Providence

Environmental Stewardship Resource Desk

#59 | 3.23.2022 to 3.29.2022

Prepared by System Library Services

Visit the Environmental Stewardship site

New Research

Environmental Stewardship publications by Providence caregivers – see Digital Commons

COVID-19

1. **The COVID-19 pandemic reshapes the plastic pollution research - A comparative analysis of plastic pollution research before and during the pandemic.** Wang Q, Zhang M, Li R. Environ Res. 2022 May 15;208:112634. doi: 10.1016/j.envres.2021.112634. Epub 2021 Dec 29. https://www.sciencedirect.com/science/article/pii/S0013935121019356
   The outbreak of the COVID-19 pandemic has exacerbated plastic pollution worldwide. So has the COVID-19 pandemic changed the research on plastic pollution? This work aims to explore the impact of the pandemic on plastic pollution research by comprehensively assessing the current status and prospects of plastic pollution research before and during the COVID-19 pandemic. A collection of publications on the topic of plastic pollution in the Web of Science database concludes that the COVID-19 pandemic has reshaped the plastic pollution research: (i) The COVID-19 pandemic has changed the trend of plastic pollution publication output. Since the COVID-19 pandemic, the number of publications on the topic of plastic pollution has shown a significant increase trend; (ii) The COVID-19 pandemic has reversed the global research landscape of research on the plastic pollution. Since the outbreak of the pandemic, more and more countries have begun to pay attention to plastic pollution. Before the pandemic, developed countries were global leaders in plastic pollution research. However, during the pandemic, developing countries began to have a significant share in the quality, quantity and international cooperation of publications; (iii) The COVID-19 pandemic has redefined the major hotspots of plastic pollution research. The focus of research has changed significantly since the pandemic. Solving plastic pollution has become a major research content. During the epidemic, in-depth research on microplastics was conducted. The results of mining the publications on plastic pollution show that there is currently no effective solution to plastic pollution caused by the COVID-19. However, given the seriousness of controlling plastic pollution, it is very necessary to continue to carry out more research.

Health Impacts of Climate Change

2. **Ambient PM(2.5) exposures and systemic inflammation in women with early pregnancy.** Zhang B, Gong X, Han B, Chu M, Gong C, Yang J, Chen L, Wang J, Bai Z, Zhang Y. Sci Total Environ. 2022 Mar 14:154564. doi: 10.1016/j.scitotenv.2022.154564. Online ahead of print. https://www.sciencedirect.com/science/article/abs/pii/S0048969722016576
The association between ambient fine particulate matter (PM2.5) and systemic inflammation in women with early pregnancy is unclear. This study estimated the effects of PM2.5 exposures on inflammatory biomarkers in women with normal early pregnancy (NEP) or clinically recognized early pregnancy loss (CREPL). Serum interleukin-1beta (IL-1β), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) were measured in 228 early pregnant women recruited in Tianjin, China. Maternal PM2.5 exposures at lag 0 through lag 30 before blood collection were estimated using temporally-adjusted land use regression models. Daily exposures to ambient PM10, NO2, SO2, CO and 8-hours maximum ozone were estimated using city-level concentrations. Single-day lag effects at lag 0 through lag 7 were estimated using multivariable linear regression models. Distributed lag effects and cumulative effects over the preceding seven days and 30 days were estimated using distributed lag non-linear models. Serum IL-1β (8.0% increase at lag 3), IL-6 (33.9% increase at lag 5) and TNF-α (12.7% increase at lag 5) in early pregnant women were significantly increased with an interquartile range increase in PM2.5 exposures adjusted for temporal confounders and demographic characteristics. These effects were robust in several two-pollutant models. Distributed lag effects over the preceding 30 days also showed that the three cytokines were significantly increased with PM2.5 on some lag days. Among all cumulative effects of PM2.5 on the three cytokines in all subjects or in the two groups, only IL-6 was significantly increased in CREPL women over the preceding seven days and 30 days. No significant cumulative effect of PM2.5 was observed in NEP women. In conclusion, exposure to ambient PM2.5 may induce systemic inflammation in women in the first trimester of pregnancy. Whether the PM2.5-related cumulative increase in maternal IL-6 is involved in the pathogenic mechanisms of early pregnancy loss needs to be identified in future research.

3. **Micro(nano)plastics pollution and human health: How plastics can induce carcinogenesis to humans?** Kumar R, Manna C, Padha S, Verma A, Sharma P, Dhar A, Ghosh A, Bhattacharya P. Chemosphere. 2022 Mar 14;298:134267. doi: 10.1016/j.chemosphere.2022.134267. Online ahead of print.
https://www.sciencedirect.com/science/article/abs/pii/S0045653522007603
Microplastics (MPs) and nanoplastics (NPs) are key indicators of the plasticine era, widely spread across different ecosystems. MPs and NPs become global stressors due to their inherent physicochemical characteristics and potential impact on ecosystems and humans. MPs and NPs have been exposed to humans via various pathways, such as tap water, bottled water, seafood, beverages, milk, fish, salts, fruits, and vegetables. This paper highlights MPs and NPs pathways to the food chains and how these plastic particles can cause risks to human health. MPs have been evident in vivo and vitro and have been at health risks, such as respiratory, immune, reproductive, and digestive systems. The present work emphasizes how various MPs and NPs, and associated toxic chemicals, such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs), impact human health. Polystyrene (PS) and polyvinyl chloride

(PVC) are common MPs and NPs, reported in human implants via ingestion, inhalation, and dermal exposure, which can cause carcinogenesis, according to Agency for Toxic Substances and Disease Registry (ATSDR) reports. Inhalation, ingestion, and dermal exposure-response cause genotoxicity, cell division and viability, cytotoxicity, oxidative stress induction, metabolism disruption, DNA damage, inflammation, and immunological responses in humans. Lastly, this review work concluded with current knowledge on potential risks to human health and knowledge gaps with recommendations for further investigation in this field.

4. **Short- and medium-term air pollution exposure, plasmatic protein levels and blood pressure in children.** de Prado-Bert P et al. Environ Res. 2022 Mar 12;211:113109. doi: 10.1016/j.envres.2022.113109. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S0013935122004364
Exposure to air pollution influences children's health, however, the biological mechanisms underlying these effects are not completely elucidated. We investigated the association between short- and medium-term outdoor air pollution exposure with protein profiles and their link with blood pressure in 1170 HELIX children aged 6-11 years. Different air pollutants (NO2, PM10, PM2.5, and PM2.5abs) were estimated based on residential and school addresses at three different windows of exposure (1-day, 1-week, and 1-year before clinical and molecular assessment). Thirty-six proteins, including adipokines, cytokines, or apolipoproteins, were measured in children's plasma using Luminex. Systolic and diastolic blood pressure (SBP and DBP) were measured following a standardized protocol. We performed an association study for each air pollutant at each location and time window and each outcome, adjusting for potential confounders. After correcting for multiple-testing, hepatocyte growth factor (HGF) and interleukin 8 (IL8) levels were positively associated with 1-week home exposure to some of the pollutants (NO2, PM10, or PM2.5). NO2 1-week home exposure was also related to higher SBP. The mediation study suggested that HGF could explain 19% of the short-term effect of NO2 on blood pressure, but other study designs are needed to prove the causal directionality between HGF and blood pressure.

5. **Air pollution and surrounding greenness in relation to ischemic stroke: A population-based cohort study.** Avellaneda-Gómez C, Vivanco-Hidalgo RM, Olmos S, Lazcano U, Valentin A, Milà C, Ambrós A, Roquer J, Tonne C. Environ Int. 2022 Mar;161:107147. doi: 10.1016/j.envint.2022.107147. Epub 2022 Feb 15.
https://www.sciencedirect.com/science/article/pii/S0160412022000733
RESULTS: Between 1st January 2016 and 31st December 2017, 10 865 individuals were admitted to public hospitals with an IS diagnosis. Median exposure levels were: 17 μg/m3 PM2.5, 35 μg/m3 NO2, 2.28 μg/m3 BC and 0.27 NDVI. Individuals with higher residential exposure to air pollution were at greater risk of IS: HR 1·04 (95% CI:0·99-1·10) per 5 μg/m3 of PM2.5; HR 1.05 (95% CI:1·00-1·10) per 1 μg/m3 of BC; HR 1·04 (95% CI:1·03-1·06) per 10 μg/m3 of NO2. Conversely, individuals with higher residential surrounding green space, had lower risk of IS (HR 0·84; CI 95%:0·7-1.0). There was no evidence of effect modification by individual characteristics.

CONCLUSIONS: Higher incidence of IS was observed in relation to long-term exposures to air pollution, particularly NO2, in a region that meets European health-based air quality standards. Residential surrounding greenness was associated with lower incidence of IS.

6. **The Impact of Ambient Environmental and Occupational Pollution on Respiratory Diseases.** Nishida C, Yatera K. Int J Environ Res Public Health. 2022 Feb 27;19(5):2788. doi: 10.3390/ijerph19052788.
https://www.mdpi.com/1660-4601/19/5/2788
Ambient pollutants and occupational pollutants may cause and exacerbate various lung and respiratory diseases. This review describes lung and respiratory diseases in relation to ambient pollutants, particularly particulate matter (PM2.5), and occupational air pollutants, excluding communicable diseases and indoor pollutants, including tobacco smoke exposure. PM2.5 produced by combustion is an important ambient pollutant. PM2.5 can cause asthma attacks and exacerbations of chronic obstructive pulmonary disease in the short term. Further, it not only carries a risk of lung cancer and death, but also hinders the development of lung function in children in the long term. It has recently been suggested that air pollution, such as PM2.5, is a risk factor for severe coronavirus disease (COVID-19). Asbestos, which causes asbestosis, lung cancer, and malignant mesothelioma, and crystalline silica, which cause silicosis, are well-known traditional occupational pollutants leading to pneumoconiosis. While work-related asthma (WRA) is the most common occupational lung disease in recent years, many different agents cause WRA, including natural and synthetic chemicals and irritant gases. Primary preventive interventions that increase awareness of pollutants and reduce the development and exacerbation of diseases caused by air pollutants are paramount to addressing ambient and occupational pollution.

7. **Association between long-term exposure to air pollution and immune-mediated diseases: a population-based cohort study.** Adami G, Pontalti M, Cattani G, Rossini M, Viapiana O, Orsolini G, Benini C, Bertoldo E, Fracassi E, Gatti D, Fassio A. RMD Open. 2022 Feb;8(1):e002055. doi: 10.1136/rmdopen-2021-002055.
https://rmdopen.bmj.com/content/8/1/e002055
CONCLUSION: Long-term exposure to air pollution was associated with higher risk of developing autoimmune diseases, in particular rheumatoid arthritis, CTDs and IBD. Chronic exposure to levels above the threshold for human protection was associated with a 10% higher risk of developing IMIDs.

8. **Ambient Air Pollution Exposure among Individuals Experiencing Unsheltered Homelessness.** MacMurdo MG, Mulloy KB, Felix CW, Curtis AJ, Ajayakumar J, Curtis J. Environ Health Perspect. 2022 Feb;130(2):27701. doi: 10.1289/EHP10414. Epub 2022 Feb 17.
https://ehp.niehs.nih.gov/doi/10.1289/EHP10414
Exposure to ambient air pollution is increasingly recognized as a major driver of morbidity and mortality.1 Ambient air pollution is anticipated to increase as a result of climate change, extreme weather events and wildfires.2,3 Within the United States, disparities already exist in exposure to air pollution. Residing in a nonwhite majority or low-income census tract is associated with increased exposure to fine particulate matter [PM ≤2.5μm in aerodynamic

diameter (PM2.5)].4 The pattern of air pollution exposure among other vulnerable populations has yet to be established.

9. **The Interplay of Environmental Exposures and Mental Health: Setting an Agenda.** Reuben A, Manczak EM, Cabrera LY, Alegria M, Bucher ML, Freeman EC, Miller GW, Solomon GM, Perry MJ. Environ Health Perspect. 2022 Feb;130(2):25001. doi: 10.1289/EHP9889. Epub 2022 Feb 16. https://ehp.niehs.nih.gov/doi/10.1289/EHP9889
DISCUSSION: We describe what can be gained by bridging environmental and psychological research disciplines and present a synthesis of what is needed to advance interdisciplinary investigations. We also consider the implications of the current evidence for a) foundational knowledge of the etiology of mental health and illness, b) toxicant policy and regulation, c) definitions of climate adaptation and community resilience, d) interventions targeting marginalized communities, and e) the future of research training and funding. We include a call to action for environmental and mental health researchers, focusing on the environmental contributions to mental health to unlock primary prevention strategies at the population level and open equitable paths for preventing mental disorders and achieving optimal mental health for all.

10. **Differential Cardiopulmonary Health Impacts of Local and Long-Range Transport of Wildfire Smoke.** Magzamen S, Gan RW, Liu J, O'Dell K, Ford B, Berg K, Bol K, Wilson A, Fischer EV, Pierce JR. Geohealth. 2021 Feb 25;5(3):e2020GH000330. doi: 10.1029/2020GH000330. eCollection 2021 Mar.
https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2020GH000330
We estimated cardiopulmonary morbidity and mortality associated with wildfire smoke (WFS) fine particulate matter (PM2.5) in the Front Range of Colorado from 2010 to 2015. To estimate WFS PM2.5, we developed a daily kriged PM2.5 surface at a 15 × 15 km resolution based on the Environmental Protection Agency Air Quality System monitors for the western United States; we subtracted out local seasonal-average PM2.5 of nonsmoky days, identified using satellite-based smoke plume estimates, from the local daily estimated PM2.5 if smoke was identified by National Oceanic and Atmospheric Administration's Hazard Mapping System. We implemented time-stratified case-crossover analyses to estimate the effect of a 10 µg/m3 increase in WFS PM2.5 with cardiopulmonary hospitalizations and deaths using single and distributed lag models for lags 0-5 and distinct annual impacts based on local and long-range smoke during 2012, and long-range transport of smoke in 2015. A 10 µg/m3 increase in WFS was associated with all respiratory, asthma, and chronic obstructive pulmonary disease hospitalizations for lag day 3 and hospitalizations for ischemic heart disease at lag days 2 and 3. Cardiac arrest deaths were associated with WFS PM2.5 at lag day 0. For 2012 local wildfires, asthma hospitalizations had an inverse association with WFS PM2.5 (OR: 0.716, 95% CI: 0.517-0.993), but a positive association with WFS PM2.5 during the 2015 long-range transport event (OR: 1.455, 95% CI: 1.093-1.939). Cardiovascular mortality was associated with the 2012 long-range transport event (OR: 1.478, 95% CI: 1.124-1.944).

11. **Occupational Therapy in an Ecological Context: Ethics and Practice.** Lieb LC. Am J Occup Ther. 2022 May 1;76(3):7603347010. doi: 10.5014/ajot.2022.049148.
Unsustainable lifestyles contribute to global greenhouse gas emissions and climate change. The growing recognition of this negative impact on the earth's ecosystems and human health and well-being compels occupational therapy practitioners to address environmental sustainability issues. Western contextual factors present obstacles to the adoption of ecologically beneficial practices in occupational therapy. Resolving these ethical challenges through the use of multiple epistemologies may yield novel solutions and usher in the adoption of ecologically sustainable occupational therapy in the United States. In this column, I explore some of the contextual factors that influence occupational therapy theory and practice as they relate to ecological sustainability. I also briefly discuss some non-Western cultural perspectives, challenges to integrating ecological ethics into occupational therapy practice in the United States, and ways individual occupational therapy practitioners and state and national organizations can begin to address this issue.

12. **Environmentally sustainable development and use of artificial intelligence in health care.** Richie C. Bioethics. 2022 Mar 15. doi: 10.1111/bioe.13018. Online ahead of print.
https://onlinelibrary.wiley.com/doi/10.1111/bioe.13018
Artificial intelligence (AI) can transform health care by delivering medical services to underserved areas, while also filling gaps in health care provider availability. However, AI may also lead to patient harm due to fatal glitches in robotic surgery, bias in diagnosis, or dangerous recommendations. Despite concerns ethicists have identified in the use of AI in health care, the most significant consideration ought not be vulnerabilities in the software, but the environmental impact of AI. Health care emits a significant amount of carbon in many countries. As AI becomes an essential part of health care, ethical reflection must include the potential to negatively impact the environment. As such, this article will first overview the carbon emissions in health care. It will, second, offer five reasons why carbon calculations are insufficient to address sustainability in health care. Third, the article will derive normative concepts from the goals of medicine, the principles of biomedical ethics, and green bioethics-the very locus in which AI in health care sits-to propose health, justice, and resource conservation as criteria for sustainable AI in health care. In the fourth and final part of the article, examples of sustainable and unsustainable development and use of AI in health care will be evaluated through the three-fold lens of health, justice, and resource conservation. With various ethical approaches to AI in health care, the imperative for environmental sustainability must be underscored, lest carbon emissions continue to increase, harming people and planet alike.

13. **Environmental Sustainability in Respiratory Care: An Overview of the healthCARe-Based envirONmental Cost of Treatment (CARBON) Programme.** Wilkinson A, Maslova E, Janson C, Xu Y, Haughney J, Quint JK, Budgen N, Menzies-Gow A, Bell J, Crooks MG. Adv Ther. 2022 Mar 13. doi: 10.1007/s12325-022-02076-7. Online ahead of print.
https://link.springer.com/article/10.1007/s12325-022-02076-7
METHODS: CARBON will quantify the carbon footprint of medications and HCRU among approximately 2.5 million patients with respiratory diseases from seven ongoing studies

spanning more than 40 countries. Across studies, to obtain the carbon footprint of all inhaled, oral, and injectable medications, SimaPro life cycle assessment software modelling resource and energy consumption data, in addition to Ecoinvent® data sets and certified published studies, will be used. The carbon footprint of HCRU in the United Kingdom will be estimated by applying the methodology and data obtained from the Sustainable Healthcare Coalition Care Pathway Guidance.
PLANNED OUTCOMES: In asthma, CARBON studies will quantify GHG emissions associated with well-controlled versus not well-controlled asthma, the contribution of short-acting β2-agonist (SABA) reliever inhalers (and their potential overuse) to the carbon footprint of care, and how implementation of treatment guidelines can drive improved outcomes and footprint reduction. In chronic obstructive pulmonary disease (COPD), CARBON studies will assess the impact of exacerbation history on GHG emissions associated with HCRU and SABA use in subsequent years and estimate the carbon footprint associated with all aspects of COPD care.
CONCLUSION: CARBON aims to show that the principle of evidence-led care focused on improvement of clinical outcomes has the potential to benefit patients and the environment.

14. **Diagnostic waste: whose responsibility?** Street A, Vernooij E, Rogers MH. Global Health. 2022 Mar 12;18(1):30. doi: 10.1186/s12992-022-00823-7.
https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-022-00823-7
Waste management is notably absent from current discussions about efforts to improve access to diagnostics in low-and middle-income Countries (LMICs). Yet an increase in testing will inevitably lead to an increase in diagnostic waste, especially since many of the diagnostic tests designed for use in LMICs are single-use point-of-care tests. Diagnostic waste poses a threat to both human and environmental health. In this commentary we draw on our experience of diagnostic waste management in Sierra Leone and review current evidence on: the volume and impact of diagnostic waste in LMICs, existing health-care waste management capacity in LMICs, established national and international policies for improving health-care waste management, and opportunities for strengthening policy in this area. We argue that questions of safe disposal for diagnostics should not be an afterthought, only posed once questions of access have already been addressed. Moreover, responsibility for safe disposal of diagnostic waste should not fall solely on national health systems by default. Instead, consideration of the end-life of diagnostic products must be fully integrated into the diagnostic access agenda and greater pressure should be placed on manufacturers to take responsibility for the full life-cycle of their products.

15. **Green Chemistry in the Synthesis of Pharmaceuticals.** Kar S, Sanderson H, Roy K, Benfenati E, Leszczynski J. Chem Rev. 2022 Feb 9;122(3):3637-3710. doi: 10.1021/acs.chemrev.1c00631. Epub 2021 Dec 15.
https://pubs.acs.org/doi/10.1021/acs.chemrev.1c00631
The principles of green chemistry (GC) can be comprehensively implemented in green synthesis of pharmaceuticals by choosing no solvents or green solvents (preferably water), alternative reaction media, and consideration of one-pot synthesis, multicomponent reactions (MCRs), continuous processing, and process intensification approaches for atom economy and final waste reduction. The GC's execution in green synthesis can be performed using a holistic design of the active pharmaceutical ingredient's (API) life cycle, minimizing hazards and pollution, and

capitalizing the resource efficiency in the synthesis technique. Thus, the presented review accounts for the comprehensive exploration of GC's principles and metrics, an appropriate implication of those ideas in each step of the reaction schemes, from raw material to an intermediate to the final product's synthesis, and the final execution of the synthesis into scalable industry-based production. For real-life examples, we have discussed the synthesis of a series of established generic pharmaceuticals, starting with the raw materials, and the intermediates of the corresponding pharmaceuticals. Researchers and industries have thoughtfully instigated a green synthesis process to control the atom economy and waste reduction to protect the environment. We have extensively discussed significant reactions relevant for green synthesis, one-pot cascade synthesis, MCRs, continuous processing, and process intensification, which may contribute to the future of green and sustainable synthesis of APIs.

16. **One planet: one health. A call to support the initiative on a global science-policy body on chemicals and waste.** Brack W et al. Environ Sci Eur. 2022;34(1):21. doi: 10.1186/s12302-022-00602-6. Epub 2022 Mar 8.
https://enveurope.springeropen.com/articles/10.1186/s12302-022-00602-6
The chemical pollution crisis severely threatens human and environmental health globally. To tackle this challenge the establishment of an overarching international science-policy body has recently been suggested. We strongly support this initiative based on the awareness that humanity has already likely left the safe operating space within planetary boundaries for novel entities including chemical pollution. Immediate action is essential and needs to be informed by sound scientific knowledge and data compiled and critically evaluated by an overarching science-policy interface body. Major challenges for such a body are (i) to foster global knowledge production on exposure, impacts and governance going beyond data-rich regions (e.g., Europe and North America), (ii) to cover the entirety of hazardous chemicals, mixtures and wastes, (iii) to follow a one-health perspective considering the risks posed by chemicals and waste on ecosystem and human health, and (iv) to strive for solution-oriented assessments based on systems thinking. Based on multiple evidence on urgent action on a global scale, we call scientists and practitioners to mobilize their scientific networks and to intensify science-policy interaction with national governments to support the negotiations on the establishment of an intergovernmental body based on scientific knowledge explaining the anticipated benefit for human and environmental health.

17. **Premature Mortality of 2050 High Bike Use Scenarios in 17 Countries.** Egiguren J, Nieuwenhuijsen MJ, Rojas-Rueda D. Environ Health Perspect. 2021 Dec;129(12):127002. doi: 10.1289/EHP9073. Epub 2021 Dec 1.
https://ehp.niehs.nih.gov/doi/10.1289/EHP9073
RESULTS: We found that, among the urban populations (20-64 y old) of 17 countries, 205,424 annual premature deaths could be prevented if high bike-use scenarios are achieved by 2050 (assuming that 100% of bike trips replace car trips). If only 8% of bike trips replace car trips in a more conservative scenario, 18,589 annual premature deaths could be prevented by 2050 in the same population. In all the countries and scenarios, the mortality benefits related to bike use (rather than car use) outweighed the mortality risks.

DISCUSSION: We found that global biking policies may provide important mortality benefits in 2050. Current and future bike- vs. car-trip policies should be considered key public health interventions for a healthy urban design.

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

News

The Arctic has lost a huge volume of sea ice in just a few years. Nature. 2022 Mar 17. doi: 10.1038/d41586-022-00741-z. Online ahead of print.

Implementing existing air pollution policies will improve health and save lives. Mulcahy E. BMJ. 2022 Mar 14;376:o677. doi: 10.1136/bmj.o677.

Climate change and biospheric output. Le Quéré C, Mayot N. Science. 2022 Mar 11;375(6585):1091-1092. doi: 10.1126/science.abo1262. Epub 2022 Mar 10.

If you would like to receive a **customized Environmental Stewardship Topic Alert** related to your specialty or area of interest, would like a **literature search** conducted, or have difficulty **accessing** any of the above articles please contact us at **librarian@providence.org**

Find previous weeks **here.**