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COVID-19

1. **Environmental and climatic impact on the infection and mortality of SARS-CoV-2 in Peru.** Samillan VJ, Flores-León D, Rojas E, Zutta BR. J Basic Clin Physiol Pharmacol. 2021 May 20. doi: 10.1515/jbcpp-2021-0007. Online ahead of print.
   OBJECTIVES: The role of the environment and climate in the transmission and case fatality rates of SARS-CoV-2 is still being investigated a year into the pandemic. Elevation and air quality are believed to be significant factors in the development of the pandemic, but the influence of additional environmental factors remains unclear.
   METHODS: We explored the relationship between the cumulative number of infections and mortality cases with climate (temperature, precipitation, solar radiation, water vapor pressure, wind), environmental data (elevation, normalized difference vegetation index or NDVI, particulate matter at 2.5 µm or PM2.5 and NO2 concentration), and population density in Peru. We use confirmed cases of infection from 1,287 districts and mortality in 479 districts, we used Spearman's correlations to assess the bivariate correlation between environmental and climatic factors with cumulative infection cases, cumulative mortality and case-fatality rate. We explored district cases within the ecozones of coast, sierra, high montane forest and lowland rainforest.
   RESULTS: Multiple linear regression models indicate elevation, mean solar radiation, air quality, population density and green vegetation cover, as a socioeconomic proxy, are influential factors in the distribution of infection and mortality of SARS-CoV-2 in Peru. Case-fatality rate was weakly associated with elevation.
   CONCLUSIONS: Our results also strongly suggest that exposure to poor air quality is a significant factor in the mortality of individuals below the age of 30. We conclude that environmental and climatic factors do play a significant role in the transmission and case fatality rates in Peru, however further study is required to see if these relationships are maintained over time.

2. **The psychology of climate anxiety.** Dodds J. BJPsych Bull. 2021 May 19:1-5. doi: 10.1192/bjb.2021.18. Online ahead of print.

https://www.cambridge.org/core/journals/bjpsych-bulletin/article/psychology-of-climate-anxiety/26AC9DF2FCD1A0BCC42070CCDFD8CDB3
This paper focuses on climate anxiety and its role in the psychology of climate change, compared with responses to the COVID-19 global pandemic. Four psychological hypotheses for why we do not act on climate change will be reviewed, and the role of anxiety for each, as well as potential solutions. Different types of climate anxiety both inside and outside the clinic will be explored, along with associated defence mechanisms and treatment.

3. **Emerging role of air pollution and meteorological parameters in COVID-19.** Zhao C, Fang X, Feng Y, Fang X, He J, Pan H. J Evid Based Med. 2021 May 18. doi: 10.1111/jebm.12430. Online ahead of print.
https://onlinelibrary.wiley.com/doi/full/10.1111/jebm.12430
Exposure to air pollutants has been associated with respiratory viral infections. Epidemiological studies have shown that air pollution exposure is related to increased cases of SARS-COV-2 infection and COVID-19-associated mortality. In addition, the changes of meteorological parameters have also been implicated in the occurrence and development of COVID-19. However, the molecular mechanisms by which pollutant exposure and changes of meteorological parameters affects COVID-19 remains unknown. This review summarizes the biology of COVID-19 and the route of viral transmission, and elaborates on the relationship between air pollution and climate indicators and COVID-19. Finally, we envisaged the potential roles of air pollution and meteorological parameters in COVID-19.

4. **Plastic waste associated with the COVID-19 pandemic: Crisis or opportunity?** Khoo KS, Ho LY, Lim HR, Leong HY, Chew KW. J Hazard Mater. 2021 May 13;417:126108. doi: 10.1016/j.jhazmat.2021.126108. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S0304389421010724
Coronavirus Diseases 2019 (COVID-19) pandemic has a huge impact on the plastic waste management in many countries due to the sudden surge of medical waste which has led to a global waste management crisis. Improper management of plastic waste may lead to various negative impacts on the environment, animals, and human health. However, adopting proper waste management and the right technologies, looking in a different perception of the current crisis would be an opportunity. About 40% of the plastic waste ended up in landfill, 25% incinerated, 16% recycled and the remaining 19% are leaked into the environment. The increase of plastic wastes and demand of plastic markets serve as a good economic indicator for investor and government initiative to invest in technologies that converts plastic waste into value-added product such as fuel and construction materials. This will close the loop of the life cycle of plastic waste by achieving a sustainable circular economy. This review paper will provide insight of the state of plastic waste before and during the COVID-19 pandemic. The treatment pathway of plastic waste such as sterilisation technology, incineration, and alternative technologies available in converting plastic waste into value-added product were reviewed.

5. **Air pollution impacts of COVID-19-related containment measures.** Chossière GP, Xu H, Dixit Y, Isaacs S, Eastham SD, Allroggen F, Speth RL, Barrett SRH. Sci Adv. 2021 May 21;7(21):eabe1178. doi: 10.1126/sciadv.abe1178. Print 2021 May.
https://advances.sciencemag.org/content/7/21/eabe1178
Responses to the COVID-19 outbreak resulted in one of the largest short-term decreases in anthropogenic emissions in modern history. To date, there has been no comprehensive assessment of the impact of lockdowns on air quality and human health. Using global satellite observations and ground measurements from 36 countries in Europe, North America, and East Asia, we find that lockdowns led to reductions in NO2 concentrations globally, resulting in ~32,000 avoided premature mortalities, including ~21,000 in China. However, we do not find corresponding reductions in PM2.5 and ozone globally. Using satellite measurements, we show that the disconnect between NO2 and ozone changes stems from local chemical regimes. The COVID-related lockdowns demonstrate the need for targeted air quality policies to reduce the global burden of air pollution, especially related to secondary pollutants.

6. **COVID-19 discarded disposable gloves as a source and a vector of pollutants in the environment.** Jędruchniewicz K, Ok YS, Oleszczuk P. J Hazard Mater. 2021 Apr 27;417:125938. doi: 10.1016/j.jhazmat.2021.125938. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S030438942100902X
The appearance of the virus SARS-CoV-2 at the end of 2019 and its spreading all over the world has caused global panic and increase of personal protection equipment usage to protect people against infection. Increased usage of disposable protective gloves, their discarding to random spots and getting to landfills may result in significant environmental pollution. The knowledge concerning possible influence of gloves and potential of gloves debris on the environment (water, soil, etc.), wildlife and humans is crucial to predict future consequences of disposable gloves usage caused by the pandemic. This review focuses on the possibility of chemical release (heavy metals and organic pollutants) from gloves and gloves materials, their adsorptive properties in terms of contaminants accumulation and effects of gloves degradation under environmental conditions.

7. **Remote-Working Carbon-Saving Footprint: Could COVID-19 Pandemic Establish a New Working Model with Positive Environmental Health Implications?** Maipas S, Panayiotides IG, Kavantzas N. Environ Health Insights. 2021 Apr 27;15:11786302211013546. doi: 10.1177/11786302211013546. eCollection 2021.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8107946/
Urban air pollution is a major problem with known negative health implications, such as respiratory and cardiovascular diseases. Lockdown measures have caused the reductions of various urban pollutants, such as nitrogen dioxide (NO2), particulate matters (PMs), and polycyclic aromatic hydrocarbons (PAHs). COVID-19 pandemic has also established remote-working as an antidote to declining economic activity due to lockdown measures. The environmental health implications of the new hybrid-working model, which drastically reduces the number of circulating vehicles, appear to be positive enough to reveal an emerging opportunity. Since this hybrid model may have started becoming a widely accepted working model, the current situation has revealed the opportunity of remote-working arrangements to

serve as a supplementary mitigative and adaptive measure against urban environmental deterioration. Also, a remote-working carbon-saving footprint may be introduced in order to evaluate a firm's carbon footprint reduction due to remote-working arrangements. These workings arrangements may be accompanied by improvements and expansions of urban green spaces and with broader use of electric vehicles, transforming our cities into more sustainable, safe, healthy, and worth-living environments.

Health Impacts of Climate Change

8. **The persistent threat of emerging plant disease pandemics to global food security.** Ristaino JB, Anderson PK, Bebber DP, Brauman KA, Cunniffe NJ, Fedoroff NV, Finegold C, Garrett KA, Gilligan CA, Jones CM, Martin MD, MacDonald GK, Neenan P, Records A, Schmale DG, Tateosian L, Wei Q. Proc Natl Acad Sci U S A. 2021 Jun 8;118(23):e2022239118. doi: 10.1073/pnas.2022239118.
Plant disease outbreaks are increasing and threaten food security for the vulnerable in many areas of the world. Now a global human pandemic is threatening the health of millions on our planet. A stable, nutritious food supply will be needed to lift people out of poverty and improve health outcomes. Plant diseases, both endemic and recently emerging, are spreading and exacerbated by climate change, transmission with global food trade networks, pathogen spillover, and evolution of new pathogen lineages. In order to tackle these grand challenges, a new set of tools that include disease surveillance and improved detection technologies including pathogen sensors and predictive modeling and data analytics are needed to prevent future outbreaks. Herein, we describe an integrated research agenda that could help mitigate future plant disease pandemics.

9. **Prenatal Ambient Ultrafine Particle Exposure and Childhood Asthma in the Northeastern United States.** Wright RJ, Hsu HL Chiu YM, Coull BA, Simon MC, Hudda N, Schwartz J, Kloog I, Durant JL. Am J Respir Crit Care Med. 2021 May 21. doi: 10.1164/rccm.202010-3743OC. Online ahead of print.
RATIONALE: Ambient ultrafine particles (UFPs; <0.1 µm) may exert greater toxicity, compared to other pollution components, due to enhanced oxidative capacity and ability to translocate systemically. Studies examining associations between prenatal UFP exposure and childhood asthma remain sparse.
OBJECTIVES: We used daily UFP exposure estimates to identify susceptible windows of prenatal UFP exposure with asthma in children, accounting for sex-specific effects.
METHODS: Analyses included 376 mother-child dyads followed since pregnancy. Daily UFP exposure during pregnancy was estimated using a spatiotemporally-resolved particle number concentration prediction model. Bayesian distributed lag interaction models (BDLIMs) were used to identify sensitive windows for UFP exposure, and examine whether effect estimates varied by sex. Incident asthma was determined at first report of asthma (3.6+3.2 years). Covariates included maternal age, education, race, and obesity, child sex, nitrogen dioxide (NO_2) and temperature averaged over gestation, and postnatal UFP exposure.
MEASUREMENTS AND MAIN RESULTS: Women were 37.8% Black and 43.9% Hispanic with 52.9% reporting <high school education; 18.4% of children developed asthma. The cumulative odds ratio (95% confidence interval) for incident asthma, per doubling of UFP exposure level

across pregnancy was 4.28 (1.41-15.7) impacting males and females similarly. BDLIMs indicated sex differences in the sensitive windows with the highest risk of asthma in females exposed to higher UFPs during late pregnancy.
CONCLUSION: Prenatal UFP exposure was associated with asthma development in children, independent of correlated ambient NO2 and temperature. Findings will benefit future research and policy-makers considering appropriate regulations that reduce the adverse effects of UFP on child respiratory health.

10. **Disability-adjusted life years due to chronic and hidden hunger under food system evolution with climate change and adaptation to 2050.** Sulser TB, Beach RH, Wiebe KD, Dunston S, Fukagawa NK. Am J Clin Nutr. 2021 May 20:nqab101. doi: 10.1093/ajcn/nqab101. Online ahead of print.
https://academic.oup.com/ajcn/advance-article/doi/10.1093/ajcn/nqab101/6277981
BACKGROUND: Climate change presents an increasing challenge for food-nutrition security. Nutrition metrics calculated from quantitative food system projections can help focus policy actions.
OBJECTIVES: To estimate future chronic and hidden hunger disability-adjusted life years (DALYs)-due to protein-energy undernutrition and micronutrient deficiencies, respectively-using food systems projections to evaluate the potential impact of climate change and agricultural sector investment for adaptation.
METHODS: We use a novel combination of a chronic and hidden hunger DALY estimation procedure and food system projections from quantitative foresight modeling to assess DALYs under alternative agricultural sector scenarios to midcentury.
RESULTS: Total chronic and hidden hunger DALYs are projected to increase globally out to 2050-by over 30 million compared with 2010-even without climate change. Climate change increases total DALY change between 2010 and 2050 by nearly 10% compared with no climate change. Agricultural sector investments show promise for offsetting these impacts. With investments, DALY incidence due to chronic and hidden hunger is projected to decrease globally in 2050 by 0.24 and 0.56 per 1000 capita, respectively. Total global DALYs will still rise because projected population growth will outpace the rate reduction, especially in Africa south of the Sahara. However, projections also show important regional reductions in total DALYs due to chronic (13.9 million in South Asia, 4.3 million in East Asia and the Pacific) and hidden hunger (7.5 million in East Asia and the Pacific) with investments.
CONCLUSIONS: Food system projections to 2050 show a decreasing DALY incidence from both chronic and hidden hunger. Population growth is projected to outpace these improvements and lead to increasing total chronic and hidden hunger DALYs globally, concentrated in Africa south of the Sahara. Climate change increases per-capita chronic and hidden hunger DALY incidence compared with no climate change. Agricultural sector investments show the potential to offset the climate impact on DALYs.

11. **Exposure to outdoor air pollution at different periods and the risk of leukemia: a meta-analysis.** Wei T, Jiao R, Nakyeyune R, Zang Z, Shao Y, Shen Y, Niu C, Zhu L, Ruan X, Liu F. Environ Sci Pollut Res Int. 2021 May 19. doi: 10.1007/s11356-021-14053-8. Online ahead of print.

The causes of leukemia remain largely unknown; our aims were to examine the association between the exposure to outdoor air pollution and leukemia risk and to explore the effect of this exposure during different periods of pregnancy and early life. We searched for all case-control and cohort studies published before February 20, 2021, which measured the risk of leukemia in relation to exposure to the air pollutants: particulate matter, benzene, nitrogen dioxide (NO2), and nitrogen oxides (NOx). We then carried out a meta-analysis and calculated the summary relative risks (RRs) of leukemia by using a random-effects model. The potential dose-response relationship was further explored. The results showed that the highest exposure to benzene (RR: 1.20, 95%CI: 1.06-1.35) and NO2 (RR: 1.04, 95%CI; 1.02-1.08) were positively correlated with leukemia risk when compared to the lowest exposure categories for each air pollutant. During pregnancy, exposure to benzene in the third trimester, as well as exposure to NO2 in the second trimester and entire pregnancy, could also increase the risk of leukemia. In the dose-response analysis, benzene exposure and NO2 exposure were linearly associated with the risk of leukemia. Other air pollutants did not have a statistical correlation with leukemia risk. There was a certain degree of publication bias in studies on benzene. Overall, our results support a link between outdoor air pollution and leukemia risk, particularly due to benzene and NO2. Prospero Registration Number: PROSPERO CRD42020207025.

12. **Does Exposure to Air Pollution Increase the Risk of Acute Care in Young Children with Asthma? An Ontario, Canada Study.** To T, Zhu J, Terebessy E, Zhang K, Fong I, Pinault L, Jerrett M, Robichaud A, Ménard R, van Donkelaar A, Martin RV, Hystad P, Brook JR, Dell S, Stieb D. Environ Res. 2021 May 18:111302. doi: 10.1016/j.envres.2021.111302. Online ahead of print. https://www.sciencedirect.com/science/article/pii/S001393512100596X
Owing to their greater outdoor activity and ongoing lung development, children are particularly vulnerable to the harmful effects of exposure to fine particulate matter (PM2.5). However, the effects of PM2.5 components are poorly understood. This study aimed to use a longitudinal birth cohort of children with physician-diagnosed incident asthma to investigate the effect of PM2.5 components at birth on morbidity measured by health services utilization. Of 1,277 Toronto Child Health Evaluation Questionnaire (T-CHEQ) participants, the study population included 362 children diagnosed with asthma who were followed for a mean of 13 years from birth until March 31, 2016, or loss-to-follow-up. Concentrations of PM2.5 and its components were assigned based on participants' postal codes at birth. Study outcomes included counts of asthma, asthma-related, and all-cause health services use. Poisson regression in single-, two-, and multi-pollutant models was used to estimate rate ratios (RR) per interquartile range (IQR) increase of exposures. Covariates were included in all models to further adjust for potential confounding. The adjusted RR for sulfate (SO4) and all-cause hospitalizations was statistically significant with RR=2.23 (95% confidence interval [CI]: 1.25-3.96) in a multi-pollutant model with nitrogen dioxide (NO2) and ozone (O3). In multi-pollutant models with oxidants, the adjusted RRs for SO4 of all-cause hospitalizations and emergency department (ED) visits were also statistically significant with RR=2.31 (95% CI: 1.32-4.03) and RR=1.39 (95% CI: 1.02-1.90), respectively. While unadjusted single-pollutant RRs for asthma-specific and asthma-related health services use with the SO4 component of PM2.5 were above one, none were statistically significant. This study found significant associations with exposure to SO4 in PM2.5 and all-cause acute care, chiefly for hospitalizations, in children with asthma.

13. **Air Pollution Relates to Airway Pathology in Wheezing Children.** Bonato M, Gallo E, Bazzan E, Marson G, Zagolin L, Cosio MG, Barbato A, Saetta M, Gregori D, Baraldo S. Ann Am Thorac Soc. 2021 May 18. doi: 10.1513/AnnalsATS.202010-1321OC. Online ahead of print.
RATIONALE: Outdoor air pollution contributes to asthma development and exacerbations; yet, its effects on airway pathology have not been defined in children.
OBJECTIVES: To explore the possible link between air pollution and airway pathology, we examined retrospectively the relation between environmental pollutants and pathological changes in bronchial biopsies of children undergoing a clinically indicated bronchoscopy.
METHODS: Structural and inflammatory changes (Basement Membrane-BM thickness, epithelial loss, eosinophils, neutrophils, macrophages, mast-cells, lymphocytes) were quantified in biopsies by immunohistochemistry. The association between exposure to PM10, SO2 and NO2 and biopsy findings was evaluated using a Generalized Additive Model with Gamma family to allow for overdispersion, adjusted for atmospheric pressure, temperature, humidity and wheezing.
RESULTS: Overall, 98 children were included (age 5.3±2.9 yrs; 53 wheezing/ 45 non-wheezing). BM thickness increased with prolonged exposure to PM10 [Rate ratio RR 1.29; CI 1.09-1.52], particularly in wheezing children. Prolonged exposure to PM10 was also associated with eosinophilic inflammation in wheezing children [RR 3.16; CI 1.35-7.39]. Conversely, in non-wheezers, increased PM10 exposure was associated with a reduction of eosinophilic [RR 0.12; CI 0.02-0.6] and neutrophilic inflammation [RR 0.36; CI 0.14-0.89]. Moreover, NO2 exposure was also linked to reductions in neutrophil [RR 0.57; CI 0.34-0.93] and eosinophil infiltration [RR 0.33; CI 0.14-0.77].
CONCLUSION: Different patterns of association were observed in wheezing and non-wheezing children. In non-wheezing children, exposure to PM10 and NO2 was linked to reduced eosinophilic/neutrophilic inflammation. Conversely, in wheezing children prolonged exposure to PM10 was associated with increased BM thickness and eosinophilic inflammation, suggesting that it might contribute to asthma development by promoting airway remodeling and inflammation.

14. **Ambient Air Pollution: Health Hazards to Children.** Brumberg HL, Karr CJ; COUNCIL ON ENVIRONMENTAL HEALTH. Pediatrics. 2021 May 17:e2021051484. doi: 10.1542/peds.2021-051484. Online ahead of print.
https://pediatrics.aappublications.org/content/early/2021/05/13/peds.2021-051484
Ambient air pollution is produced by sources including vehicular traffic, coal-fired power plants, hydraulic fracturing, agricultural production, and forest fires. It consists of primary pollutants generated by combustion and secondary pollutants formed in the atmosphere from precursor gases. Air pollution causes and exacerbates climate change, and climate change worsens health effects of air pollution. Infants and children are uniquely sensitive to air pollution, because their organs are developing and they have higher air per body weight intake. Health effects linked to air pollution include not only exacerbations of respiratory diseases but also reduced lung function development and increased asthma incidence. Additional outcomes of concern include preterm birth, low birth weight, neurodevelopmental disorders, IQ loss, pediatric cancers, and increased risks for adult chronic diseases. These effects are mediated by oxidative stress,

chronic inflammation, endocrine disruption, and genetic and epigenetic mechanisms across the life span. Natural experiments demonstrate that with initiatives such as increased use of public transportation, both air quality and community health improve. Similarly, the Clean Air Act has improved air quality, although exposure inequities persist. Other effective strategies for reducing air pollution include ending reliance on coal, oil, and gas; regulating industrial emissions; reducing exposure with attention to proximity of residences, schools, and child care facilities to traffic; and a greater awareness of the Air Quality Index. This policy reviews both short- and long-term health consequences of ambient air pollution, especially in relation to developmental exposures. It examines individual, community, and legislative strategies to mitigate air pollution.

15. **Association of NO2 and Other Air Pollution Exposures With the Risk of Parkinson Disease.** Jo S, Kim YJ, Park KW, Hwang YS, Lee SH, Kim BJ, Chung SJ. JAMA Neurol. 2021 May 17. doi: 10.1001/jamaneurol.2021.1335. Online ahead of print.
https://jamanetwork.com/journals/jamaneurology/fullarticle/2780249
IMPORTANCE: The development of Parkinson disease (PD) may be promoted by exposure to air pollution.
OBJECTIVE: To investigate the potential association between exposure to particulate matters (PM2.5 and PM10), nitrogen dioxide (NO2), ozone (O3), sulfur dioxide (SO2), and carbon monoxide (CO) and the risk of incident PD.
DESIGN, SETTING, AND PARTICIPANTS: This retrospective cohort study used data from the Korean National Health Insurance Service. Among the 1 021 208 Korean individuals in the database, those who had lived in Seoul from January 2002 to December 2006 (n = 176 875) were screened for eligibility. A total of 78 830 adults older than 40 years without PD and who lived in Seoul between January 2002 and December 2006 were included in this study. Individuals diagnosed with PD before 2006 (n = 159) and individuals 40 years or younger (n = 97 886) were excluded. Each participant was followed up with annually from January 2007 to December 2015, thereby adding up to 757 704 total person-years of follow-up. Data were analyzed from January to September 2020.
EXPOSURES: Individual exposure levels to PM2.5, PM10, NO2, O3, SO2, and CO were estimated based on the participants' residential address at the district level. To evaluate long-term exposure to air pollution, time-varying 5-year mean air pollutant exposure was calculated for each participant.
MAIN OUTCOMES AND MEASURES: The outcome measure was the association between air pollution and the risk of incident PD measured as hazard ratios after adjusting for demographic factors, socioeconomic factors, and medical comorbidities.
RESULTS: At baseline, the mean (SD) age of the 78 830 participants was 54.4 (10.7) years, and 41 070 (52.1%) were female. A total of 338 individuals with newly diagnosed PD were identified during the study period. Exposure to NO2 was associated with an increase in risk of PD (hazard ratio for highest vs lowest quartile, 1.41; 95% CI, 1.02-1.95; P for trend = .045). No statistically significant associations between exposure to PM2.5, PM10, O3, SO2, or CO and PD incidence were found.
CONCLUSIONS AND RELEVANCE: In this large cohort study, a statistically significant association between NO2 exposure and PD risk was identified. This finding suggests the role of air

pollutants in PD development, advocating for the need to implement a targeted public health policy.

16. **Particulate matter air pollutants and cardiovascular disease: Strategies for intervention.** Aryal A, Harmon AC, Dugas TR. Pharmacol Ther. 2021 May 13:107890. doi: 10.1016/j.pharmthera.2021.107890. Online ahead of print.
Air pollution is consistently linked with elevations in cardiovascular disease (CVD) and CVD-related mortality. Particulate matter (PM) is a critical factor in air pollution-associated CVD. PM forms in the air during the combustion of fuels as solid particles and liquid droplets and the sources of airborne PM range from dust and dirt to soot and smoke. The health impacts of PM inhalation are well documented. In the US, where CVD is already the leading cause of death, it is estimated that PM2.5 (PM < 2.5 μm in size) is responsible for nearly 200,000 premature deaths annually. Despite the public health data, definitive mechanisms underlying PM-associated CVD are elusive. However, evidence to-date implicates mechanisms involving oxidative stress, inflammation, metabolic dysfunction and dyslipidemia, contributing to vascular dysfunction and atherosclerosis, along with autonomic dysfunction and hypertension. For the benefit of susceptible individuals and individuals who live in areas where PM levels exceed the National Ambient Air Quality Standard, interventional strategies for mitigating PM-associated CVD are necessary. This review will highlight current state of knowledge with respect to mechanisms for PM-dependent CVD. Based upon these mechanisms, strategies for intervention will be outlined. Citing data from animal models and human subjects, these highlighted strategies include: 1) antioxidants, such as vitamins E and C, carnosine, sulforaphane and resveratrol, to reduce oxidative stress and systemic inflammation; 2) omega-3 fatty acids, to inhibit inflammation and autonomic dysfunction; 3) statins, to decrease cholesterol accumulation and inflammation; 4) melatonin, to regulate the immune-pineal axis and 5) metformin, to address PM-associated metabolic dysfunction. Each of these will be discussed with respect to its potential role in limiting PM-associated CVD.

17. **Environmental exposure to mineral coal and by-products: Influence on human health and genomic instability.** Souza MR, Hilário Garcia AL, Dalberto D, Martins G, Picinini J, Souza GMS, Chytry P, Dias JF, Bobermin LD, Quincozes-Santos A, da Silva J. Environ Pollut. 2021 May 12;287:117346. doi: 10.1016/j.envpol.2021.117346. Online ahead of print.
Environmental exposure to pollution generated by mining and burning coal is inevitable for people living nearby. Therefore, the aim of this study was to evaluate the influence of coal dust on health conditions and genomic instability of individuals who live near coal mines and thermoelectric power plants, and to relate the results to inorganic elements and inflammatory responses. Thus, we evaluated 284 individuals from four cities in the south of Brazil around a region with coal mines and a thermoelectric power plant (one city was considered a negative control). The results of the Comet assay and Micronucleus (MN) test did not show a genotoxic or mutagenic effect related to environmental exposure to coal, but the inflammatory cytokine tumor necrosis factor-α (TNF-α) was increased in all cities around the power plant when compared to the control conditions. Higher levels of MN were associated with body mass index and cardiovascular risk, and higher levels of Damage Index (DI), TNF-α and interleukin1β (IL-1β) with number of cigarettes/day. Principal component analysis (PCA) was used to integrate DNA

damage and inflammatory results with inorganic elements. This study also demonstrated the relationship between zinc and MN, copper, and interleukin10 (IL-10), and among silicon and sulfur with DI and nucleoplasmic bridge. A relationship was also observed between the reduction of inorganic elements and both aging and quality of health. The use of different methodologies and the relationship between the results obtained in these studies, including different lifestyles, can increase the understanding of the interaction between this mineral and the health status of residents of regions affected by coal pollution.

WE ACT

18. **An Examination of the Intersection of Climate Change, the Physician Specialty Workforce, and Graduate Medical Education in the U.S.** Colbert CY, French JC, Brateanu A, Pacheco SE, Khatri SB, Sapatnekar S, Vacharathit V, Pien LC, Prelosky-Leeson A, LaRocque R, Mark B, Salas RN. Teach Learn Med. 2021 May 19:1-12. doi: 10.1080/10401334.2021.1913417. Online ahead of print.
    As U.S. healthcare systems plan for future physician workforce needs, the systemic impacts of climate change, a worldwide environmental and health crisis, have not been factored in. The current focus on increasing the number of trained physicians and optimizing efficiencies in healthcare delivery may be insufficient. Graduate medical education (GME) priorities and training should be considered in order to prepare a climate-educated physician workforce. Evidence: We used a holistic lens to explore the available literature regarding the intersection of future physician workforce needs, GME program priorities, and resident education within the larger context of climate change. Our interinstitutional, transdisciplinary team brought perspectives from their own fields, including climate science, climate and health research, and medical education to provide recommendations for building a climate-educated physician workforce. Implications: Acknowledging and preparing for the effects of climate change on the physician workforce will require identification of workforce gaps, changes to GME program priorities, and education of trainees on the health and societal impacts of climate change. Alignment of GME training with workforce considerations and climate action and adaptation initiatives will be critical in ensuring the U.S. has a climate-educated physician workforce capable of addressing health and healthcare system challenges. This article offers a number of recommendations for physician workforce priorities, resident education, and system-level changes to better prepare for the health and health system impacts of climate change.

19. **Patient-Planetary Health Co-benefit Prescribing: Emerging Considerations for Health Policy and Health Professional Practice.** Redvers N. Front Public Health. 2021 Apr 30;9:678545. doi: 10.3389/fpubh.2021.678545. eCollection 2021.
    https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8119779/
    In addition to the importance of fostering and developing measures for better health-system resilience globally from the effects of climate change, there have been increasing calls for health professionals, as well as public health and medical education systems, to become partners in climate change mitigation efforts. Direct clinical practice considerations, however, have not been adequately fostered equitably across all regions with an often-confusing array of practice areas within planetary health and sustainable healthcare. This article calls for a more

coordinated effort within clinical practice spaces given the urgency of global environmental change, while also taking lessons from Indigenous traditional knowledge systems-a viewpoint that is rarely heard from or prioritized in public health or medicine. Simpler and more coordinated messaging in efforts to improve patient and planetary health are needed. The creation of unifying terminology within planetary health-rooted clinical and public health practice has been proposed with the potential to bring forth dialogue between and within disciplinary offshoots and public health advocacy efforts, and within clinical and health-system policy spaces.

Lancet Planetary Health – ***open-access, interdisciplinary journal focused on sustainability***

News & Commentary

Air pollution in post-COVID-19 world: the final countdown of modern civilization? : Comment on: "COVID-19 and air pollution: the worst is yet to come". Dutheil F, Baker JS, Navel V. Environ Sci Pollut Res Int. 2021 May 17:1-3. doi: 10.1007/s11356-021-14433-0. Online ahead of print.

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