Professor of Environmental Health Science, Faculty of Public Health and Director of Research Center for Climate Change Universitas Indonesia (UI) has conducted research for 35 years. He has published more than 60 papers on environmental epidemiology and climate change health impacts, 12 book chapters and edited an air pollution book. He was actively involved in United Nation Framework on Climate Change Conference of the Parties 15, 21 and 22.

A system paradigm for the knowns and unknowns of risk

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Background: Understanding what factors influence the process of risk perception can be important for the management of 'not- perceived' or 'unknown' risk. The known and unknown risks, as suggested by Mr. Donald Rumsfeld, were once widely quoted in the risk science community. However, the 2*2 categorization was incomplete, and the concept of 'unknown' was not straightforward for its meaningful management. In this presentation, the underlying characteristics of 'unknown' risks were searched in the literature, and a new system perspective is proposed for the management of 'unknowns'.

Methods: From Google search, more than 100 different 2*2 diagrams of 'known and unknown' risks were retrieved, and after excluding duplications, diagrams were classified into 4 different classes of risk classification categories: awareness (occurrence) -> understanding (abstraction) -> knowledge (codification) -> management (connection). The 4 categories were further grouped into domains of system ('knowledge', 'management'), and member ('awareness', 'understanding'), based on the interconnected nature of classifications.

The risks known to system, but unknown to members (system deficiencies), included tacit system knowledge(codification) without member awareness (or understanding), such as assumptions, knowledge gaps, uncertain risk, and problems without solutions. The risks unknown to system, but known to members (system failures) included tacit member knowledge(understanding) without system codification, such as bias, hidden knowledge, or untapped tacit knowledge.

Results: From a system perspective, the unknown nature of the risk could be either due to system deficiencies or failures. Here, the risks identified as system deficiencies represented lack of 'pre-cautions', in the areas of field knowledge gaps, unidentified risks, and no-solutions even with problems. Meanwhile, the risks identified as system failures represented broken systems, without corrections for biases, or feed-backs of at-the-field experiences.

Conclusions: The role of system for the unknown risk is greater, and system approaches, especially to make the current ones more precautionary, will be needed for developing countries.

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Dr. Domyung Paek is a Professor Emeritus of Soul National University, Korea, where he worked with occupational medicine residents and graduate students of public health. He is now working at Green Hospital in Seoul, the first and only hospital established by the victims of occupational diseases (carbon disulfide poisoning at Wonjin), and interested in the 'system approach' of health and safety for developing countries.

The assessment of occupational health literacy (OHL) regarding pesticide poisoning among farmers in Thailand

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Background: Pesticide poisoning is one of the most common occupational diseases among farmers in Thailand. Most farmers lack appropriate knowledge and have poor behavior in using these chemicals . Therefore, the farmers need to access, understand, appraise, and apply health information in order to make appropriate judgement to protect themselves from the illness. The aim of the study was to assess OHL among farmers about pesticide poisoning and for development of additional OHL measures.

Description of Content: The survey study was conducted under "The strengthening of the district quality of life committee for disease prevention and control project". The team decided to select a topic of OHL among farmers in one district from the northern province of the country. The farmers were randomly selected and interviewed directly with a questionnaire by our staff. A tool for assessment of OHL was applied from the European health literacy survey questionnaire (HLS-EU-Q) developed by Sorensen et al.

Implications for the Collegium: Of 150 farmers participated in the study, most of them were female and had only primary education. About 56% of them were self-employed ,doing pesticide spraying by themselves. Almost all of the participants had a high level of knowledge about pesticides and their safe use. Regarding OHL, 38% of the farmers had adequate or higher level of OHL. When each skill of OHL was analyzed, the lowest mean score was in the category of application of information into real practice.

Contribution to possible follow up/action Although the farmers had OHL and knowledge about pesticide safety and health, they still lacked the skill to use their knowledge in practice. The outcomes of the study should lead to develop measures for improving all of 4 OHL skills.

Funding source Thailand Government budget

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Developmental neurotoxicity for neonicotinoid pesticides overlooked by regulators

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Background: Neonicotinoids, or "neonics," are the most widely used insecticides worldwide, and highly persistent in the environment. They act to disrupt the ?4?2 subunit of the nicotinic acetylcholine receptor, found in the cortex, thalamus, and cerebellum.
Unpublished industry-sponsored Developmental Neurotoxicity Test result summaries were received by J. Sass from U.S. Environmental Protection Agency, in response to a Freedom of Information request.

Methods: Imidacloprid effects in offspring of animals treated during pregnancy at the high dose include statistically significant decreases in the thickness of the caudate/putamen areas of the brain (EPA 2002). In 2017 EPA downgraded these findings as: "minor in magnitude is now not considered adverse based upon current practices" (EPA 2017). Brain tissue from the mid and low dose treatment groups has never been submitted to EPA.

The thiamethoxam DNT study reported altered brain morphology in the offspring at all doses, but a subsequent re- analysis by the registrant, Syngenta, led EPA to dismiss the low and mid-dose findings as inconsistent across doses, or inconsistent with historical control animals (EPA 2007, Table 15).

The acetamiprid DNT study reported altered auditory startle reflex in offspring at the mid and high dose treatment groups (EPA 2001), which was subsequently dismissed after the registrant, Nippon Soda Co, submitted a re- analysis conducted by Exponent Inc (EPA 2007, p. 40). Clothianidin and dinotefuran DNT studies were not conducted.

Results: From December 2011 and May 2018, the EPA granted industry requests for waivers for 90%of DNT, 92% of chronic cancer, and 97% of immunotox studies, according to The Intercept (Lerner, June 30, 2021). As such, pesticides are often approved with incomplete or no chronic toxicity testing data.

Conclusions: Recommendations: A transparent and credible process is needed to address scientific disagreements, and to improve scientific rigor in the pesticide approval process.

Funding source Funding support was provided by Natural Resources Defense Council for J. Sass

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Increased plasma glutathion due to adaptation to oxidative stress in nanoexposure?

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Background: Biomonitoring of workers exposed to nanoparticles is needed in the workplace and simple methods to monitor oxidative stress are needed. A continuing study in the workshops of the research institute developing nanocomposites was performed in 2019 and 2020. Spectrophotometry was tested to potentially replace more expensive High-Performance Liquid Chromatography/Tandem Mass Spectrometry (HPLC/MS/MS), that proved significant level of oxidative stress in the researchers in 2016-2018.

Description of Content: Aerosol exposures were monitored during the working operations including a suite of real-time, integrated instruments and personal samplers; 43 researchers and comparable 45 controls were examined pre-exposure (7:30 - 8:30 a.m.) and post-exposure (1:15-2:30 p.m.). Thiobarbituric acid reactive substances (TBARS), as an oxidative stress marker; glutathione (GSH), and ferric reducing antioxidant power (FRAP) as markers of antioxidants status were used.

Implications for the Collegium: Total particle number concentration in the workshops during 3 hours´ of exposure ranged from 4.26x103 to 2.17x104/cm3. Nanoparticles accounted for 22-96%. In the workers, both pre-exposure and post-exposure plasma GSH in 2019 and 2020 was higher compared with the controls ($p<0.05$). A significant association between post- exposure plasma GSH and concentration of nanoparticles and backfill amount on the filters was observed. In urine, no differences in the markers were found. In EBC, only pre-shift elevation of TBARS in the workers was seen, however, several levels did not exceed the quantitation limit.

Contribution to possible follow up/action Plasma GSH level significantly correlated with acute parameters of exposure in the workshops and reflected chronic exposure. This effect was seen as an elevation of antioxidant capacity, potentially reflecting the adaptation to suppress oxidative stress. This needs to be verified in the future. However, the sensitivity of spectrophotometry methods for biomonitoring oxidative stress in workers exposed to nanoparticles appeared low. EBC analysis using HPLC/MS/MS stays the preferred non-invasive method as shown in our studies (TiO2 2012-2013, nanoFe-oxides 2013, nanocomposites 2016-2018). Acknowledgements: Cooperatio 207041-3, GACR 22-08358S

Funding source grants: Cooperatio 207041-3 of the Charles University in Prague, GACR 22-08358S

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Poly- and perfluoroalkyl substances (PFASs) in groundwater and drinking water in Israel

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Background: Poly- and perfluoroalkyl substances (PFASs) are a family of more than 4000 highly fluorinated aliphatic compounds with a broad range of industrial applications. Large- scale PFAS contamination has been documented in the United States, Europe, in the Asia-Pacific region, as well as in Africa and South America but there is little published data from the Middle East. This presentation will include data on PFAS concentrations in water in Israel including groundwater (57 sites) and drinking water (122 wells) and will discuss policy implications for the water sector and chemicals registration in Israel.

Methods: The highest concentrations of PFOS and PFOA (up to 1,283 and 80 µg/L, respectively) in groundwater were found at refineries and fuel tank farm sites, where aqueous firefighting foam (AFFF) was used in firefighting training and following large fuel fires. Twenty percent of drinking water wells (in suspected contaminated areas) were contaminated with PFAS. Concentrations in drinking water wells were generally below the interim drinking water guideline in Israel (0.2 µg/L PFOA, 0.6 µg/L PFOS, sum of ratios=1). Drinking water supply from one drinking water well was discontinued.

Results: In light of scientific and regulatory advances, there is a need for a re-evaluation of the interim drinking water guideline in Israel for PFAS.
In the absence of chemical registration regulations or specific legislation on PFOA and PFOS in Israel, there are no current restrictions on imports or use of PFOA and PFOS containing products including AFFF. Several organizations voluntarily shifted to short chain PFAS in AFFF and work is underway to promote PFAS free fire fighting foams.

Conclusions: There is an urgent need for global action to protect groundwater and drinking water from PFAS contamination and to prevent use of PFAS containing products including AFFF.

Funding source Ministry of Health and Water Authority in Israel

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Welder's lung with end stage pulmonary fibrosis – a case report

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Background: Welding ,performed by more than a million workers worldwide is associated with exposures to irritative, fibrogenic and carcinogenic substances. We diagnosed several welders suffering from pulmonary ailments and present a case with end-stage pulmonary fibrosis with pathologic and mineralogic investigation.

Description of Content: Pathological analysis of tissue was undertaken, as was SEM/EDS for mineral content.

Implications for the Collegium: The 60 year-old previous smoker had worked 38 years as a welder (under poor hygiene for nearly 20 years). For 7 years he complained of increasing shortness of breath and chronic bronchitis symptoms. His symptoms worsened; 2 years ago he was unable to do any exercise and has needed oxygen via a nasal cannula. He presented with acrocyanosis, dyspnea at rest, bilateral basilar crackles with a few squeaky noises. Pulmonary function testing revealed advanced restrictive pattern and severely impaired gas exchange. Computed tomography showed bilateral slight basal reticular and a ground glass pattern with honeycombing, several bullae and right lateral pleural thickening. Detailed histopathology of his lungs showed severe interstitial fibrosis and dust deposits in the lungs including welding type bodies. SEM/EDS analysis exhibited Fe, Si, Ti, Si Al, Fe with Cr (Steel), Aluminum, and Zirconium. Owing to his extremely bad health condition the patient underwent successful bilateral lung transplantation resulting in nearly normal lung functioning and health condition. Due to the extensive history of welding fume exposure, the absence of a likely other causative disorder, the course of the finally very severe clinical picture with typical histopathology and lung deposits of welding components and the unacceptable diagnosis of IPF with this history and pathologic findings, the most likely diagnosis of this case is welder's pulmonary fibrosis.

Contribution to possible follow up/action Welders lung fibrosis is a rare disorder. To date there are no in-depth epidemiological studies . We present typical histopathology and detailed SEM/EDS analysis.

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Toxic Substances Control Act (TSCA) Implementation: How the Amended Law Has Failed to Protect Vulnerable Populations from Toxic Chemicals in the United States

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Background: Exposures to industrial chemicals are widespread and can increase the risk of adverse health effects such as cancer, developmental disorders, respiratory effects, diabetes, and reproductive problems. The amended Toxic Substances Control Act (amended TSCA) requires the U.S. Environmental Protection Agency (EPA) to evaluate risks of chemicals in commerce, account for risk to potentially exposed and susceptible populations, and mitigate risks for chemicals determined to pose an unreasonable risk to human health and the environment.

Methods: This analysis compares EPA's first 10 chemical risk evaluations under amended TSCA to best scientific practices for conducting risk assessments. We find EPA's risk evaluations underestimated human health risks of chemical exposures by excluding conditions of use and exposure pathways; not considering aggregate exposure and cumulative risk; not identifying all potentially exposed or susceptible subpopulations, and not quantifying differences in risk for susceptible groups; not addressing data gaps; and using flawed systematic review approaches to identify and evaluate the relevant evidence.

Results: We present specific recommendations for improving the implementation of amended TSCA using the best available science to ensure equitable, socially just safeguards to public health. Failing to remedy these shortcomings will result in continued systematic underestimation of risk for all chemicals evaluated under amended TSCA.

Conclusions: We will continue to engage with key decision makers at the U.S. EPA and members of Congress and disseminate the findings of our analysis to ensure that EPA's implementation of amended TSCA is consistent with the best available science for conducting risk evaluations and does not underestimate health risks of chemical exposures, particularly to susceptible populations.

Funding source The JPB Foundation (201903-1505), The Tides Foundation (1092-56821), The Marisla Foundation (1-21-028/1), and The Passport Foundation

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Dr. Chartres leads the Science & Policy team at the Program on Reproductive Health and the Environment (PRHE) USCF, which analyzes federal chemical policy, including EPA's implementation of the Toxic Substances Control Act, the law that evaluates and regulates industrial chemicals used in U.S. commerce. He has extensive experience in the use of systematic review methods and leads PRHE's work in implementing these methods to ensure the best available science is used for policy decision-making.

What regulators might learn from the history of silica-caused autoimmune disease (if they paid ttention).

Paul D. Blanc[1]

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Background: The rich history of silica-associated autoimmune disease dates back more than a century but has yet to inform for worker protection.

Methods: In 1775, Louis Le Blanc noted that the 'maladie de Saint-Roch' in sandstone workers led to rheumatic joint pains. In 1914, Bramwell reported 9 cases of diffuse scleroderma, of who 5 were stonemasons. Collis and Yule, analyzing standardized mortality among silica-exposed workers, in 1933 reported a four- fold increased rate for chronic rheumatism. In 1950, Colinet in Belgium published two cases of rheumatic (RA) in abrasive powder workers; in 1952, the first presentation was made of what came to
be known as "Caplan's syndrome." From 1970-2019, a series of 11 Swedish publications have documented the association between silica and RA, including in large population-based investigations. Scleroderma (SSc) in South African gold miners was reported by Erasmus in 1957; multiple other reports have followed. Systemic lupus erythematosus(SLE) first was linked to silica in 1973 in Japan and in 1976 by Turner-Warwick in U.S. sandblasters. Other published silica associations include Sjorgren's syndrome, ANCA+ vasculitis, and polymyositis/ dermatomyositis. Despite this history, until recently, Caplan's syndrome wrongly has been considered a British coal mining phenomenon. The 2014 supporting documentation for OSHA's silica standard was equivocal on systemic auto-immune disease (with no
cited data after 1999). The recent outbreak of the artificial stone silicosis epidemic has provided strong new clinical evidence of the burden of autoimmune disease in silica exposed workers.

Results: The Collegium could take a prominent role in promoting acceptance of a causal role for silica exposure in work-related auto-immune disease.

Conclusions: Regulators should revisit established and emerging data in autoimmune disease in silica-exposed occupations, including but not limited to the mining industry, to better inform protective standards and disease surveillance measures.

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Paul Blanc holds the Endowed Chair in Occupational and Environmental Medicine at the University of California San Francisco. Blanc received his BA from Goddard College (Vermont) where his teacher John Froines introduced him to the field. Blanc is the author of How Everyday Products Make People Sick (UC Press, 2009) and Fake Silk: The Lethal History of Viscose Rayon (Yale, 2016).

Draft Collegium Ramazzini Statement: Screening for occupational lung cancer

Steven Markowitz[1]
[1] Writing Committee for the Draft Collegium Ramazzini Statement: Screening for Occupational Lung Cancer

Background: The Collegium's most recent Statement addressing cancer screening was issued in 2008 and asserted that the scientific evidence for the early detection of lung cancer was "low to fair." Enormous gains in scientific research and clinical practice have been made in the intervening 1.5 decades, lending support for a re-evaluation of screening for lung cancer, the most common occupational cancer.

Methods: Key elements of a Draft CR Statement on Screening for Occupational Lung Cancer will be presented in a poster. The Draft Statement will have undergone initial review by its writing committee but will not yet be finalized.
Feedback from Collegium members attending the meeting in Carpi will be useful for finalizing the Statement and will help build consensus in the Collegium on this important topic.

Results: Issuing a broadly supported Statement on Screening for Occupational Lung Cancer will provide guidance for medical and public health entities that pursue screening in this domain. Few consensus guidance documents exist at present on screening for occupational lung cancer, permitting the Collegium to provide leadership in this area

Conclusions: The Statement will be reviewed and finalized after the Ramazzini Days in Carpi with subsequent dissemination and publication in medical journals.

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SCIENTIFIC SESSION POSTER III
Work of the Fellows

1. Building Collegium Ramazzini science response capacity during global public health emergencies *Joseph T Hughes, Jr., USA*
2. Impacts of occupational safety and health: outcomes over 60 years in the U.S. construction Industry *Knut Ringen, USA*
3. Digitalization for improving OSH at Indian construction sites: focus on leading indicators for improvement *Krishna Nirmalya Sen, India*
4. Kabwe mine pollution - a recast of the "unsettled dust" *Given Moonga, Germany*
5. Sailors: A population at uniquely high risk for asbestos-related cancers *Richard A. Lemen, USA*
6. Health effects at low-level exposure to asbestos: validation of the retrospective exposure assessment methodology *Pierluigi Cocco, UK*
7. Cumulative exposure in asbestos-related diseases *Metoda Dodi? Fikfak, Slovenia*
8. The role of occupational health services in prevention and prophylactic programs in Poland *Jolanta Walusiak-Skorupa, Poland*
9. More evidence of a pro-atherosclerotic effect and large atherosclerotic burden in relation to low-level cadmium exposure *Florencia Harari, Sweden*
10. Human health and ocean pollution *Philip J. Landrigan, USA*

Building Collegium Ramazzini science response capacity during global public health emergencies

Joseph T Hughes, Jr.[1]

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Background: From our first Collegium Ramizzini (CR) policy statement on COVID-19 and the workplace (May 2020), the key worker protection issues identified have evolved over the course of the pandemic in every country in the world.
Some of the Collegium's recommendations were prescient; others were completely ignored. Key thematic areas that have evolved over the past three years will be essential for informing future pandemic responses.

Methods: Workers whose occupations put them in contact with infected persons and the public have been at greatly increased risk of disease and death and have suffered disproportionately in the COVID-19 pandemic. Workplaces have repeatedly been the source of serious outbreaks. The COVID-19 pandemic has demonstrated a woeful lack of preparedness in many governments and health care organizations, and by employers.

Results: As we reach the third year of the COVID-19 pandemic, it is critical to create opportunities to build collaborations among professionals in disaster response, infection prevention and control, medicine, and occupational health and safety. Similar to the approach of the National Institutes of Health (NIH) Disaster Research Response Program (DR2), new professional, scientific and inter-disciplinary collaborations between medical clinicians, public health practitioners, researchers, and advocates can spur efforts to build stronger linkages for pandemic worker protection.

Conclusions: Building on the Collegium's past track record of rapid response policy statements like COVID-19 Worker Protections, additional follow-up actions during global public health crises like our current pandemic could include a more formalized Emergency Support Science Activation Plan, establishing a response protocol during global public health emergencies. Components of the plan may create listings of pre-identified experts with specific areas of scientific expertise, and an activation pre-training program in disaster response. A consultative science convening process of CR Fellows could be rapidly established to respond to emerging worker health threats as we saw during during the COVID-19 crisis.

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Joseph "Chip" Hughes has 40 years of experience in both the private and public sectors in developing environmental and occupational health education programs for workers and citizens in high-risk occupations and communities. He previously served for more than 30 years as director of the National Institute of Environmental Health Sciences Worker Training Program. He also served as the Deputy Assistant Secretary for Pandemic and Emergency Response for the U.S. Occupational Safety and Health Administration.

Impacts of occupational safety and health: outcomes over 60 years in the U.S. construction Industry

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Background: Construction has always been a high risk industry for both traumatic injuries and occupational illnesses. In the United States, it was not until the Occupational Safety and Health Act was implemented in 1971 that real administrative systems for standards development and enforcement were put in place with the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH). This presentation addresses the question 'how much impact has the OSH movement had on occupational health outcomes'?

Methods: We used 25 years of data for pneumoconiosis (as defined by the International Labour Organization (ILO)) detected on chest radiographs with B-reader interpretation and material hearing loss (as defined by NIOSH) from a medical screening program stratified by decade of first construction employment: before 1960, 1960-69, 1970-79, 1980-89, and after 1990. Poisson regression analyses assessed relative risk by decade adjusted for age, sex, smoking, and years of construction trade work.

Results: When compared to workers employed before 1960, workers first employed after 1990 experienced a 68% reduction in adjusted relative risk for pneumoconiosis, but only 14% for hearing impairment. The greatest reductions occurred among workers first employed after 1970.

Conclusions: We compare pneumoconiosis to hearing loss because they show very different results, with disease prevalence, respectively, of 4.5% and 60%. The Occupational Safety and Health Act has had huge impacts, as evidenced by our pneumoconiosis findings. This shows that regulation matters. It is also clear that there have been disparities in the priorities set in occupational safety and health, as demonstrated by the poor outcomes for hearing loss. We have much to celebrate, but we have no right to be satisfied.

Funding source US Department of Energy

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Dr. Ringen has served as principal investigator on the Building Trades National Medical Screening Program (BTMed.org) since 1996.

Digitalization for improving OSH at Indian construction sites: focus on leading indicators for improvement

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Background: Globally, the construction sector is a major employment generator and contributes significantly to GDP. Indian Construction is no exception.
Ensuring safety and wellbeing is a major responsibility of the employer. At workplaces, establishing occupational safety and health (OSH) objectives and measurement of performance play a significant role towards safety and health cultural transformation. Monitoring of key OSH performance indicators, both leading & lagging, helps to measure progress towards achieving OSH objectives.

Methods: We attempt to highlight efficacies of a few digital initiatives which are developed and installed in a large Engineering Procurement and Construction (EPC) organization to monitor and communicate key performance indicators (KPIs), since these are pivotal in preventing workplace incidents, injuries, and illness. Major emphasis is given on capturing OSH observations, training & competency development, and line mangers' engagement for influencing worker behaviour towards adoption of safer practices.
Some of the Digital Interventions include:

- Digital Applications for capturing of OSH observations
- Virtual Reality (VR) and Microlearning modules
- Snippets of OSH incident lessons learned

Results: Digital platforms such as virtual dashboards facilitated a real measurement to management for better decision making and it further allowed each individual to act on what they have to do on day-to-day activities to achieve OSH objectives. Application of digital technologies such as virtual reality (VR) and microlearning modules provided consistency & flexibility in training as well as simulation of hazardous workplaces and real time events which in turn increased employee attention.

Conclusions: Establishing smart OSH objectives including usage of digital applications, Virtual Reality (VR) devices, micro learning modules associated with gap analysis of the systems established across all the workplaces, assisted in enhancing engagement of employees, competency development of workers, timely interventions to address OSH challenges & continually improve OSH management systems.

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Dr. Sen has been working in occupational safety and health in the construction industry for three and half decades. Currently he leads the Environmental Health and Safety Department, Minerals and Metals, Strategic Business Group (SBG) of L&T Construction. He has received awards from the Institution of Engineers, American Society of Safety Engineers and Royal Society for the Prevention of Accidents. He chairs the International Commission on Occupational Health, Scientific Committee in the Construction Industry.

Kabwe mine pollution - a recast of the "unsettled dust"

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Background: Lead pollution is widespread in Kabwe, particularly in townships near the zinc mine abandoned two decades ago. These communities have been exposed to a variety of pollutants that have harmed the health and livelihood, particularly of children. These mining communities have continued to face negative mining-related environmental and public health impacts, as well as limited access to basic social infrastructure services and poverty. Most children from Kabwe townships exceed the 'level of concern' for BLL in humans of 5 μg/dL, with 32% exceeding the toxicity threshold of 65 μg/dL. Several interventions have been implemented in Kabwe, with a primary goal of implementing a comprehensive set of complementary activities aimed at both treating children with elevated blood lead levels (BLLs) and preventing recontamination by reducing Pb exposure in children's living, learning, and play environments, as well as through behavior modification. Despite these efforts, environmental and health problems remain serious due to widespread Pb contamination.

Description of Content: We analyzed existing data on blood lead levels (BLL) for 362 children below the age of 15 from Kabwe town to test for spatial dependency among the blood lead levels in children using the household geolocations.

Implications for the Collegium: Blood lead exposures in Kabwe children is spatially autocorrelated. We observed distinct, clear hotspots in communities near the old lead and zinc mining site, which is located on its western side. Cold spots were found in areas far from the mine and traced on the eastern side. This pattern suggests a link between observed blood lead and distance from the abandoned lead and zinc mine, as well as prevailing winds.

Contribution to possible follow up/action

The human health and environmental consequences of Kabwe's mining activities remain unresolved. Communities must deal with the consequences, with children frequently bearing the brunt of the burden. More robust interventional measures are required, utilization research data for targeted intervention.

Funding source Institutional Funding

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Given Moonga is completing his PhD in Medical Research in International Health at the Center for International Health, LMU Munich. He has conducted research on occupational exposures to heavy metals in mining towns in Africa. He is also a founding member of the Planetary Health East African Hub (PHEAH), holding the role of advisor on planetary health strategies and policy in Southern and Eastern Africa.

Sailors: A population at uniquely high risk for asbestos-related cancers

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Background: Sailors have long been known to experience high rates of injury, disease, and premature death. Chrysotile and amphibole asbestos were used extensively in ship construction for insulation, joiner bulkhead systems, pipe coverings, bulkhead panels, and more. Asbestos-containing ships are still in service. Many studies have shown asbestos-related diseases (ARD) among shipyard workers, but few have examined the epidemiology of ARD and death among sailors who served on ships.

Description of Content: We conducted a literature review using PubMed and NIOSHTIC-2, using keywords such as asbestos, mesothelioma, lung cancer, seamen, sailor, and merchant marine. We also search for government records, including those maintained by the U.S. Maritime Administration. Inclusion criteria were original scientific articles or reviews. Documents not found in our initial search were identified in references from articles located in our initial database searches. Medical conditions of interest were mesothelioma, lung cancer, and interstitial and pleural abnormalities.

Implications for the Collegium: We identified 60 epidemiologic studies, including cohort, case-control, and cross-sectional studies, and case reports. Virtually all published epidemiologic studies of sailors report elevated morbidity and mortality from mesothelioma, lung cancer, and other ARD, demonstrating sailors are at high risk.
Unlike most workers, sailors serving on ships at sea work, eat, and sleep at their workplace. They may be exposed to shipboard asbestos 24 hours per day, 7 days per week, for weeks or months on end. Current asbestos standards and permissible exposure limits, however, are based on an 8-hour workday and a 5-day work week. Occupational health standards for sailors must be cognizant of their unique exposure patterns.

Contribution to possible follow up/action Regulatory standards to address work-related exposure to asbestos must account for non-standard work shifts, such as those experienced by sailors. New occupational exposure standards are needed to account for sailors' unique exposures to asbestos. Follow-up clinical and epidemiological studies will be required to determine these standards' effectiveness.

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Richard A. Lemen is former Assistant Surgeon General of the United States, and Adjunct Professor of Environmental and Occupational Medicine at the Rollins School of Public Health of the Emory University in Atlanta, Georgia, USA, and former Deputy and Acting Director of the National Institute for Occupational Health.

Health effects at low-level exposure to asbestos: validation of the retrospective exposure assessment methodology

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Background: Assuming poor reliability of the retrospective exposure assessment techniques, a consensus document of the Italian Society of Occupational Medicine raised criticism against results showing an elevated risk of lung cancer with a clear dose–response trend at cumulative exposure of asbestos lower than those suggested by the Helsinki consensus paper.

Description of Content: This work presents the results of two studies addressing these concerns. In the first study, we classified the high- resolution computerized tomography (HRCT) scans of the lung in 115 male workers retired from an acrylic and polyester fibre plant using the grading proposed by Gamsu et al. We then calculated the risk associated with increasing level of cumulative asbestos exposure estimated retrospectively. In a second study, we quantified the past cumulative exposure to asbestos in 24 subjects who died from asbestos-related diseases and underwent a forensic autopsy. Subsequently, used a scanning electron microscope (SEM) equipped with energy-dispersive X-ray spectroscopy (EDS), we counted the asbestos fibre in the autoptic lung per gram of dry lung tissue and tested its correlation with the retrospective cumulative exposure estimate.

Implications for the Collegium: In the first study, the time-weighted average exposure to asbestos was 0.24 fibres/ml (95% confidence interval (CI) 0.19–0.29), and the cumulative exposure was 4.51 fibres/mL-years (95% CI 3.95–5.07). Risk of interstitial fibrosis increased significantly ($p = 0.009$) with cumulative exposure to asbestos, up to 8-fold (95% CI 1.18–54.5) for a cumulative exposure of 5.26 fibres/mL-years or more. In the second study, there was a good correlation between the estimate of cumulative exposure to asbestos and the fibre count in the autoptic lung ($r = 0.618$, $p = 0.001$).

Contribution to possible follow up/action Our results suggest that retrospective exposure estimates based on detailed information can reliably reflect past exposure to asbestos. Pleuro-parenchymal lung alterations can be related to past asbestos exposure at levels lower than previously thought.

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Prof. Pierluigi Cocco is currently an honorary professor of Occupational Medicine at the University of Manchester, UK. Dr. Cocco was full professor of Occupational Medicine at the University of Cagliari, Italy, until 2020.

Cumulative exposure in asbestos-related diseases

Metoda Dodi? Fikfak[1]

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Background: Between 1998 and 2021, a cohort of 2,500 workers who had been exposed to asbestos were evaluated for suspected asbestos-related diseases (ARD) by the Interdisciplinary Specialist Team. The ARDs of interest were lung cancer, mesothelioma, asbestosis, and pleural plaques. We used two cumulative exposure (CE) metrics for this cohort and analyzed the association of ARD incidence with each metric.

Description of Content: One metric (CE-A) was based on over 1,000 air sample measurements which were made using different analytical techniques. We used a conversion factor to account for these differences. The other metric (CE-B) was based on the conversion factor from the European Community Directive on Prevention of Asbestos Pollution in the Environment. For each worker, a CE-A and CE-B were calculated. The mean values by diagnosis were calculated for each metric.

Implications for the Collegium: The highest mean CE-A was calculated for asbestosis (31.8 fibers/cm^3-yr), followed by gastrointestinal cancer (25.2 fibers/cm^3-yr). A similar mean CE-A was calculated for mesothelioma (19.6 fibers/cm^3-yr) and lung cancer (19.2 fibers/cm^3-yr). The mean CE-A for pleural changes (primarily pleural plaques) was 15.5 fibers/cm^3-yr.
Calculations for the CE-B method showed significantly higher mean values than by the CE-A method by a factor of 4.4 to 7.8. Using this method, the highest mean CEs calculated were 151.9 fibers/cm^3-yr for mesothelioma and the lowest for pleural changes (85.7 fibers/cm^3-yr); gastrointestinal cancer was ranked third (117.9 fibers/cm^3-yr).

Contribution to possible follow up/action
The use of one recommended conversion factor for mg/m^3 to fibers/cm^3 is overvalued. It yields higher CEs than when using a combination of conversion factors, which in addition to dust composition also takes into account the processing method and the process type. The latter method is more reliable however; more attention should be directed at establishing a correlation between lung burden and CE. Calculating separate cumulative doses for chrysotile and amphiboles for every patient is also warranted.

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Dr. Metoda Dodi? Fikfak received her doctorate at the University of Massachusetts, Lowell with a research focus on lung cancer and exposure to chrysotile and amphibole asbestos. For it, she received the National Cancer Institute, USA award. After returning to her homeland, she led several projects. A project involving 12 cohort studies on the health status of various professional groups has been completed under her leadership. She leads the Clinical Institute for Occupational, Transport and Sports Medicine.

The role of occupational health services in prevention and prophylactic programs in Poland

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Background: The goal of occupational health services is to protect the health of workers and to promote the establishment of a healthy and safe work environment and a well-functioning work community. To achieve this aim, occupational health services carry out promotion, preventive and curative activities. The Nofer Institute of Occupational Medicine (NIOM) is the only institute in the area of occupational medicine in Poland that defines recommendations and standards for occupational health care.

Yearly, in Poland about 4.5 million prophylactic examinations of employees are performed by more than 5,000 certified physicians. The system of occupational health care includes all employers and employees in country. Beneficiaries of the proposed prophylactic approach are employees, employers including health and safety specialists, occupational health professionals, medical specialists, and general practitioners.

NIOM has developed a series of prophylactic activities within the National Health Program that launched by the Ministry of Health in 2017. Promotional campaigns, monographs, educational materials for physicians, educational and informative leaflets for employers and employees were issued. A Consultation Centre (including career counseling) has been launched for patients and students with work-related problems. Wide ranging educational activity in the field of occupational health for physicians has been also developed. Experience gained with the National Health Programme activities may be the basis for further development of the prophylactic role of occupational health system.

Methods: Presentation of the author's experience with national health programs.

Results: Exchange of experience between countries.

Conclusions: New solutions based on international experience.

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Prof. Jolanta Walusiak-Skorupa is an occupational medicine specialist and expert in occupational health and work-related diseases. She is involved in the development of modern occupational health systems focusing on prophylaxis, prevention, and total worker health strategy, as well as return to work programs. Prof. Walusiak-Skorupa is director general of the Nofer Institute of Occupational Medicine and previously served as head of the Clinic of Occupational Diseases and Environmental Health.

More evidence of a pro-atherosclerotic effect and large atherosclerotic burden in relation to low-level cadmium exposure

Florencia Harari[1]; Lars Barregard[1]; Gerd Sallsten[1]; Niklas Forsgard[2]; Margaretha Persson[3]; Thomas Lundh[4]; Björn Fagerberg[5]; Gunnar Engström[3]; Göran Bergström [5].

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Background: Cadmium exposure has been associated with atherosclerosis and cardiovascular mortality at varying levels of exposure. However, few studies have examined how cadmium affects the atherosclerotic burden. We investigated the association between low-level cadmium exposure and atherosclerotic burden in a Swedish population-based cohort.

Description of Content: We performed a cross-sectional study using data from the Swedish CardioPulmonary bioImage Study (SCAPIS), including 5622 middle-aged men and women, enrolled 2013-2018. Cadmium was measured in whole blood (B-Cd) using inductively coupled plasma mass spectrometry. Presence of atherosclerotic plaque (yes/no, uni- / bilateral), total plaque area (mm2) and presence of large plaques (>25 mm2), all measured in the carotid arteries using high- resolution ultrasonography, were used as outcomes. We used Poisson and linear regression as well as unrestricted cubic splines, and adjusted the models for cardiovascular risk factors and confounders.

Implications for the Collegium: Fifty-seven percent of the individuals had atherosclerotic plaques and the median total plaque area was 16 mm2 (range: 0.2-222). The median B-Cd concentration was 0.24 µg/L (range: 0.01-8.5). In multivariable-adjusted models, individuals in the fourth quartile of B-Cd (Q4) had a prevalence ratio (PR) for plaque of 1.10 (95%CI: 1.01- 1.19) when compared with the first quartile (Q1). Individuals in Q4 had on average 3.8 mm2 larger plaques (95%CI 0.78-6.7) and a 27% increased risk of having large plaques (95%CI 0.93-1.74) compared with individuals in Q1. The PR for bilateral plaques for individuals in Q4 vs Q1 (1.21; 95%CI 1.06-1.4) was larger than that for unilateral plaques (1.09; 95%CI: 0.96-1.24). Unrestricted cubic spline analyses showed a threshold B-Cd level of 0.3 µg/L. Estimates were larger for men and current smokers. Associations were not driven by extreme values.

Contribution to possible follow up/action Our study shows that increasing cadmium exposure is associated with a larger atherosclerotic burden and reinforces the urgent need of public health measures to reduce cadmium exposure in the general population.

Funding source The Swedish Heart-Lung Foundation, University of Gothenburg and the Sahlgrenska University Hospital under the ALF-agreement.

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Associate professor Florencia Harari is the deputy research group leader at the Environmental Medicine and Toxicology research group at the Department of Occupational and Environmental Medicine, University of Gothenburg, Sweden. She is an Ecuadorian physician who obtained her PhD degree at Karolinska Institutet, Sweden. Her research is focused on the toxicity of metals from occupational and environmental exposures and on work-related musculoskeletal disorders.

Human health and ocean pollution

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Background: Ocean pollution is widespread and worsening. It is a complex mixture of plastic waste, metals, chemicals, petroleum, industrial discharges, fertilizers, pharmaceuticals and sewage. More than 80% arises on land. Its health impacts are only beginning to be recognized.

Methods: Literature review and expert elicitation.

Results: Petroleum-based pollutants in the ocean reduce photosynthesis in the marine microorganisms (Cyanobacteria) that generate 50% of the earth's oxygen. The oceans absorb nearly one-third of atmospheric CO2 and increasing CO2 emissions have caused ocean acidification, thus dissolving coral reefs and calcium-containing microorganisms. Plastic pollution threatens marine mammals, fish, and seabirds and accumulates in mid-ocean gyres. It breaks down into chemical-laden microplastic particles that enter the food web. Global spread of industrialized agriculture with increasing use of chemical fertilizers catalyzes harmful algal blooms that produce potent toxins. Ocean pollution's threats to human health are great and growing, but incompletely understood. Exposures of infants to methylmercury through maternal consumption of contaminated seafood damages developing brains, reduces IQ and increases risk for ADHD and autism. Phthalates, bisphenol A, flame-retardants, and perfluorinated chemicals released into the ocean from plastic waste can disrupt endocrine signaling, reduce fertility, damage the nervous system, and increase cancer risk. Microplastic particles have been detected in human tissues but their health effects are currently unknown. With increasing pollution, climate change and warming seas, risk is high that vibrio infections, including cholera, will increase in frequency and extend to new areas. All of these impacts fall disproportionately on vulnerable populations in the Global South exacerbating environmental injustice on a planetary scale.

Conclusions: Like all pollution, ocean pollution can be prevented through data-driven strategies based on law, policy, technology, enforcement and incentives that target priority sources. Bold, science-driven leadership is key.

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Philip J. Landrigan, MD, MSc, is pediatrician and epidemiologist who studies the impacts on human health of hazardous exposures in the workplace and the environment. He has become interested in planetary-scale health threats. He co-chaired the Lancet Commission on Pollution and Health and led the Monaco Commission on Human Health and Ocean Pollution. Dr. Landrigan is director of the Program for Global Public Health and the Common Good at Boston College.

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SCIENTIFIC SESSION POSTER IV
Work at the Castle

1. 50 years of research on prevention of environmental and occupational diseases at the Castle of Bentivoglio *Daniele Mandrioli, Italy*
2. The Global Glyphosate Study: first toxicological evaluations on sub-chronic toxicity arm and state of the art *Simona Panzacchi, Italy*
3. Life-span carcinogenicity study on Sprague–Dawley rats exposed to gamma-radiation: Comparison of tumor occurrence after a single acute dose exposure versus fractionated doses exposure *Eva Tibaldi, Italy*

50 years of research on prevention of environmental and occupational diseases at the Castle of Bentivoglio

Daniele Mandrioli[1]

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Background: The Ramazzini Institute, founded by Professor Cesare Maltoni, is a non-profit social cooperative. with over 35,000 members. The mission of the Ramazzini Institute is primary and secondary prevention of occupational and environmental diseases in line with the main teaching from Bernardino Ramazzini "it is better to prevent than to treat". In 2021 the Ramazzini Institute celebrates 50 years of activities of the Cesare Maltoni Cancer Research Center (CMCRC) located in the Castle of Bentivoglio.

Methods: The CMCRC is the largest and longest-existing programs of experimental carcinogenesis bioassays in Europe. In 50 years, long-term carcinogenicity studies on more than 200 agents present in the occupational and general environment have been conducted at the CMCRC. In light of the increasing understanding of the role of chemical exposures in different non-communicable diseases, the CMCRC bioassays designs recently evolved in order to include a number of outcomes other than cancer, such as reproductive/developmental toxicity or neurotoxicity. Furthermore, the CMCRC activities expanded over the years and now include epidemiological studies, mechanistic studies and systematic reviews. The studies of the CMCRC consistently provided independent and solid evidence over the years to regulators, decision makers, public health authorities and consumers.

Results: The CMCRC scientific activities evolved and expanded over the last 50 years, but the values are still the ones of its founder Prof. Cesare Maltoni: independence, scientific rigor and focus on exposures of public health concern. These values intertwine the past, the present and the future of the CMCRC with the Collegium Ramazzini.

Conclusions: The Castle of Bentivoglio will continue serving the Collegium Ramazzini for the years to come, not only as host of its General Secretariat, but also as guardian of the shared legacy of Cesare Maltoni and Bernardino Ramazzini.

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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.

The Global Glyphosate Study: first toxicological evaluations on sub-chronic toxicity arm and state of the art

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Background: Glyphosate-based herbicides (GBH) are the most widely used pesticides mainly for weed management; worldwide an intense scientific, legal, and public debate has been generated over their safety. The RI, with the support of other independent Institutes and Universities in Europe and United States, has launched the most comprehensive study ever on glyphosate and glyphosate-based herbicides to produce solid scientific evidence on real-life exposures to GBHs. This project was designed to study, in the same population of animals, toxicity, carcinogenicity, prenatal developmental toxicity, neurotoxicity, multi-generational, endocrine disruption, microbiome effects. The first results, presented here, are related to the sub-chronic toxicity study (13-week prenatal).

Description of Content: We treated Sprague-Dawley (SD) rats with pure glyphosate or two different GBHs: Roundup Bioflow (used mainly in Europe) and RangerPro (used in USA). RangerPro contains a surfactant, polyoxyethylene amine (POEA), that has been banned in Europe. The exposure started from prenatal life until 17-week of age. Doses selected were 3 and ranged from the European ADI (0.5 mg/kg bw/day) to the European NOAEL (50 mg/kg bw/day). Animals were monitored and weighed during the whole life and at the terminal sacrifice a complete necropsy was performed.
Blood was collected for hematological and biochemical analyses. Pathological evaluation was performed.

Implications for the Collegium: No unusual mortality or differences in body weight, water and feed consumption were observed. Organ weights at the end of the treatment remained in the normal range of variability. Non-neoplastic lesions of varying degrees were observed in different dose groups and in both sexes. Liver and kidneys seemed to be particularly sensitive target organs. Evaluation of the other arms of the study are ongoing.

Contribution to possible follow up/action The results of the sub-chronic study indicate that liver and kidneys are important target organs for GBHs.

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Dr. Panzacchi is Head of the Unit of Biostatistics at the Cesare Maltoni Cancer Research Center of the Ramazzini Institute (CMCR/RI). She obtained a degree in Biological Sciences and a Master of Philosophy in Biostatics from the University of Bologna. She is involved in several in vivo projects at the CMCRC/RI and she presently is the Deputy Study Director of the Global Glyphosate Study.

Life-span carcinogenicity study on Sprague–Dawley rats exposed to gamma-radiation: Comparison of tumor occurrence after a single acute dose exposure versus fractionated doses exposure

Eva Tibaldi[1]

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Background: Following the Chernobyl nuclear disaster and given the paucity of scientific data at that time on the carcinogenicity of ionizing radiation, the Ramazzini Institute (RI) started to conduct in vivo experiments on ionizing radiation (gamma radiation) using Sprague Dawley rats as experimental model. The focus of this presentation is the data related to the main experiment (BT1R) in which the rats were exposed post-natally to three different doses of gamma radiation administered in a single acute dose (similar to exposure during nuclear accidents) or in fractionated repeated doses (similar to exposures occurring in the medical setting).

Description of Content: The experiment involved 4,016 six-week-old Sprague-Dawley (SD) rats divided into 7 experimental groups (6 treatment groups and 1 control). The rats were treated at three dose levels (0.1, 1 and 3Gy), delivered in a single acute dose, given at the start of the experiment (6 weeks), or in fractionated doses (10 doses once every 4 weeks). The animals were kept under observation until natural death (life-span).

Implications for the Collegium: The results confirm the dose-related carcinogenic effects of gamma-radiation for several organs and tissues. Moreover, also a single exposure to the lowest dose of 0.1 Gy induced a statistically significant increased incidence in Zymbal gland carcinomas, spleen hemangiosarcomas and benign interstitial cell tumor of the testis in males, while in females a statistically significant increase for pancreas islet cell carcinomas and mammary gland fibrosarcomas were observed. Fractionated chronic exposures produced in general significantly lower increase of tumors when compared with single acute exposures.

Contribution to possible follow up/action The results call for attention to various human exposure scenarios, showing that even low doses (0.1 Gy) are capable of inducing a significant increase of tumors and that overall fractionated doses over time induce significantly less tumors than acute single exposures.

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Dr. Tibaldi is the Head of the Pathology Unit at the Cesare Maltoni Cancer Research Center, Ramazzini Institute. Her work is focused on pathology involved in screening of slides to perform diagnosis and conducting peer review of histopathology for different types of in vivo studies.