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COVID-19

1. **Long-Term Air Pollution Exposure and COVID-19 Mortality: A Patient-Level Analysis from New York City.** Bozack A et al. Am J Respir Crit Care Med. 2021 Dec 9. doi: 10.1164/rccm.202104-0845OC. Online ahead of print.
   https://www.atsjournals.org/doi/pdf/10.1164/rccm.202104-0845OC
   RATIONALE: Risk factors for COVID-19 mortality may include environmental exposures, such as air pollution.
   OBJECTIVES: Determine whether, amongst adults hospitalized with PCR-confirmed COVID-19, long-term air pollution exposure is associated with risk for mortality, intensive care unit (ICU) admission or intubation.
   METHODS: We performed a retrospective analysis of SARS-CoV-2 PCR positive patients admitted to seven New York City hospitals from March 8, 2020 to August 30, 2020. The primary outcome was mortality; secondary outcomes were ICU admission and intubation. We estimated the annual average fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2) and black carbon (BC) concentrations at patients' residential addresses. We employed double-robust Poisson regression to analyze associations between annual average $PM_{2.5}$, NO_2 and BC exposure and COVID-19 outcomes, adjusting for age, sex, race/ethnicity, hospital, insurance and time from onset of the pandemic.
   RESULTS: Of the 6,542 patients, 41% were female and aged median 65 years (IQR 53, 77). Over 50% self-identified as a person of color [N=1,687 (26%) Hispanic, N=1,659 (25%) Black]. Air pollution exposures were generally low. Overall, 31% (N=2,044) of the cohort died, 19% (N=1,237) were admitted to the ICU and 16% (1,051) were intubated. In multivariable models, higher long-term exposure to $PM_{2.5}$ was associated with increased risk of mortality (RR 1.11, 95% CI 1.02, 1.21 per 1μg/m3 increase in $PM_{2.5}$) and ICU admission (RR 1.13, 95% CI 1.00, 1.28 per 1μg/m3 increase in $PM_{2.5}$). In multivariable models, neither NO_2 nor BC exposure was associated with COVID-19 mortality, ICU admission or intubation.

CONCLUSIONS: Amongst patients hospitalized with COVID-19, higher long-term PM2.5 exposure was associated with increased risk of mortality and ICU admission. This article is open access and distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives License 4.0 (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Health Impacts of Climate Change

2. **Climate change and nutrition-associated diseases.** Fanzo JC, Downs SM. Nat Rev Dis Primers. 2021 Dec 9;7(1):90. doi: 10.1038/s41572-021-00329-3.
https://www.nature.com/articles/s41572-021-00329-3
Climate change has multiple negative effects on global public health; reduced quality and quantity of crops result in increased food and financial insecurities leading to malnutrition (undernutrition and obesity) and diet-related non-communicable diseases, such as diabetes mellitus and cardiovascular diseases. In addition, food systems substantially contribute to greenhouse gas emissions and a shift towards sustainability is required to preserve human and planetary health.

3. **Association of Air Pollution and Physical Activity With Brain Volumes.** Furlong MA, Alexander GE, Klimentidis YC, Raichlen DA. Neurology. 2021 Dec 8:10.1212/WNL.0000000000013031. doi: 10.1212/WNL.0000000000013031. Online ahead of print.
OBJECTIVE: In high pollution areas, physical activity may have a paradoxical effect on brain health by increasing particulate deposition in the lungs. We examined whether physical activity modifies associations of air pollution with brain volumes in an epidemiological framework.
METHODS: The UK Biobank (UKB) enrolled >500,000 adult participants from 2006-2010. Wrist accelerometers, multimodal MRI with T1 images and T2 FLAIR data, and land use regression, were used to estimate vigorous physical activity (VigPA), structural brain volumes, and air pollution (AP) respectively in subsets of the full sample. We evaluated associations between AP interquartile ranges, VigPA, and brain structure volumes, and assessed interactions between AP and VigPA.
RESULTS: 8,600 participants were included, with an average age of 55.55 (sd=7.46). After correcting for multiple testing, in overall models VigPA was positively associated with grey matter (GMV) and negatively associated with white matter hyperintensity volumes (WMHV), while NO2, PM2.5absorbance, and PM2.5 were negatively associated with GMV. NO2 and PM2.5absorbance interacted with VigPA on WMHV (FDR-corrected interaction p-values=0.037). Associations between these air pollutants and WMHVs were stronger among participants with high VigPA. Similarly, VigPA was negatively associated with WMHV for those in areas of low NO2 and PM2.5absorbance, but was null among those living in areas of high NO2 and PM2.5absorbance.
CONCLUSIONS: Physical activity is associated with beneficial brain outcomes, while AP is associated with detrimental brain outcomes. Vigorous physical activity may exacerbate associations of AP with white matter hyperintensity lesions, and AP may attenuate the beneficial associations of physical activity with these lesions.

4. **Effect modification of greenness on PM(2.5) associated all-cause mortality in a multidrug-resistant tuberculosis cohort.** Ge E et al. Thorax. 2021 Dec 7:thoraxjnl-2020-216819. doi: 10.1136/thoraxjnl-2020-216819. Online ahead of print.

   RATIONALE: Evidence for the association between fine particulate matter (PM2.5) and mortality among patients with tuberculosis (TB) is limited. Whether greenness protects air pollution-related mortality among patients with multidrug-resistant tuberculosis (MDR-TB) is completely unknown.

   METHODS: 2305 patients reported in Zhejiang and Ningxia were followed up from MDR-TB diagnosis until death, loss to follow-up or end of the study (31 December 2019), with an average follow-up of 1724 days per patient. 16-day averages of contemporaneous Normalised Difference Vegetation Index (NDVI) in the 500 m buffer of patient's residence, annual average PM2.5 and estimated oxidant capacity Ox were assigned to patients regarding their geocoded home addresses. Cox proportional hazards regression models were used to estimate HRs per 10 µg/m3 exposure to PM2.5 and all-cause mortality among the cohort and individuals across the three tertiles, adjusting for potential covariates.

   RESULTS: HRs of 1.702 (95% CI 1.680 to 1.725) and 1.169 (1.162 to 1.175) were observed for PM2.5 associated with mortality for the full cohort and individuals with the greatest tertile of NDVI. Exposures to PM2.5 were stronger in association with mortality for younger patients (HR 2.434 (2.432 to 2.435)), female (2.209 (1.874 to 2.845)), patients in rural (1.780 (1.731 to 1.829)) and from Ningxia (1.221 (1.078 to 1.385)). Cumulative exposures increased the HRs of PM2.5-related mortality, while greater greenness flattened the risk with HRs reduced in 0.188-0.194 on average.

   CONCLUSIONS: Individuals with MDR-TB could benefit from greenness by having attenuated associations between PM2.5 and mortality. Improving greener space and air quality may contribute to lower the risk of mortality from TB/MDR-TB and other diseases.

5. **"Failing kidneys in a failing planet; CKD of unknown origin".** Geladari E et al. Rev Environ Health. 2021 Dec 6. doi: 10.1515/reveh-2021-0109. Online ahead of print.

   The 'alarm clock' for human beings in the era of climate medicine has rung. Original diseases have appeared, that could not be explained and attributed to common causes, which are suggested to be linked to global warming and environmental factors. Such an indolent disease is the chronic kidney disease of unknown cause (CKDu), introduced also as Mesoamerican or Uddanam nephropathy. Scientists equate the climate impact on kidneys with the canary in the coal mine; coal miners used to carry caged canaries with them, so that if poisonous gases, such as methane or carbon monoxide leaked into the mine-shaft, the gases would kill the canary before killing the miners; similarly, kidneys are injured before devastating and lethal complications occur in humans. In some regions of Central America, the deaths due to chronic kidney disease increased by 177% with a death toll being as high as over 20,000. It was first documented in animals that periodic heat and dehydration have a major role in causing chronic kidney disease. Based on that observation, it is advocated that young male agricultural workers in Central America and South Asia, develop renal disease by getting exposed to extreme heat repeatedly. The clinico-pathological characteristics of this type of kidney injury, do not belong to an existing classification, even though a form of tubulo-interstitial renal disease has been proposed. In this review, we will discuss about CKDu, its epidemiology and pathophysiological

mechanisms, clinical presentation and diagnostic biomarkers and examine potential therapeutic options.

6. **Air pollution and preterm birth: A time-stratified case-crossover study in the San Joaquin Valley of California.** Ha S, Martinez V, Chan-Golston AM. Paediatr Perinat Epidemiol. 2021 Dec 6. doi: 10.1111/ppe.12836. Online ahead of print.
https://onlinelibrary.wiley.com/doi/10.1111/ppe.12836
RESULTS: During warm seasons (May-October), an IQR increase in ozone was associated with 9-11% increased odds of VPTB from lag 0 (ORlag0 1.09, 95% CI 1.04, 1.16) to lag 7 (ORlag7 1.11, 95% CI 1.04, 1.16). Findings were consistent for MPTB and ETB. Ozone was potentially responsible for an excess of 3-6 VPTBs, 7-9 PTBs and 24-42 ETBs per 1,000 singleton deliveries. During cold seasons (November-April), increased PM2.5 exposure was associated with 5-6% increased odds of VPTB beginning at lag 3 (ORlag3 1.06, 95% CI 1.02, 1.11). PM2.5 was associated with an excess of 1-3 VPTBs, 0-3 MPTBs and 6-18 ETBs per 1,000 singleton deliveries. CONCLUSIONS: PM2.5 and ozone are associated with increased risk of VPTB, MPTB and ETB within one week of exposure and are potential contributors to the increasing PTB trend. More research is needed to further understand the role of air pollution on PTB risk.

7. **Mortality Risk from PM2.5: A Comparison of Modeling Approaches to Identify Disparities across Racial/Ethnic Groups in Policy Outcomes.** Spiller E, Proville J, Roy A, Muller NZ. Environ Health Perspect. 2021 Dec;129(12):127004. doi: 10.1289/EHP9001. Epub 2021 Dec 15.
https://ehp.niehs.nih.gov/doi/10.1289/EHP9001
RESULTS: Use of race/ethnicity-specific information increased PM2.5-related premature mortality estimates in older populations by 9% and among older Black Americans by 150% for all-source pollution exposure. Under a uniform degradation of air quality and race/ethnicity-specific information, older Black Americans were found to have approximately 3 times higher mortality relative to White Americans, which is obscured under a non-race/ethnicity-specific modeling approach. Standard approaches of using non-racial/ethnic specific information underestimate the benefits of the Mercury Air Toxics Standards to older Black Americans by almost 60% and overestimate the benefits to older White Americans by 14% relative to using a race/ethnicity-specific modeling approach.
DISCUSSION: Policy analyses incorporating race/ethnicity-specific concentration-response functions and mortality data relative to nondifferentiated inputs underestimate the overall magnitude of PM2.5 mortality burden and the disparity in impacts on older Black American populations. Based on our results, we recommend that the best available race/ethnicity-specific inputs are used in regulatory assessments to understand and reduce environmental injustices. https://doi.org/10.1289/EHP9001.

8. **Are There Heterogeneous Impacts of Air Pollution on Mental Health?** Hu Q, Feng Y, Xu M. Front Public Health. 2021 Nov 19;9:780022. doi: 10.3389/fpubh.2021.780022. eCollection 2021.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8640523/
Many studies reveal that air pollution is related to mental health. However, the level of impact and the regulatory mechanism of air pollution on different types of mental health are unknown. This paper examines the heterogeneous impact and mediating mechanisms of air pollution on

mental health based on data of 51 countries from 2010 to 2017 by using panel Tobit random effect model, mediating effect model, and bootstrap test. The findings show that, firstly, there is heterogeneous impact of air pollution on different types of mental health. Specifically, air pollution has a significant positive impact on depression; and the impacts on happiness and anxiety are closely related to income level. Secondly, the heterogeneous impact of air pollution on mental health is contingent on income levels. Thirdly, the heterogeneous impacts under different income levels are exacerbated by different levels of education and population density. Lastly, the mediating effect of physical health on different types of mental health is also heterogeneous. To be specific, the effects of air pollution on depression and anxiety are partly mediated by physical health; whereas the effect on happiness is not. These findings contribute to the understanding of air pollution on public health, and have significant implication for social and public health policy makers.

9. **Exposure to air pollution is associated with an increased risk of metabolic dysfunction-associated fatty liver disease.** Guo B et al. J Hepatol. 2021 Oct 26:S0168-8278(21)02153-X. doi: 10.1016/j.jhep.2021.10.016. Online ahead of print.
https://www.journal-of-hepatology.eu/article/S0168-8278(21)02153-X/fulltext
RESULTS: Increased exposure levels to all four air pollutants were significantly associated with increased odds of MAFLD, with odds ratios (ORs) of 1.13 (95% CI, 1.10-1.17), 1.29 (1.25-1.34), 1.11 (1.09-1.14), and 1.15 (1.12-1.17) for each 10 µg/m3 increase in PM1, PM2.5, PM10, and NO2, respectively. Further stratified analyses revealed that individuals who are male, alcohol drinkers, and current and previous smokers, those who consume a high-fat diet, and those with central obesity experience more significant adverse effects of AP than other individuals.
CONCLUSIONS: This study provides evidence that long-term exposure to ambient PM1, PM2.5, PM10, and NO2 may increase the odds of MAFLD in the real world. These effects may be exacerbated by unhealthy lifestyle habits, central obesity, and diabetes mellitus. Further prospective studies are necessary to identify the specific pathways.
LAY SUMMARY: We conducted an epidemiologic study on the potential role of ambient air pollution in the risk of metabolic-associated fatty liver disease (MAFLD) in approximately 90 thousand adults in China. We found that long-term exposure to ambient air pollution may increase the odds of MAFLD, especially in individuals who are male, smokers, and alcohol drinkers, those who consume a high-fat diet, and those with central obesity.

WE ACT

10. **Earth Dreams: Reimagining ARPA for Health of People, Places and Planet.** Logan AC, Berman BM, Prescott SL. Int J Environ Res Public Health. 2021 Dec 3;18(23):12788. doi: 10.3390/ijerph182312788.
https://www.mdpi.com/1660-4601/18/23/12788
Bold new approaches are urgently needed to overcome global health challenges. The proposed Advanced Research Projects Agency for Health (ARPA-H) is intended to provide rapid health breakthroughs. While new technologies for earlier disease detection and more effective treatment are critical, we urge equal attention be given to the wider (physical, emotional, social, political, and economic) environmental ecosystems driving the non-communicable

disease (NCD) crisis in the first place. This requires an integrated, cross-sectoral vision that spans the interwoven connections affecting health across the scales of people, places, and planet. This wider "exposome" perspective considers biopsychosocial factors that promote resilience and reduce vulnerabilities of individuals and communities over time-the many variables driving health disparities. Since life course health is strongly determined by early life environments, early interventions should be prioritized as a matter of effectiveness and social justice. Here, we explore the origins of the Advanced Research Project Agency and point to its potential to build integrated solutions, with wisdom and ethical value systems as a compass. Since the planned ARPA-H is anticipated to spawn international collaborations, the imagined concept is of relevance to a broad audience of researchers. With appropriate input, the quest for health equity through personalized, precision medicine while deconstructing unacceptable structural inequities may be accelerated.

11. **Climate Change and Human Health ECHO: Global Telementoring for Health Professionals.**
Katzman JG et al. J Med Educ Curric Dev. 2021 Nov 26;8:23821205211061019. doi: 10.1177/23821205211061019. eCollection 2021 Jan-Dec.
https://journals.sagepub.com/doi/full/10.1177/23821205211061019
OBJECTIVE: To increase the knowledge and communication skills of health professionals related to climate change and human health (CCHH).
METHODS: From February to April 2021, Project ECHO (Extension for Community Healthcare Outcomes) created an 8-week, synchronous and virtual, CCHH ECHO telementoring series for health professionals. Didactics, simulated cases, and climate change tools were used to educate the interprofessional group of participants.
RESULTS: During this CCHH ECHO pilot series, 625 unique participants represented 45 US states and 25 countries. The participants reported that they increased their knowledge, skills, and communication techniques regarding climate change and health.
CONCLUSIONS: The human health effects of climate change is an emerging field, and increasing knowledge and communication skills among health practitioners is of critical importance. The CCHH ECHO is one potential platform that may reach a diverse community of health professionals globally due to the diffusion and demonopolization of knowledge.

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News

Climate change and the right to health of people with disabilities. Stein PJS, Stein MA. Lancet Glob Health. 2021 Dec 2:S2214-109X(21)00542-8. doi: 10.1016/S2214-109X(21)00542-8. Online ahead of print.

Climate change, health and armed conflict: the links that still need making. van Bergen L, Birch M. Med Confl Surviv. 2021 Dec;37(4):257-259. doi: 10.1080/13623699.2021.2007570.

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