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COVID-19

1. **Personal protective equipment (PPE) pollution associated with the COVID-19 pandemic along the coastline of Agadir, Morocco.** Haddad MB, De-la-Torre GE, Abelouah MR, Hajji S, Alla AA. Sci Total Environ. 2021 Jul 27;798:149282. doi: 10.1016/j.scitotenv.2021.149282. Online ahead of print.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8313889/
The increasing use of personal protective equipment (PPE) as a sanitary measure against the new coronavirus (SARS-CoV-2) has become a significant source of many environmental risks. The majority of the governments enforce the use of PPE in public areas, such as beaches. Thus, the use and disposal of PPE have compromised most solid waste management strategies, ultimately leading to the occurrence of PPE polluting the marine environment. The present study aimed to monitor the PPE pollution associated with COVID-19 along the coastline of Agadir, Morocco. In parallel, the influence of the activities carried out in each sampled beach before and after the lockdown break was reported. Overall, a total number of 689 PPE items were identified, with a mean density of 1.13×10^{-5} PPE m-2 (0-1.21×10^{-4} PPE m-2). The majority of the PPE items found were face masks (96.81%), out of which 98.4% were surgical masks and 1.6% were reusable cloth masks. The most polluted sites were the beaches with recreational activities, followed by surfing, and fishing as the main activity. Importantly, PPE density increased significantly after lockdown measures. Additionally, the discarded PPE sampled in the supralittoral zone was higher than PPE recorded in the intertidal zone. This confirms that PPE items are driven by the beachgoers during their visit. PPE items are a source of microplastic and chemical pollutants, a substrate to invasive species colonization, and a potential threat of entanglement, ingestion, and/or infection among apex predators. In the specific case of Agadir beaches, significant efforts are required to work on the lack of environmental awareness and education. It is recommended to improve beach cleaning strategies and to penalize incorrect PPE disposal. Additional alternatives may be adopted, as

the involvement of biodegradable materials in PPE manufacturing, recycling through pyrolysis, and encouraging reusable and washable masks.

2. **Uncovering the release of micro/nanoplastics from disposable face masks at times of COVID-19.** Morgana S, Casentini B, Amalfitano S. J Hazard Mater. 2021 Jun 26;419:126507. doi: 10.1016/j.jhazmat.2021.126507. Online ahead of print.
   https://www.sciencedirect.com/science/article/pii/S0304389421014722
   Wearing face masks is a fundamental prevention and control measure to limit the spread of COVID-19. The universal use and improper disposal of single-use face masks are raising serious concerns for their environmental impact, owing to the foregone contribution to plastic water pollution during and beyond the pandemic. This study aims to uncover the release of micro/nanoplastics generated from face mask nonwoven textiles once discarded in the aquatic environment. As assessed by microscopy and flow cytometry, the exposure to different levels of mechanical stress forces (from low to high shear stress intensities) was proved effective in breaking and fragmenting face mask fabrics into smaller debris, including macro-, micro-, and nano-plastics. Even at the low level of fabric deterioration following the first second of treatment, a single mask could release in water thousands of microplastic fibers and up to 108 submicrometric particles, mostly comprised in the nano-sized domain. By contributing to the current lack of knowledge regarding the potential environmental hazards posed by universal face masking, we provided novel quantitative data, through a suitable technological approach, on the release of micro/nanoplastics from single-use face masks that can threaten the aquatic ecosystems to which they finally end-up.

3. **Improving Patient Outcomes in the Dual Crises of Climate Change and COVID-19: Proceedings of the Third Annual Clinical Climate Change Meeting, January 8, 2021.** Senay E, Galvez M, Thanik E, Zajac L, Sheffield P, Wright R, Bernstein A, Salas R, Bernstein A, Shephard P, Salas R, Rizzo A, Sherman J, Sherman J, Richardson L, Richardson L, Butts G, Marwah H, Solomon C, Pezeshki G, Lee A, Wright R. J Occup Environ Med. 2021 Aug 4. doi: 10.1097/JOM.0000000000002345. Online ahead of print.
   https://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=ovft&AN=00043764-900000000-97798&PDF=y
   The tremendous global toll of the COVID-19 pandemic does not fall equally on all populations. Indeed, this crisis has exerted more severe impacts on the most vulnerable communities, spotlighting the continued consequences of longstanding structural, social, and healthcare inequities. This disparity in COVID-19 parallels the unequal health consequences of climate change, whereby underlying inequities perpetuate adverse health outcomes disproportionately among vulnerable populations. As these two crises continue to unfold, there is an urgent need for healthcare practitioners to identify and implement solutions to mitigate adverse health outcomes, especially in the face of global crises. To support this need, the 2021 Clinical Climate Change Conference held a virtual meeting to discuss the implications of the convergence of the climate crisis and COVID-19, particularly for vulnerable patient populations and the clinicians who care for them. Presenters and panelists provided evidence-based solutions to help health professionals improve and adapt their practice to these evolving scenarios. Together, participants explored community health system and national solutions to reduce the impacts of

COVID-19 and the climate crisis, to promote community advocacy, and to foster new partnerships between community and healthcare leaders to combat systemic racism and achieve a more just and equitable society.

4. **Human Cooperation and the Crises of Climate Change, COVID-19, and Misinformation.** Van Lange PAM, Rand DG. Annu Rev Psychol. 2021 Aug 2. doi: 10.1146/annurev-psych-020821-110044. Online ahead of print.
Contemporary society is facing many social dilemmas-including climate change, COVID-19, and misinformation-characterized by a conflict between short-term self-interest and longer-term collective interest. The climate crisis requires paying costs today to benefit distant others (and oneself) in the future. The COVID-19 crisis requires the less vulnerable to pay costs to benefit the more vulnerable in the face of great uncertainty. The misinformation crisis requires investing effort to assess truth and abstain from spreading attractive falsehoods. Addressing these crises requires an understanding of human cooperation. To that end, we present (a) an overview of mechanisms for the evolution of cooperation, including mechanisms based on similarity and interaction; (b) a discussion of how reputation can incentivize cooperation via conditional cooperation and signaling; and (c) a review of social preferences that undergird the proximate psychology of cooperation, including positive regard for others, parochialism, and egalitarianism. We discuss the three focal crises facing our society through the lens of cooperation, emphasizing how cooperation research can inform our efforts to address them.

5. **The SARS-CoV-2 (COVID-19) pandemic in hospital: An insight into environmental surfaces contamination, disinfectants' efficiency, and estimation of plastic waste production.** Faezeh Seif, Noorimotlagh Z, Mirzaee SA, Kalantar M, Barati B, Fard ME, Fard NK. Environ Res. 2021 Jul 29;202:111809. doi: 10.1016/j.envres.2021.111809. Online ahead of print.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8320441/
The current COVID-19 pandemic that is caused by SARS-CoV-2 has led all the people around the globe to implement preventive measures such as environmental cleaning using alcohol-based materials, and social distancing in order to prevent and minimize viral transmission via fomites. The role of environmental surface contamination in viral transmission in within hospital wards is still debatable, especially considering the spread of new variants of the virus in the world. The present comprehensive study aims to investigate environmental surface contamination in different wards of a hospital as well as the efficacy of two common disinfectants for virus inactivation, and tries to produce an estimate of plastic residue pollution as an environmental side effect of the pandemic. With regard to environmental surface contamination, 76 samples were taken from different wards of the hospital, from which 40 were positive. These samples were taken from contaminated environmental surfaces such as patient bed handles, the nursing station, toilet door handles, cell phones, patient toilet sinks, toilet bowls, and patient's pillows, which are regularly-touched surfaces and can pose a high risk for transmission of the virus. The number of positive samples also reveals that SARS-CoV-2 can survive on inanimate surfaces after disinfection by ethanol 70 % and sodium hypochlorite (0.001 %). The results correspond to the time that the VOC 202012/01 (lineage B.1.1.7) had emerged in the hospital and this should be considered that this variant could possibly have different traits, characteristics, and level of persistence in the environment. The plastic waste as an

environmental side effect of the pandemic was also investigated and it was confirmed that the amount of plastic residue for a single (RT) PCR confirmatory test for COVID-19 diagnosis is 821.778 g of plastic residue/test. As a result, it is recommended that for improving plastic waste management programs, considering challenges such as minimizing plastic waste pollution, optimization of gas control technologies in incinerators, process redesign, reduction of single-use plastics and PPE, etc. Is of utmost importance.

6. **Electronic waste pollution and the COVID-19 pandemic.** Dutta D, Arya S, Kumar S, Lichtfouse E. Environ Chem Lett. 2021 Jul 27:1-4. doi: 10.1007/s10311-021-01286-9. Online ahead of print. https://link.springer.com/article/10.1007/s10311-021-01286-9
How waste will be managed in the future? Will humans be able to design zero-waste products and systems, or will there be a continuous urban mining to recycle waste in the circular economy? Here, new insights have been recently provided by the COVID-19 pandemic, which has somehow accelerated society evolution and thus provided a glimpse at what might happen in the future. In particular, lockdowns have suddenly amplified working from home with computers, increased the amount plastic and paper packages and decreased waste transportations. Here, we discuss issues of electronic waste (E-waste) pollution, toxicity and urban mining.

7. **Effect of Environmental Pollutants PM2.5, CO, NO(2), and O(3) on the Incidence and Mortality of SARS-CoV-2 Infection in Five Regions of the USA.** Meo SA, Abukhalaf AA, Alessa OM, Alarifi AS, Sami W, Klonoff DC. Int J Environ Res Public Health. 2021 Jul 23;18(15):7810. doi: 10.3390/ijerph18157810.
https://www.mdpi.com/1660-4601/18/15/7810
In recent decades, environmental pollution has become a significant international public problem in developing and developed nations. Various regions of the USA are experiencing illnesses related to environmental pollution. This study aims to investigate the association of four environmental pollutants, including particulate matter ($PM_{2.5}$), carbon monoxide (CO), Nitrogen dioxide (NO_2), and Ozone (O_3), with daily cases and deaths resulting from SARS-CoV-2 infection in five regions of the USA, Los Angeles, New Mexico, New York, Ohio, and Florida. The daily basis concentrations of $PM_{2.5}$, CO, NO_2, and O_3 were documented from two metrological websites. Data were obtained from the date of the appearance of the first case of (SARS-CoV-2) in the five regions of the USA from 13 March to 31 December 2020. Regionally (Los Angeles, New Mexico, New York, Ohio, and Florida), the number of cases and deaths increased significantly along with increasing levels of $PM_{2.5}$, CO, NO_2 and O_3 ($p < 0.05$), respectively. The Poisson regression results further depicted that, for each 1 unit increase in $PM_{2.5}$, CO, NO_2 and O_3 levels, the number of SARS-CoV-2 infections significantly increased by 0.1%, 14.8%, 1.1%, and 0.1%, respectively; for each 1 unit increase in CO, NO_2, and O_3 levels, the number of deaths significantly increased by 4.2%, 3.4%, and 1.5%, respectively. These empirical estimates demonstrate an association between the environmental pollutants $PM_{2.5}$, CO, NO_2, and O_3 and SARS-CoV-2 infections, showing that they contribute to the incidence of daily cases and daily deaths in the five different regions of the USA. These findings can inform health policy decisions about combatting the COVID-19 pandemic outbreak in these USA regions and internationally by supporting a reduction in environmental pollution.

8. **Greenness, air pollution, and mortality risk: A U.S. cohort study of cancer patients and survivors.** Coleman CJ, Yeager RA, Riggs DW, Coleman NC, Garcia GR, Bhatnagar A, Pope CA. Environ Int. 2021 Jul 29;157:106797. doi: 10.1016/j.envint.2021.106797. Online ahead of print. https://www.sciencedirect.com/science/article/pii/S0160412021004220
BACKGROUND: Several studies suggest that living in areas of high surrounding greenness may be associated with a lower cardiopulmonary mortality risk. However, associations of greenness with specific causes of death in cancer patients and survivors has not been examined and it is unknown whether this relationship is affected by area levels of fine particulate matter air pollution (PM2.5). This study evaluated associations between greenness and PM2.5 on causes of death in a large, U.S.-based cohort of cancer patients and survivors.
METHODS: Surveillance, Epidemiology and End Results (SEER) data were used to generate a cohort of 5,529,005 cancer patients and survivors from 2000 to 2016. Census-tract Normalized Difference Vegetation Index (NDVI) during May-October from 2003 to 2016 was population-weighted to act as a county-level greenness measure. County-level PM2.5 exposure was estimated from annual concentrations averaged from 1999 to 2015. Cox Proportional Hazards models were used to estimate the association between greenness, PM2.5, and cause-specific mortality while controlling for age, sex, race, and other individual and county level variables.
FINDINGS: An IQR increase in greenness was associated with a decrease in cancer mortality for cancer patients (Hazard ratio of 0.94, 95% CI: 0.93-0.95), but not for cardiopulmonary mortality (0.98, 95% CI: 0.96-1.00). Inversely, an increase in 10 μg/m3 PM2.5 was associated with increased cardiopulmonary mortality (1.24, 95% CI: 1.19-1.29), but not cancer mortality (0.99, 95% CI: 0.97-1.00). Hazard ratios were robust to inclusion of PM2.5 in models with greenness and vice versa. Although exposure estimates were constant over most stratifications, greenness seemed to benefit individuals diagnosed with high survivability cancers (0.92, 95% CI: 0.90-0.95) more than those with low survivability cancers (0.98. 95% CI: 0.96-0.99).
INTERPRETATION: Higher levels of greenness are associated with lower cancer mortality in cancer patients. The evidence suggests minimal confounding between greenness and PM2.5 exposures and risk of mortality.

9. **Environmental exposure to metals and the risk of high blood pressure: a cross-sectional study from NHANES 2015-2016.** Rahman HH, Niemann D, Munson-McGee SH. Environ Sci Pollut Res Int. 2021 Jul 31. doi: 10.1007/s11356-021-15726-0. Online ahead of print.
Exposure to metal pollution can be caused from inhalation, ingestion, or absorption from air, water, or food. Chronic exposure to trace amounts of metals can lead to high blood pressure, or hypertension, and other chronic diseases. The rationale of our study was to determine if there was a correlation between nineteen forms of urinary metal concentrations and high blood pressure, defined as ≥ 130 mm Hg systolic or ≥ 80 mm Hg diastolic, in the adult US population, to understand the possible impacts of metal exposure on humans. Five types of urinary arsenic species and fourteen types of urinary metals were studied to examine their correlation with high blood pressure. We used the dataset from the 2015-2016 National Health and Nutrition Examination Survey (NHANES) for the study. A specialized complex survey design analysis

package was used in analyzing the NHANES data. We used pairwise t tests and the logit regression models to study the correlation between urinary arsenic (five types) and urinary metal (fourteen types) concentrations and high blood pressure. The total study population analyzed included 4037 adults aged 20 years and older, of whom 57.9% of males and 51.7% of females had high blood pressure. Urinary arsenous acid (OR: 2.053, 95% CI: 1.045, 4.035), tin (OR: 1.983, 95% CI: 1.169, 3.364), and cesium (OR: 2.176, 95% CI: 1.013, 4.675) were associated with increased odds of high blood pressure. The other four types of urinary arsenic and twelve types of urinary metals were not associated with high blood pressure. Our results determined that exposure to environmental metals such as arsenous acid, tin, and cesium can be associated with high blood pressure. Further investigation is suggested to support our findings.

10. **Ambient air pollution and ovarian cancer survival in California.** Villanueva C, Chang J, Ziogas A, Bristow RE, Vieira VM. Gynecol Oncol. 2021 Jul 27:S0090-8258(21)00602-8. doi: 10.1016/j.ygyno.2021.07.036. Online ahead of print.
OBJECTIVE: To examine whether exposure to ambient ozone, particulate matter with diameter less than 2.5 μm (PM2.5), nitrogen dioxide (NO2), and distance to major roadways (DTR) impact ovarian cancer-specific survival, while considering differences by stage, race/ethnicity, and socioeconomic status.
METHODS: Women diagnosed with epithelial ovarian cancer from 1996 to 2014 were identified through the California Cancer Registry and followed through 2016. Women's geocoded addresses were linked to pollutant exposure data and averaged over the follow-up period. Pollutants were considered independently and in multi-pollutant models. Cox proportional hazards models assessed hazards of disease-specific death due to environmental exposures, controlling for important covariates, with additional models stratified by stage at diagnosis, race/ethnicity and socioeconomic status.
RESULTS: PM2.5 and NO2, but not ozone or DTR, were significantly associated with survival in univariate models. In a multi-pollutant model for PM2.5, ozone, and DTR, an interquartile range increase in PM2.5 (Hazard Ratio [HR], 1.45; 95% Confidence Interval [CI], 1.41-1.49) was associated with worse prognosis. Similarly, in the multi-pollutant model with NO2, ozone, and DTR, women with higher NO2 exposures (HR for 20.0-30.0 ppb, 1.30; 95% CI, 1.25-1.36 and HR for >30.0 ppb, 2.48; 95% CI, 2.32-2.66) had greater mortality compared to the lowest exposed (<20.0 ppb). Stratified results show the effects of the pollutants differed by race/ethnicity and were magnified among women diagnosed in early stages.
CONCLUSIONS: Our analyses suggest that greater exposure to NO2 and PM2.5 may adversely impact ovarian cancer-specific survival, independent of sociodemographic and treatment factors. These findings warrant further study.

11. **Hourly air pollution exposure and emergency department visit for acute myocardial infarction: Vulnerable populations and susceptible time window.** Cheng J, Tong S, Su H, Xu Z. Environ Pollut. 2021 Jul 16;288:117806. doi: 10.1016/j.envpol.2021.117806. Online ahead of print.
Although short-term exposure to air pollution can trigger sudden heart attacks, evidence is scarce regarding the relationship between sub-daily changes in air pollution level and the risk of acute myocardial infarction (AMI). Here we assessed the intraday effect of air pollution on AMI

risk and potential effect modification by pre-existing cardiac risk factors. Hourly data on emergency department visits (EDVs) for AMI and air pollutants in Brisbane, Australia during 2013-2015 were acquired from pertinent government departments. A time-stratified case-crossover analysis was adopted to examine relationships of AMI risk with hourly changes in particulate matters (aerodynamic diameter ≤ 2.5 μm (PM2.5) and ≤10 μm (PM10)) and gaseous pollutants (ozone and nitrogen dioxide) after adjusting for potential confounders. We also conducted stratified analyses according to age, gender, disease history, season, and day/night time exposure. Excess risk of AMI per 10 μg/m3 increase in air pollutant concentration was reported at four time windows: within 1, 2-6, 7-12, and 13-24 h. Both single- and multi-pollutant models found an elevated risk of AMI within 2-6 h after exposure to PM2.5 (excessive risk: 12.34%, 95% confidence interval (CI): 1.44%-24.42% in single-pollutant model) and PM10 within 1 h (excessive risk: 5.21%, 95% CI: 0.26%-10.40% in single-pollutant model). We did not find modification effect by age, gender, season or day/night time, except that PM2.5 had a greater effect on EDVs for AMI during night-time than daytime. Our findings suggest that AMI risk could increase within hours after exposure to particulate matters.

12. **The mortality cost of carbon.** Bressler RD. Nat Commun. 2021 Jul 29;12(1):4467. doi: 10.1038/s41467-021-24487-w.
https://www.nature.com/articles/s41467-021-24487-w
Many studies project that climate change can cause a significant number of excess deaths. Yet, in integrated assessment models (IAMs) that determine the social cost of carbon (SCC) and prescribe optimal climate policy, human mortality impacts are limited and not updated to the latest scientific understanding. This study extends the DICE-2016 IAM to explicitly include temperature-related mortality impacts by estimating a climate-mortality damage function. We introduce a metric, the mortality cost of carbon (MCC), that estimates the number of deaths caused by the emissions of one additional metric ton of CO2. In the baseline emissions scenario, the 2020 MCC is 2.26×10^{-4} [low to high estimate -1.71×10^{-4} to 6.78×10^{-4}] excess deaths per metric ton of 2020 emissions. This implies that adding 4,434 metric tons of carbon dioxide in 2020-equivalent to the lifetime emissions of 3.5 average Americans-causes one excess death globally in expectation between 2020-2100. Incorporating mortality costs increases the 2020 SCC from $37 to $258 [-$69 to $545] per metric ton in the baseline emissions scenario. Optimal climate policy changes from gradual emissions reductions starting in 2050 to full decarbonization by 2050 when mortality is considered.

13. **Association of ambient air pollution with depressive and anxiety symptoms in pregnant women: A prospective cohort study.** Lamichhane DK, Jung DY, Shin YJ, Lee KS, Lee SY, Ahn K, Kim KW, Shin YH, Suh DI, Hong SJ, Kim HC. Int J Hyg Environ Health. 2021 Aug 5;237:113823. doi: 10.1016/j.ijheh.2021.113823. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S1438463921001383
BACKGROUND: Air pollution is associated with depressive and anxiety symptoms in the general population. However, this relationship among pregnant women remains largely unknown.
OBJECTIVE: To evaluate the association between pregnancy air pollution exposure and maternal depressive and anxiety symptoms during the third trimester assessed using the Center for Epidemiologic Studies-Depression and State-Trait Anxiety Inventory scales, respectively.

METHODS: We analyzed 1481 pregnant women from a cohort study in Seoul. Maternal exposure to particulate matter with an aerodynamic diameter <2.5 μm (PM2.5) and <10 μm (PM10), as well as to nitrogen dioxide (NO2) and ozone (O3) for each trimester and the entire pregnancy was assessed at participant's residential address by land use regression models. We estimated the relative risk (RR) and corresponding confidence interval (CI) of the depressive and anxiety symptoms associated with an interquartile range (IQR) increase in PM2.5, PM10, NO2, and O3 using modified Poisson regression.

RESULTS: In single-pollutant models, an IQR increase in PM2.5, PM10, and NO2 during the second trimester was associated with an increased risk of depressive symptoms (PM2.5 RR = 1.15, 95% CI: 1.04, 1.27; PM10 RR = 1.13, 95% CI: 1.04, 1.23; NO2 RR = 1.15, 95% CI: 1.03, 1.29) after adjusting for relevant covariates. Similarly, an IQR increase in O3 during the third trimester was associated with an increased risk of depressive symptoms (RR = 1.09, 95% CI: 1.01, 1.18), while the IQR increase in O3 during the first trimester was associated with a decreased risk (RR = 0.89, 95% CI: 0.82, 0.96). Exposure to PM2.5, PM10, and NO2 during the second trimester was significantly associated with anxiety symptoms. The associations with PM2.5 and O3 in single-and multi-pollutant models were consistent.

CONCLUSIONS: Our findings indicate that increased levels of particulate matter, NO2, and O3 during pregnancy may elevate the risk of depression or anxiety in pregnant women.

14. **Is air pollution linked with poor response to biologics?** Zhao N, Bernatsky S. Nat Rev Rheumatol. 2021 Aug 4. doi: 10.1038/s41584-021-00681-4. Online ahead of print.
Limited data suggest associations between air pollution and rheumatic disease risk and outcomes. More sophisticated research is needed to clarify the conditions under which air pollution might influence the health of people with rheumatic disease, including their response to biologic drugs.

15. **The Environmental Role of Hydration in Kidney Health and Disease.** Nerbass FB, Pecoits-Filho R, Calice-Silva V. Contrib Nephrol. 2021 Aug 4;199:1-14. doi: 10.1159/000517712. Online ahead of print.
Clinical Background: Hydration status, which is influenced by environment and self-behavior is associated with kidney health and disease. Epidemiology: Lack of safe water, sanitation, and high temperatures are environmental issues that affect a significant part of the worldwide population. Occupational factors that discourage proper hydration, as well as low water intake in favorable environment conditions, are also highly prevalent. As a consequence, inadequate water intake can lead to several kidney problems ranging from uncomplicated urinary tract infections to kidney stones, acute kidney injury, and chronic disorders with high mortality rates. Challenges: Increasing water intake is an individual effort when self-behavior is the main reason for inadequate hydration status. When the environment is an obstacle, it might require complex changes in a concerted multidisciplinary effort from employers, health authorities, researchers, and governments. Prevention and Treatment: Strategies can be implemented at global, local, and individual levels. Global efforts include actions to decrease poverty and climate change consequences, while increasing access to safe water and sanitation. Local actions can improve working conditions and access to water and toilets to workers. At an

individual level, self-monitoring through regular observation of thirst sensation, acute weight loss, urine frequency, and urine color are recommended tools to monitor hydration status.

16. **Factors That Influence Climate Change-Related Mortality in the United States: An Integrative Review.** McDermott-Levy R, Scolio M, Shakya KM, Moore CH. Int J Environ Res Public Health. 2021 Aug 3;18(15):8220. doi: 10.3390/ijerph18158220.
https://www.mdpi.com/1660-4601/18/15/8220
Global atmospheric warming leads to climate change that results in a cascade of events affecting human mortality directly and indirectly. The factors that influence climate change-related mortality within the peer-reviewed literature were examined using Whittemore and Knafl's framework for an integrative review. Ninety-eight articles were included in the review from three databases-PubMed, Web of Science, and Scopus-with literature filtered by date, country, and keywords. Articles included in the review address human mortality related to climate change. The review yielded two broad themes in the literature that addressed the factors that influence climate change-related mortality. The broad themes are environmental changes, and social and demographic factors. The meteorological impacts of climate change yield a complex cascade of environmental and weather events that affect ambient temperatures, air quality, drought, wildfires, precipitation, and vector-, food-, and water-borne pathogens. The identified social and demographic factors were related to the social determinants of health. The environmental changes from climate change amplify the existing health determinants that influence mortality within the United States. Mortality data, national weather and natural disaster data, electronic medical records, and health care provider use of International Classification of Disease (ICD) 10 codes must be linked to identify climate change events to capture the full extent of climate change upon population health.

17. **Future global urban water scarcity and potential solutions.** He C, Liu Z, Wu J, Pan X, Fang Z, Li J, Bryan BA. Nat Commun. 2021 Aug 3;12(1):4667. doi: 10.1038/s41467-021-25026-3.
https://www.nature.com/articles/s41467-021-25026-3
Urbanization and climate change are together exacerbating water scarcity-where water demand exceeds availability-for the world's cities. We quantify global urban water scarcity in 2016 and 2050 under four socioeconomic and climate change scenarios, and explored potential solutions. Here we show the global urban population facing water scarcity is projected to increase from 933 million (one third of global urban population) in 2016 to 1.693-2.373 billion people (one third to nearly half of global urban population) in 2050, with India projected to be most severely affected in terms of growth in water-scarce urban population (increase of 153-422 million people). The number of large cities exposed to water scarcity is projected to increase from 193 to 193-284, including 10-20 megacities. More than two thirds of water-scarce cities can relieve water scarcity by infrastructure investment, but the potentially significant environmental trade-offs associated with large-scale water scarcity solutions must be guarded against.

18. **Air Pollution and Kidney Diseases: PM2.5 as an Emerging Culprit.** An Y, Liu ZH. Contrib Nephrol. 2021 Aug 3;199:1-11. doi: 10.1159/000517710. Online ahead of print.

Clinical Background: As a result of modern industrialization, air pollution has become a potential contributor to global burden of noncommunicable diseases, such as cardiovascular disease, respiratory disease, and kidney disease. Epidemiology: Emerging epidemiological evidence has demonstrated that exposure to ambient air pollution is associated with an increased risk for the development and progression of chronic kidney disease (CKD) and CKD-related mortality. Exposure to PM2.5, even at relatively low concentrations, is a risk factor for a lower estimated glomerular filtration rate and a faster decline in glomerular filtration rate. It has been estimated that the global burden of CKD attributable to PM2.5 is 6.95 million incident cases of CKD per year. Low- and middle-income countries in the Eastern Mediterranean and South-East Asia regions experienced the highest urban air pollution levels, thus facing a heavier burden of related disease. Challenges: Despite a growing awareness of kidney damage related to air pollution, large gaps still exist between the exact toxicological effect of particles on the kidney and the increasing prevalence of air pollution-related kidney diseases. Considering the geographic variation of air pollution, more longitudinal studies in different parts of the world are urgently needed, especially in those most affected countries. Prevention and Treatment: Air pollution control should be regarded as a high priority in urban plan and policy making. Actions are required to narrow gaps in knowledge and clean air, thus preventing air pollution-related kidney disease.

19. **Air pollution and multiple sclerosis: a comprehensive review.** Abbaszadeh S, Tabary M, Aryannejad A, Abolhasani R, Araghi F, Khaheshi I, Azimi A. Neurol Sci. 2021 Aug 3. doi: 10.1007/s10072-021-05508-4. Online ahead of print.
Multiple sclerosis (MS) is an inflammatory, autoimmune demyelinating disorder of the central nervous system (CNS), leading to progressive functional impairments, and many intrinsic and acquired factors are believed to be associated with its development and relapse. In terms of environmental factors, air pollution has gained much attention during recent decades, as chronic exposure to ambient air pollution seems to increase the level of some pro-inflammatory markers in the human brain, which can lead to neuroinflammation, neurodegeneration, and blood-brain barrier (BBB) breakdown. These events may also be associated with the risk of MS development and relapse. In this review, we aimed to summarize recent findings around the impact of air pollutants, including particulate matter (PM10, PM2.5, and ultra-fine particles), gaseous pollutants (carbon monoxide [CO], nitrogen oxides [NOx], sulfur dioxide [SO2], and ozone [O3]), and heavy metals, on MS development and relapse.

20. **Effects of Environmental Worry on Fruit and Vegetable Intake.** Zheng L, Luszczynska A, Miao M, Chen Y, Gan Y. Int J Behav Med. 2021 Aug 2. doi: 10.1007/s12529-021-10012-2. Online ahead of print.
BACKGROUND: Environmental worry, a response to environmental pollution, is a well-established predictor of pro-environmental behaviors. However, its relationship with health-promoting behaviors, such as fruit and vegetable intake (FVI), is unclear. In three studies, we explored the associations between environmental worry, behavioral intention, and FVI. METHOD: Study 1, enrolling 358 company trainees who provided their data at Time 1 (T1) and Time 2 (T2; a 2-month follow-up), examined the relationship between environmental worry and FVI. Study 2, enrolling 226 employees providing their data at T1 and T2 (a 2-month follow-up),

examined the mediating effects of intention in the relationship between environmental worry and FVI using a cross-lagged design. In study 3, data from 217 participants were collected three times over a period of 4 months. We re-examined the mediating effect of intention and further explored the moderating effect of future focus.

RESULTS: Environmental worry predicted beneficial changes in FVI (studies 1, 2, and 3). Environmental worry predicted FVI through intention (studies 2 and 3). The mediating effect of intention on the relationship between environmental worry and FVI was moderated by future focus: individuals with high environmental worry formed stronger intention when they also reported a strong future focus (study 3).

CONCLUSIONS: Our findings provide novel evidence for the direct and indirect links between environmental worry and health-promoting behavior (i.e., FVI).

21. **Fine Particulate Matter and Dementia Incidence in the Adult Changes in Thought Study.**
Shaffer RM, Blanco MN, Li G, Adar SD, Carone M, Szpiro AA, Kaufman JD, Larson TV, Larson EB, Crane PK, Sheppard L. Environ Health Perspect. 2021 Aug;129(8):87001. doi: 10.1289/EHP9018. Epub 2021 Aug 4.
Comment in
    doi: 10.1289/EHP9605.
https://ehp.niehs.nih.gov/doi/10.1289/EHP9018
BACKGROUND: Air pollution may be associated with elevated dementia risk. Prior research has limitations that may affect reliability, and no studies have evaluated this question in a population-based cohort of men and women in the United States.

OBJECTIVES: We evaluated the association between time-varying, 10-y average fine particulate matter (PM2.5) exposure and hazard of all-cause dementia. An additional goal was to understand how to adequately control for age and calendar-time-related confounding through choice of the time axis and covariate adjustment.

METHODS: Using the Adult Changes in Thought (ACT) population-based prospective cohort study in Seattle, we linked spatiotemporal model-based PM2.5 exposures to participant addresses from 1978 to 2018. Dementia diagnoses were made using high-quality, standardized, consensus-based protocols at biennial follow-ups. We conducted multivariable Cox proportional hazards regression to evaluate the association between time-varying, 10-y average PM2.5 exposure and time to event in a model with age as the time axis, stratified by apolipoprotein E (APOE) genotype, and adjusted for sex, education, race, neighborhood median household income, and calendar time. Alternative models used calendar time as the time axis.

RESULTS: We report 1,136 cases of incident dementia among 4,166 individuals with nonmissing APOE status. Mean [mean ± standard deviation (SD)] 10-y average PM2.5 was 10.1 (±2.9) μg/m3. Each 1-μg/m3 increase in the moving average of 10-y PM2.5 was associated with a 16% greater hazard of all-cause dementia [1.16 (95% confidence interval: 1.03, 1.31)]. Results using calendar time as the time axis were similar.

DISCUSSION: In this prospective cohort study with extensive exposure data and consensus-based outcome ascertainment, elevated long-term exposure to PM2.5 was associated with increased hazard of all-cause dementia. We found that optimal control of age and time confounding could be achieved through use of either age or calendar time as the time axis in

our study. Our results strengthen evidence on the neurodegenerative effects of PM2.5. https://doi.org/10.1289/EHP9018.

22. **Monetizing the Burden of Childhood Asthma Due to Traffic Related Air Pollution in the Contiguous United States in 2010.** Farrukh M, Khreis H. Int J Environ Res Public Health. 2021 Jul 25;18(15):7864. doi: 10.3390/ijerph18157864.
https://www.mdpi.com/1660-4601/18/15/7864
BACKGROUND: Traffic-related air pollution (TRAP) refers to the wide range of air pollutants emitted by traffic that are dispersed into the ambient air. Emerging evidence shows that TRAP can increase asthma incidence in children. Living with asthma can carry a huge financial burden for individuals and families due to direct and indirect medical expenses, which can include costs of hospitalization, medical visits, medication, missed school days, and loss of wages from missed workdays for caregivers.
OBJECTIVE: The objective of this paper is to estimate the economic impact of childhood asthma incident cases attributable to nitrogen dioxide (NO2), a common traffic-related air pollutant in urban areas, in the United States at the state level.
METHODS: We calculate the direct and indirect costs of childhood asthma incident cases attributable to NO2 using previously published burden of disease estimates and per person asthma cost estimates. By multiplying the per person indirect and direct costs for each state with the NO2-attributable asthma incident cases in each state, we were able to estimate the total cost of childhood asthma cases attributable to NO2 in the United States.
RESULTS: The cost calculation estimates the total direct and indirect annual cost of childhood asthma cases attributable to NO2 in the year 2010 to be $178,900,138.989 (95% CI: $101,019,728.20-$256,980,126.65). The state with the highest cost burden is California with $24,501,859.84 (95% CI: $10,020,182.62-$38,982,261.250), and the state with the lowest cost burden is Montana with $88,880.12 (95% CI: $33,491.06-$144,269.18).
CONCLUSION: This study estimates the annual costs of childhood asthma incident cases attributable to NO2 and demonstrates the importance of conducting economic impacts studies of TRAP. It is important for policy-making institutions to focus on this problem by advocating and supporting more studies on TRAP's impact on the national economy and health, including these economic impact estimates in the decision-making process, and devising mitigation strategies to reduce TRAP and the population's exposure.

23. **The Effect of Meteorological, Pollution, and Geographic Exposures on Death by Suicide: A Scoping Review.** Cornelius SL, Berry T, Goodrich AJ, Shiner B, Riblet NB. Int J Environ Res Public Health. 2021 Jul 23;18(15):7809. doi: 10.3390/ijerph18157809.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8345465/
Suicide is a significant public health concern worldwide and in the United States. Despite the far-reaching impact of suicide, risk factors are still not well understood and efforts to accurately assess risk have fallen short. Current research has highlighted how potentially modifiable environmental exposures (i.e., meteorological, pollution, and geographic exposures) can affect suicide risk. A scoping review was conducted to evaluate the strength of the historical and current literature on the environment's effect on suicide and suicide risk. Three databases (i.e., Medline, Embase, and PsychInfo) were reviewed to identify relevant studies and two authors

independently reviewed studies considering pre-determined inclusion criteria. A total of 46 meteorological studies were included as well as 23 pollution studies and 12 geographic studies. Descriptive statistics, including counts, percentages, review of studies' sample size (minimum, maximum, median, and interquartile range), were calculated using Excel and SAS 9.4. Overall, strong evidence supports that exposure to sunlight, temperature, air pollution, pesticides, and high altitude increases suicide risk, although effect sizes range from very small to small.

24. **Neuroscience and climate change: How brain recordings can help us understand human responses to climate change.** Wang S, van den Berg B. Curr Opin Psychol. 2021 Jul 10;42:126-132. doi: 10.1016/j.copsyc.2021.06.023. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S2352250X21000956
There is little published neuroscience research on the psychology of climate change. This review outlines how carefully designed experiments that measure key neural processes, linked to specific cognitive processes, can provide powerful tools to answer research questions in climate change psychology. We review relevant literature from social neuroscience that can be applicable to environmental research-the neural correlates of fairness and cooperation, altruistic behaviour and personal values-and discuss important factors when translating environmental psychology constructs to neuroscientific measurement. We provide a practical overview of how to implement environmental neuroscience using electroencephalography, summarising important event-related potential components and how they can be used to answer questions in climate change psychology. Challenges for the field include accurate attribution of findings, both within and between studies, the need for interdisciplinary collaboration, peer review and reporting processes.

25. **Greywater as a sustainable source for development of green roofs: Characteristics, treatment technologies, reuse, case studies and future developments.** Mahmoudi A, Mousavi SA, Darvishi P. J Environ Manage. 2021 Jul 3;295:112991. doi: 10.1016/j.jenvman.2021.112991. Online ahead of print.
Municipal activities are one of the most important water users worldwide; thus, the treatment and reuse of greywater for non-potable purposes helps to reduce a remarkable amount of consumed water within urban communities. To achieve greywater reuse standards, and remove surfactants, micropollutants, organic matters, microorganisms and other pollutants various methods including physical, chemical and biological processes have been used. Treated greywater can be used on site for different purposes: carwash, toilet flushing, fire protection, green roofs, green walls, non-food irrigation etc. Among them, the use of greywater is very important in the expansion of the green roofs. Green roofs offer many benefits to urban areas such as decreasing air pollution, reducing building cooling needs, promoting mental health of habitants, noise reduction and aesthetics improvement. Therefore, this article provides an overview mainly from two aspects, the possibilities of greywater reuse by studying the characteristics and available options for greywater treatment and its benefits toward the developing green roofs.

26. **Large Air Quality and Public Health Impacts due to Amazonian Deforestation Fires in 2019.** Butt EW, Conibear L, Knote C, Spracklen DV. Geohealth. 2021 Jul 1;5(7):e2021GH000429. doi: 10.1029/2021GH000429. eCollection 2021 Jul.
https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021GH000429
Air pollution from Amazon fires has adverse impacts on human health. The number of fires in the Amazon has increased in recent years, but whether this increase was driven by deforestation or climate has not been assessed. We analyzed relationships between fire, deforestation, and climate for the period 2003 to 2019 among selected states across the Brazilian Legal Amazon (BLA). A statistical model including deforestation, precipitation and temperature explained ~80% of the variability in dry season fire count across states when totaled across the BLA, with positive relationships between fire count and deforestation. We estimate that the increase in deforestation since 2012 increased the dry season fire count in 2019 by 39%. Using a regional chemistry-climate model combined with exposure-response associations, we estimate this increase in fire resulted in 3,400 (95UI: 3,300-3,550) additional deaths in 2019 due to increased exposure to particulate air pollution. If deforestation in 2019 had increased to the maximum recorded during 2003-2019, the number of active fire counts would have increased by an additional factor of 2 resulting in 7,900 (95UI: 7,600-8,200) additional premature deaths. Our analysis demonstrates the strong benefits of reduced deforestation on air quality and public health across the Amazon.

27. **Particulate Matter 2.5 and Hematological Disorders From Dust to Diseases: A Systematic Review of Available Evidence.** Fongsodsri K, Chamnanchanunt S, Desakorn V, Thanachartwet V, Sahassananda D, Rojnuckarin P, Umemura T. Front Med (Lausanne). 2021 Jul 14;8:692008. doi: 10.3389/fmed.2021.692008. eCollection 2021.
https://www.frontiersin.org/articles/10.3389/fmed.2021.692008/full
Particulate matter 2.5 (PM2.5) in the air enters the human body by diffusion into the blood. Therefore, hematological abnormalities might occur because of these toxic particles, but few studies on this issue have been reported. According to Cochrane guidance, we performed a systematic review on the relationship between exposure to PM2.5 and the risk of hematological disorders. Ten articles were included in this review. Anemia was found among children and elderly populations with 2- to 5-year PM2.5 exposure. Young children from mothers exposed to air pollution during pregnancy had a higher incidence of leukemia similar to the elderly. Supporting these data, outdoor workers also showed abnormal epigenetic modifications after exposure to very high PM2.5 levels. Adults living in high PM2.5 areas for 2 years were more likely to develop thrombocytosis. Finally, elderly populations with 7- to 8-year PM2.5 exposure showed increased risks of venous thromboembolism. In conclusion, the associations between PM2.5 and hematological aberrations among high-risk people with long-term exposure were reported.

28. **Allergies in Urban Areas on the Rise: The Combined Effect of Air Pollution and Pollen.** Gisler A. Int J Public Health. 2021 May 4;66:1604022. doi: 10.3389/ijph.2021.1604022. eCollection 2021.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8284864/
Urban populations are expanding rapidly. UN estimates suggest that by 2050, two-thirds of the world's population will live in cities [1]. In cities, green spaces are shrinking, but pollen allergies

and allergic respiratory symptoms are still increasing in adults and children [2]. These allergies may be exacerbated by other factors like air pollution. In the European Union (EU), air pollution levels exceed World Health Organization (WHO) thresholds for 96% of the urban population [3, 4]. Air pollution alone has an adverse effect on respiratory health [5], and biological and chemical studies have shown that air pollution aggravates the allergenicity of pollen. Air pollutants increase the allergen content of pollen and damage its surface, releasing more allergens [6]. Air pollutants also make pollen more allergenic by changing its elemental composition, causing pollen to release more airborne sub-pollen particles and increasing total pollen count [6]. By this, air pollution combines with humidity and temperature to drive pollen count in the environment.

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29. **Environmental Life Cycle Assessment in Medical Practice: A User's Guide.** McGinnis S, Johnson-Privitera C, Nunziato JD, Wohlford S. Obstet Gynecol Surv. 2021 Jul;76(7):417-428. doi: 10.1097/OGX.0000000000000906.
https://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&AN=00006254-202107000-00018&LSLINK=80&D=ovft
IMPORTANCE: The environmental impacts of medical practice are becoming more important as the unsustainable activities of global societies continue to damage the environment and contribute to health problems. Life cycle assessment (LCA) is a methodology to quantify a wide range of environmental impacts, including global warming, over the full life cycle of products, processes, and systems, to allow for data-driven environmental decisions.
OBJECTIVE: This article introduces the concepts, terminology, and methodology of LCA using examples from the medical industry. It provides guidance and best practices for the standard steps of an LCA study.
EVIDENCE ACQUISITION: A review of the literature was done to provide examples of the use of LCA and carbon footprints in medicine. Hypothetical medical products were modeled using LCA software to illustrate the capabilities and limitations of this method.
RESULTS: Life cycle assessment examples in medicine illustrate the ability of this method to compare environmental impacts for products that perform the same function. They also highlight the relative scale of damage across all life cycle phases for a variety of environmental impact categories. Resources have also been provided for various useful LCA tools.
CONCLUSIONS AND RELEVANCE: Life cycle assessment can provide medical practitioners with quantified environmental metrics in order to make decisions that minimize the environmental impacts of medical products, processes, and systems. Carbon footprints are LCA studies that focus only on the impact of climate change. Life cycle assessment is expected to grow as a tool for environmental decisions in medical practice.

30. **Sustainability Initiatives in the Operating Room.** Wu S, Cerceo E. Jt Comm J Qual Patient Saf. 2021 Jul 16:S1553-7250(21)00162-8. doi: 10.1016/j.jcjq.2021.06.010. Online ahead of print.
BACKGROUND: Operating rooms (ORs) contribute up to 30% of a hospital's waste, are very resource-intensive, and thus provide an opportunity for improvement.

METHODS: A narrative review was conducted, searching MEDLINE, EMBASE, and ProQuest databases. The study included 78 of the 108 published articles.

RESULTS: The researchers identified and categorized articles according to the following major themes: Committee and Leadership; Waste Reduction; Segregating OR waste; Minimizing unnecessary devices and packaging; Reducing energy consumption; Choosing anesthetic gases; Education; Reducing water consumption; Different surgical venues; Donating medical supplies. Formation of an OR committee or a hospital Green Team dedicated to environmentally sustainable initiatives can significantly improve health care's impact on the environment while saving money. Changes in supply chain with preferences for reusable devices, effective recycling, repurposing instruments, and donating items can all be effective means of diverting waste away from landfills. Reducing unnecessary packaging and instruments would eliminate excess in the waste stream. Curtailing energy and water usage results in cost and environmental savings. Surgical venue (inpatient vs. outpatient surgical center) can also contribute to waste. Transitioning away from certain inhaled anesthetics can minimize greenhouse gas impact. Education to all levels in the health care system is important to drive change and maintain change.

CONCLUSION: Optimizing efficiency and decreasing waste generation can have a positive impact on the environment and can be accompanied by cost reduction. Because the field of sustainability in health care is young but burgeoning, increased research is needed to support evidence-based approaches.

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News & Commentary

Green infrastructure can limit but not solve air pollution injustice. Jennings V, Reid CE, Fuller CH. Nat Commun. 2021 Aug 3;12(1):4681. doi: 10.1038/s41467-021-24892-1.

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