

## Environmental Stewardship Resource Desk

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### New Research

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#### COVID-19

- 1. Resource management: ways to sustain the environmental gains of COVID-19 lockdown.**  
Mary Celin S, Bhanot P, Kalsi A. Environ Dev Sustain. 2022 Apr 7:1-24. doi: 10.1007/s10668-022-02228-3. Online ahead of print.  
<https://link.springer.com/article/10.1007/s10668-022-02228-3>  
Natural resources are under constant exploitation due to industrialization and urbanization. Ecological disturbance caused by over exploitation of resources is one of the possible reasons for the outbreak of COVID-19 pandemic. Due to the highly infectious nature of this disease, countries across the world have taken self-imposed isolation measures such as lockdown, quarantine, curfew, etc., to limit human-to-human spread. Though this pandemic has shaken the world and left millions suffering, it has also caused surprising positive effects to environment. Due to reduced human pressure on ecosystems during the lockdown, betterment of air, water quality and biodiversity along with reduced consumption of natural resources have been reported. It is necessary to maintain this improvement in order to avoid the environmental benefits slipping away once the world limbs back to normalcy. The benefits acquired in terms of resource conservation prompt us to avoid unnecessary human interference and adopt sustainable life styles. Wide usage of information and communication technologies (viz. work from home, teleconferencing, e-learning and e-commerce) during the pandemic revealed their potential in meeting the needs of human livelihood and played a significant role in improvement in air quality and reduced resource consumption. Implementing them should be a policy measure during an environmental crisis. Active government involvement is necessary for coordinating institutional and policy aspects of resource conservation. Smooth transitioning to more sustainable post-COVID world thus requires coordinated action at individual, local, national and international levels. Restoring environmental resources is essential to prevent future pandemics.

#### Health Impacts of Climate Change

- 2. Mortality risk associated with greenness, air pollution, and physical activity in a representative U.S. cohort.** Coleman CJ, Yeager RA, Pond ZA, Riggs DW, Bhatnagar A, Arden Pope C 3rd. *Sci Total Environ.* 2022 Jun 10;824:153848. doi: 10.1016/j.scitotenv.2022.153848. Epub 2022 Feb 14.

Greenness, represented by census-tract Normalized Difference Vegetation Index (NDVI) for the seasonal period of May-October, was averaged over the years 2003-2016. Air pollution was estimated by census-tract level PM<sub>2.5</sub> concentrations from 1999 to 2015. Cox Proportional Hazard Models were used to estimate hazard ratios (HR) for differences in greenness, air pollution, and physical activity. Alternative models that evaluated potential confounding and stratified models that evaluated effect modification were examined. Mortality risks were associated with PM<sub>2.5</sub> (HR = 1.14, 95% CI: 1.09-1.19 per 10 µg/m<sup>3</sup>) and physical inactivity (1.49, 1.44-1.54 relative to sufficiently active), but not with greenness (1.01, 0.99-1.03 per IQR). The PM<sub>2.5</sub>-mortality association was mitigated at high levels of greenness (1.05, 0.91-1.22). There was no strong evidence of confounding between air pollution, physical activity, and greenness. However, stratified analysis suggested effect modification for PM<sub>2.5</sub> and NDVI by physical activity. A significant protective greenness-mortality association was observed for only highly active individuals (0.91, 0.86-0.96). Also, relatively high PM<sub>2.5</sub>-mortality HRs were observed for more physically active individuals (1.25, 1.12-1.40). PM<sub>2.5</sub> air pollution and physical inactivity are robustly associated with mortality risk. Greenness may be most beneficial and air pollution relatively harmful to highly active individuals. This analysis provides evidence that, in addition to not smoking, being physically active and living in a clean, green environment contributes to improved health and reduced risk of mortality.

- 3. Polycyclic aromatic hydrocarbon and its effects on human health: An overview.** Mallah MA et al. *Chemosphere.* 2022 Jun;296:133948. doi: 10.1016/j.chemosphere.2022.133948. Epub 2022 Feb 10.

Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals of considerable environmental significance. PAHs are chemical contaminants of fused carbon and hydrogen aromatic rings, basically white, light-yellow, or solid compounds without color. Natural sources of pollution are marginal or less significant, such as volcanic eruptions, natural forest fires, and moorland fires that trigger lightning bursts. The significant determinants of PAH pollution are anthropogenic pollution sources, classified into four groups, i.e., industrial, mobile, domestic, and agricultural pollution sources. Humans can consume PAHs via different routes, such as inhalation, dermal touch, and ingestion. The Effect of PAHs on human health is primarily based on the duration and route of exposure, the volume or concentration of PAHs to which one is exposed, and the relative toxicity of PAHs. Many PAHs are widely referred to as carcinogens, mutagens, and teratogens and thus pose a significant danger to human health and the well-being of humans. Skin, lung, pancreas, esophagus, bladder, colon, and female breast are numerous organs prone to tumor development due to long-term PAH exposure. PAH exposure may increase the risk of lung cancer as well as cardiovascular disease (CVD), including atherosclerosis, thrombosis, hypertension, and myocardial infarction (MI). Preclinical studies have found a relationship between PAH exposure, oxidative stress, and atherosclerosis. In addition, investigations have discovered a relationship between PAH exposure at work and CVD illness and mortality

development. This review aims to explain PAH briefly, its transportation, its effects on human health, and a relationship between environmental exposures to PAHs and CVD risk in humans.

4. **Prenatal air pollution exposure and neonatal health.** Palma A, Petrunyk I, Vuri D. *Health Econ.* 2022 May;31(5):729-759. doi: 10.1002/hec.4474. Epub 2022 Jan 9.  
<https://onlinelibrary.wiley.com/doi/epdf/10.1002/hec.4474>  
Air pollution has been shown to have adverse effects on many health outcomes including respiratory effects, cardiovascular effects, and mortality. However, evidence on the effects of prenatal exposure is still limited. We investigate the causal impact of prenatal exposure to air pollution on neonatal health in Italy in the 2000s. We exploit variation in rainfall shocks to instrument for non-random air pollution exposure. Our empirical setting combines detailed information on mother's residential location from birth certificates with PM10 concentrations from air pollution monitors. Ten additional units in the average PM10 level (approximately one standard deviation) would decrease birth weight by about 0.5% and gestational age by 0.16%; it would increase the prevalence of low birth weight by 22% and of preterm birth by 16%. The effects are stronger in magnitude for third trimester exposure and for less educated mothers. These findings suggest that the health impacts of air pollution on newborns are unequally distributed in the population.
5. **War in Europe: health implications of environmental nuclear disaster amidst war.** Laine JE. *Eur J Epidemiol.* 2022 Apr 15. doi: 10.1007/s10654-022-00862-9. Online ahead of print.  
Recent incidents at nuclear facilities in Ukraine related to the attacks from Russian forces highlight the fragility of nuclear power plants and other nuclear facilities in war and the very real potential for another environmental nuclear disaster and associated health risks in Europe. Nuclear catastrophes from war can occur from radioactive materials released from war threatened nuclear power plants and other nuclear facilities in war zones, in addition to the direct threat from the deployment of nuclear weaponry and can result in immediate and long-term health impacts. Despite historical nuclear catastrophic events, including the Chernobyl nuclear power plant accident and atomic bombings of Hiroshima and Nagasaki, and that for more than a century epidemiologists have studied the consequences of radiation exposures, there are still major unanswered questions regarding radiation risks and human health. Epidemiologists will need to continue to quantify the health effects from exposure to environmental radiation, including background radiation, and are able to contribute to conversations about reliance on nuclear energy and alternative energy futures. As a society we are compelled to rethink our ties to nuclear energy, especially with the potential of increasing reliance on nuclear power amid oil and gas crisis and considering climate change, nuclear warfare, including nuclear weapon testing, and the fragility of humanity and health to even low doses of radiation from these and other natural and unnatural sources.
6. **Historic redlining and the siting of oil and gas wells in the United States.** Gonzalez DJX, Nardone A, Nguyen AV, Morello-Frosch R, Casey JA. *J Expo Sci Environ Epidemiol.* 2022 Apr 13. doi: 10.1038/s41370-022-00434-9. Online ahead of print.  
<https://www.nature.com/articles/s41370-022-00434-9>

**BACKGROUND:** The presence of active or inactive (i.e., postproduction) oil and gas wells in neighborhoods may contribute to ongoing pollution. Racially discriminatory neighborhood security maps developed by the Home-Owners Loan Corporation (HOLC) in the 1930s may contribute to environmental exposure disparities.

**OBJECTIVE:** To determine whether receiving worse HOLC grades was associated with exposure to more oil and gas wells.

**METHODS:** We assessed exposure to oil and gas wells among HOLC-graded neighborhoods in 33 cities from 13 states where urban oil and gas wells were drilled and operated. Among the 17 cities for which 1940 census data were available, we used propensity score restriction and matching to compare well exposure neighborhoods that were similar on observed 1940 sociodemographic characteristics but that received different grades.

**RESULTS:** Across all included cities, redlined D-graded neighborhoods had  $12.2 \pm 27.2$  wells km<sup>-2</sup>, nearly twice the density in neighborhoods graded A ( $6.8 \pm 8.9$  wells km<sup>-2</sup>). In propensity score restricted and matched analyses, redlined neighborhoods had 2.0 (1.3, 2.7) more wells than comparable neighborhoods with a better grade.

**SIGNIFICANCE:** Our study adds to the evidence that structural racism in federal policy is associated with the disproportionate siting of oil and gas wells in marginalized neighborhoods.

- 7. Air pollution and biomarkers of cardiovascular disease and inflammation in the Malmö Diet and Cancer cohort.** Azzouz M, Xu Y, Barregard L, Fagerberg B, Zöller B, Molnár P, Oudin A, Spanne M, Engström G, Stockfelt L. *Environ Health*. 2022 Apr 12;21(1):39. doi: 10.1186/s12940-022-00851-1.

<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-022-00851-1>

**CONCLUSION:** Long-term residential exposure to moderate levels of particulate air pollution was associated with several biomarkers of inflammation and cardiovascular disease. This supports inflammation as a mechanism behind the association between air pollution and cardiovascular disease.

- 8. Thermal biology of invasive Aedes mosquitoes in the context of climate change.** Lahondère C, Bonizzoni M. *Curr Opin Insect Sci*. 2022 Apr 11:100920. doi: 10.1016/j.cois.2022.100920. Online ahead of print.

The increasing incidence of arboviral diseases in tropical endemic areas and their emergence in new temperate countries is one of the most important challenges that Public Health agencies are currently facing. Because mosquitoes are poikilotherms, shifts in temperature influence physiological functions besides egg viability. These traits impact not only vector density, but also their interaction with their hosts and arboviruses. As such the relationship among mosquitoes, arboviral diseases and temperature is complex. Here we summarize current knowledge on the thermal biology of Aedes invasive mosquitoes, highlighting differences among species. We also emphasise the need to expand knowledge on the variability in thermal sensitivity across populations within a species, especially in light of climate change that encompasses increase not only in mean environmental temperature but also in the frequency of hot and cold snaps. Finally, we suggest a novel experimental approach to investigate the molecular architecture of thermal adaptation in mosquitoes.

9. **Comparing human exposure to fine particulate matter in low and high-income countries: A systematic review of studies measuring personal PM(2.5) exposure.** Lim S, Bassey E, Bos B, Makacha L, Varaden D, Arku RE, Baumgartner J, Brauer M, Ezzati M, Kelly FJ, Barratt B. *Sci Total Environ.* 2022 Apr 11;155207. doi: 10.1016/j.scitotenv.2022.155207. Online ahead of print. <https://www.sciencedirect.com/science/article/pii/S0048969722023002>  
CONCLUSION: This review revealed a growing literature of personal PM2.5 exposure studies, which highlighted a large variability in exposures recorded and severe inequalities in geographical and social population subgroups.
  
10. **Projecting the Impacts of a Changing Climate: Tropical Cyclones and Flooding.** Anderson GB, Schumacher A, Done JM, Hurrell JW. *Curr Environ Health Rep.* 2022 Apr 11. doi: 10.1007/s40572-022-00340-0. Online ahead of print.  
RECENT FINDINGS: Despite a wealth of studies characterizing health impacts of floods and tropical cyclones, many are better suited for qualitative, rather than quantitative, projections of climate change health impacts. However, a growing number have features that will facilitate their use in quantitative projections, features we highlight here. Further, while it can be difficult to project how exposures to flood and tropical cyclone hazards will change in the future, climate science continues to advance in its capabilities to capture changes in these exposures, including capturing regional variation. Developments in climate epidemiology and climate science are opening new possibilities in projecting the health impacts of floods and tropical cyclones under a changing climate.
  
11. **Rising Carbon Dioxide and Global Nutrition: Evidence and Action Needed.** Ziska LH. *Plants (Basel).* 2022 Apr 6;11(7):1000. doi: 10.3390/plants11071000. <https://www.mdpi.com/2223-7747/11/7/1000>  
While the role of CO<sub>2</sub> as a greenhouse gas in the context of global warming is widely acknowledged, additional data from multiple sources is demonstrating that rising CO<sub>2</sub> of and by itself will have a tremendous effect on plant biology. This effect is widely recognized for its role in stimulating photosynthesis and growth for multiple plant species, including crops. However, CO<sub>2</sub> is also likely to alter plant chemistry in ways that will denigrate plant nutrition. That role is also of tremendous importance, not only from a human health viewpoint, but also from a global food-web perspective. Here, the goal is to review the current evidence, propose potential mechanistic explanations, provide an overview of critical unknowns and to elucidate a series of next steps that can address what is, overall, a critical but unappreciated aspect of anthropogenic climate change.
  
12. **Detection of microplastics in human lung tissue using  $\mu$ FTIR spectroscopy.** Jenner LC, Rotchell JM, Bennett RT, Cowen M, Tentzeris V, Sadofsky LR. *Sci Total Environ.* 2022 Mar 29;831:154907. doi: 10.1016/j.scitotenv.2022.154907. Online ahead of print. <https://www.sciencedirect.com/science/article/pii/S0048969722020009>  
Airborne microplastics (MPs) have been sampled globally, and their concentration is known to increase in areas of high human population and activity, especially indoors. Respiratory symptoms and disease following exposure to occupational levels of MPs within industry settings have also been reported. It remains to be seen whether MPs from the environment can

be inhaled, deposited and accumulated within the human lungs. This study analysed digested human lung tissue samples (n = 13) using  $\mu$ FTIR spectroscopy (size limitation of 3  $\mu$ m) to detect and characterise any MPs present. In total, 39 MPs were identified within 11 of the 13 lung tissue samples with an average of  $1.42 \pm 1.50$  MP/g of tissue (expressed as  $0.69 \pm 0.84$  MP/g after background subtraction adjustments). The MP levels within tissue samples were significantly higher than those identified within combined procedural/laboratory blanks (n = 9 MPs, with a mean  $\pm$  SD of  $0.53 \pm 1.07$ , p = 0.001). Of the MPs detected, 12 polymer types were identified with polypropylene, PP (23%), polyethylene terephthalate, PET (18%) and resin (15%) the most abundant. MPs (unadjusted) were identified within all regions of the lung categorised as upper ( $0.80 \pm 0.96$  MP/g), middle/lingular ( $0.41 \pm 0.37$  MP/g), and with significantly higher levels detected in the lower ( $3.12 \pm 1.30$  MP/g) region compared with the upper (p = 0.026) and mid (p = 0.038) lung regions. After subtracting blanks, these levels became  $0.23 \pm 0.28$ ,  $0.33 \pm 0.37$  and  $1.65 \pm 0.88$  MP/g respectively. The study demonstrates the highest level of contamination control and reports unadjusted values alongside different contamination adjustment techniques. These results support inhalation as a route of exposure for environmental MPs, and this characterisation of types and levels can now inform realistic conditions for laboratory exposure experiments, with the aim of determining health impacts.

13. **The world-wide waste web.** Martínez JH, Romero S, Ramasco JJ, Estrada E. Nat Commun. 2022 Mar 29;13(1):1615. doi: 10.1038/s41467-022-28810-x.

<https://www.nature.com/articles/s41467-022-28810-x>

Countries globally trade with tons of waste materials every year, some of which are highly hazardous. This trade admits a network representation of the world-wide waste web, with countries as vertices and flows as directed weighted edges. Here we investigate the main properties of this network by tracking 108 categories of wastes interchanged in the period 2001-2019. Although, most of the hazardous waste was traded between developed nations, a disproportionate asymmetry existed in the flow from developed to developing countries. Using a dynamical model, we simulate how waste stress propagates through the network and affects the countries. We identify 28 countries with low Environmental Performance Index that are at high risk of waste congestion. Therefore, they are at threat of improper handling and disposal of hazardous waste. We find evidence of pollution by heavy metals, by volatile organic compounds and/or by persistent organic pollutants, which are used as chemical fingerprints, due to the improper handling of waste in several of these countries.

## WE ACT

14. **Toward Ecologically Sustainable Mental Health Care-A Call for Action From Within Psychiatry.**

Luykx JJ, Voetterl HTS. JAMA Psychiatry. 2022 Apr 13. doi: 10.1001/jamapsychiatry.2022.0594. Online ahead of print.

<https://jamanetwork.com/journals/jamapsychiatry/article-abstract/2790779>

The future consequences of global warming to psychiatry will be of both direct and indirect nature. Examples of direct effects include higher suicide rates and violent behavior resulting from temperature increases; indirect effects may manifest themselves in rising depression prevalences, for instance as a result of loneliness after losing loved ones to the effects of

climate change.<sup>1</sup> In the near future, climate change is bound to be considered a risk factor for mental health and well-being through such pathways, eg, drought resulting in civil unrest, thereby increasing prevalence rates of posttraumatic stress disorder and depression.

**15. Value-informed nursing practice is needed to make our healthcare systems more environmentally sustainable.**

Yakusheva O, Czerwinski MA, Buerhaus PI. *Nurs Outlook*. 2022 Apr 12;S0029-6554(22)00012-4. doi: 10.1016/j.outlook.2022.02.003. Online ahead of print. [https://www.nursingoutlook.org/article/S0029-6554\(22\)00012-4/fulltext](https://www.nursingoutlook.org/article/S0029-6554(22)00012-4/fulltext)

In this 3rd part of our 6-part series on value-informed nursing practice-practice that focuses on both achieving desired patient outcomes and minimizing the use of costly resources to achieve these outcomes-we focus on the importance of nurses in improving environmental outcomes and reducing costly environmental waste. We also propose how nursing education needs to change to prepare the next generation of nurses to effectively address environmental problems through providing value-informed nursing practice.

**16. Environmental Sustainability in Orthopaedic Surgery.**

Engler ID, Curley AJ, Fu FH, Bilec MM. *J Am Acad Orthop Surg*. 2022 Apr 11. doi: 10.5435/JAAOS-D-21-01254. Online ahead of print. <https://journals.lww.com/jaaos/pages/articleviewer.aspx?year=9900&issue=00000&article=00410&type=Fulltext>

Climate change has been increasingly recognized in the healthcare sector over recent years, with global implications in infrastructure, economics, and public health. As a result, a growing field of study examines the role of healthcare in contributing to environmental sustainability. These analyses commonly focus on the environmental impact of the operating room, due to extensive energy and resource utilization in surgery. While much of this literature has arisen from other surgical specialties, several environmental sustainability studies have begun appearing in the field of orthopaedic surgery, consisting mostly of waste audits and, less frequently, more comprehensive environmental life cycle assessments. The present study aims to review this limited evidence. The results suggest that methods to reduce the environmental impact of the operating room include proper selection of anesthetic techniques that have a smaller carbon footprint, minimization of single use instruments, use of minimalist custom-design surgical packs, proper separation of waste, and continuation or implementation of recycling protocols. Future directions of research include higher-level studies, such as comprehensive life cycle assessments, to identify more opportunities to decrease the environmental impact of orthopaedic surgery.

**17. Thoughts About Environment.**

Fawcett J. *Nurs Sci Q*. 2022 Apr;35(2):267-269. doi: 10.1177/08943184211070578. <https://journals.sagepub.com/doi/10.1177/08943184211070578>

The purpose of this essay is to discuss what is meant by the external environment within our discipline. The essay includes an overview of attention to environment that began when human beings first inhabited the planet and has continued to contemporary times within the context of nursing conceptual models. The finally recognized need for attention to global environmental conditions that include climate and climate change is cited. The essay concludes with a call for decolonizing the disciplinary meanings of environment.

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### News & Commentary

[Climate change - four decades of missed opportunities](#). Witze A. Nature. 2022 Apr;604(7905):239-240. doi: 10.1038/d41586-022-00998-4.

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