

## Environmental Stewardship Resource Desk

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### New Research

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#### COVID-19

1. **Plastic pollution during COVID-19: Plastic waste directives and its long-term impact on the environment.** Shams M, Alam I, Mahbub MS. Environ Adv. 2021 Oct;5:100119. doi: 10.1016/j.envadv.2021.100119. Epub 2021 Sep 25.

<https://www.sciencedirect.com/science/article/pii/S2666765721000909>

Majority of the million tons of plastic produced each year is being disposed after single-use. Plastic bottle, bags, food containers, gloves, and cup that end up in landfills and environment could linger for hundreds to thousands of years. Moreover, COVID-19 pandemic caused by the novel coronavirus (SARS-CoV-2), will also exacerbate the global plastic pollution as the use of personal protective equipment (PPE i.e., gloves, masks) became mandatory to prevent the spread of the virus. Plastic eventually breaking down in micro & nanoscopic bits due to physical or chemical or biological actions in the environment, can enter animal and human food web. So, plastic management programs need to be more robust with a focus on the prevention of the micro and nanoplastics entrance into the environment and food web. In the present pandemic situation, it is even more necessary to know about how much plastic waste is being generated and how different countries are coping up with their plastic waste management. In this review, we have elucidated how global plastic production rise during COVID-19 and how it would contribute to short and long-term impacts on the environment. Plastic pollution during the pandemic will increase the GHS emissions in the incineration facilities. Improper disposal of plastics into the oceans and lands would endanger the marine species and subsequently human lives. We have also assessed how the increased plastic pollution will aggravate the micro and nanoscale plastic problem, which have now become an emerging concern. This review will be helpful for people to understand the plastic usage and its subsequent consequences in the environment in a pandemic like COVID-19.

2. **The COVID-19 pandemic necessitates a shift to a plastic circular economy.** Yuan X, Wang X, Sarkar B, Ok YS. *Nat Rev Earth Environ.* 2021 Sep 27:1-2. doi: 10.1038/s43017-021-00223-2. Online ahead of print.

<https://www.nature.com/articles/s43017-021-00223-2>

The COVID-19 pandemic is exacerbating plastic pollution. A shift in waste management practices is thus urgently needed to close the plastic loop, requiring governments, researchers and industries working towards intelligent design and sustainable upcycling.

3. **SARS-CoV-2 variants and environmental effects of lockdowns, masks and vaccination: a review.** Akter S, Zakia MA, Mofijur M, Ahmed SF, Vo DN, Khandaker G, Mahlia TMI. *Environ Chem Lett.* 2021 Sep 26:1-12. doi: 10.1007/s10311-021-01323-7. Online ahead of print.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8475459/>

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is continuously evolving and four variants of concern have been identified so far, including Alpha, Beta, Gamma and Delta variants. Here we review the indirect effect of preventive measures such as the implementation of lockdowns, mandatory face masks, and vaccination programs, to control the spread of the different variants of this infectious virus on the environment. We found that all these measures have a considerable environmental impact, notably on waste generation and air pollution. Waste generation is increased due to the implementation of all these preventive measures. While lockdowns decrease air pollution, unsustainable management of face mask waste and temperature-controlled supply chains of vaccination potentially increases air pollution.

### Health Impacts of Climate Change

4. **Extreme heat, preterm birth, and stillbirth: A global analysis across 14 lower-middle income countries.** McElroy S, Ilango S, Dimitrova A, Gershunov A, Benmarhnia T. *Environ Int.* 2021 Oct 6;158:106902. doi: 10.1016/j.envint.2021.106902. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S0160412021005274>

Stillbirths and complications from preterm birth are two of the leading causes of neonatal deaths across the globe. Lower- to middle-income countries (LMICs) are experiencing some of the highest rates of these adverse birth outcomes. Research has suggested that environmental determinants, such as extreme heat, can increase the risk of preterm birth and stillbirth. Under climate change, extreme heat events have become more severe and frequent and are occurring in differential seasonal patterns. Little is known about how extreme heat affects the risk of preterm birth and stillbirth in LMICs. Thus, it is imperative to examine how exposure to extreme heat affects adverse birth outcomes in regions with some of the highest rates of preterm and stillbirths. Most of the evidence linking extreme heat and adverse birth outcomes has been generated from high-income countries (HICs) notably because measuring temperature in LMICs has proven challenging due to the scarcity of ground monitors. The paucity of health data has been an additional obstacle to study this relationship in LMICs. In this study, globally gridded meteorological data was linked with spatially and temporally resolved Demographic and Health Surveys (DHS) data on adverse birth outcomes. A global analysis of 14 LMICs was conducted per a pooled time-stratified case-crossover design with distributed-lag nonlinear models to ascertain the relationship between acute exposure to extreme heat and PTB and stillbirths. We

notably found that experiencing higher maximum temperatures and smaller diurnal temperature range during the last week before birth increased the risk of preterm birth and stillbirth. This study is the first global assessment of extreme heat events and adverse birth outcomes and builds the evidence base for LMICs.

- 5. The association between air pollution parameters and emergency department visits and hospitalizations due to cardiovascular and respiratory diseases: a time-series analysis.** Saygin H, Mercan Y, Yorulmaz F. *Int Arch Occup Environ Health*. 2021 Oct 6. doi: 10.1007/s00420-021-01769-w. Online ahead of print.

RESULTS: Among the air pollution parameters, the mean  $\pm$  standard deviation of SO<sub>2</sub> and PM<sub>10</sub> were 16.2  $\pm$  22.1 and 75.8  $\pm$  48.2  $\mu\text{g}/\text{m}^3$ , respectively. An increase of 10  $\mu\text{g}/\text{m}^3$  in SO<sub>2</sub> was associated with a 3% [Relative Risk (RR), 95% Confidence Interval (CI): 2-4] increase in cardiovascular ED visit and 2% (RR, 95% CI 2-3) increase in respiratory ED visit, and 1% (RR, 95% CI 1-3) increase in respiratory hospitalizations. An increase of 10  $\mu\text{g}/\text{m}^3$  in PM<sub>10</sub> was associated with a 1% (RR, 95% CI 1-2) increase in cardiovascular hospitalizations.

CONCLUSIONS: Increases in SO<sub>2</sub> are a risk factor for cardiovascular and respiratory ED visits, and respiratory hospitalizations. Increases in PM<sub>10</sub> are a risk factor for cardiovascular hospitalizations.
- 6. The effect of short term exposure to outdoor air pollution on fertility.** González-Comadran M et al. *Reprod Biol Endocrinol*. 2021 Oct 6;19(1):151. doi: 10.1186/s12958-021-00838-6. <https://rbej.biomedcentral.com/articles/10.1186/s12958-021-00838-6>

RESULTS: One hundred ninety-four women were recruited, contributing with data for 486 embryo transfers. Acute and subacute exposure to PMs showed a tendency in increasing miscarriage rate and reducing clinical pregnancy rate, although results were not statistically significant. The first sensitivity analysis, showed a significant risk of miscarriage for PM<sub>2.5</sub> exposure on 3D after adjusting for subacute exposure, and an increased risk of achieving no pregnancy for PM<sub>2.5</sub>, PM<sub>coarse</sub> and PM<sub>10</sub> on 3D. The second sensitivity analysis showed a significant risk of miscarriage for PM<sub>2.5</sub> exposure on 3D, and a significant risk of achieving no pregnancy for PM<sub>2.5</sub>, PM<sub>coarse</sub> and PM<sub>10</sub> particularly on 3D. No association was observed for nitrogen dioxides on reproductive outcomes.

CONCLUSIONS: Exposure to particulate matter has a negative impact on reproductive outcomes in IVF patients. Subacute exposure seems to increase the harmful effect of the acute exposure on miscarriage and pregnancy rates. Nitrogen dioxides do not modify significantly the reproductive success.
- 7. Environmental influences on sleep in the California Teachers Study Cohort.** Zhong C, Longcore T, Benbow J, Chung NT, Chau K, Wang SS, Lacey JV Jr, Franklin M. *Am J Epidemiol*. 2021 Oct 6;kwab246. doi: 10.1093/aje/kwab246. Online ahead of print. <https://academic.oup.com/aje/advance-article/doi/10.1093/aje/kwab246/6382169>

We evaluated the association between several spatially derived environmental exposures (ALAN, noise, greenspace, and air pollution) and self-reported sleep outcomes obtained in 2012-2015 in a large, prospective cohort of 51,562 California women in the California Teachers Study cohort. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated for sleep

duration and sleep latency. After adjusting for age, race/ethnicity, chronotype, use of sleep medication, and self-reported trouble sleeping, ALAN (OR per 5 mcd/m<sup>2</sup> brightness: 1.13, 95% CI 1.07-1.20) and air pollution (OR per 5 µg/m<sup>3</sup> PM<sub>2.5</sub>: 1.06, 95% CI 1.04-1.09) were associated with shorter sleep duration (<7 hours), and noise was associated with longer sleep latency (>15 minutes) (OR per 10 dB: 1.05, 95% CI 1.01-1.10). Greenspace was associated with increased sleep duration (OR per 0.1 units: 0.41, 95% CI 0.28-0.60) and decreased sleep latency (OR per 0.1 units: 0.55, 95% CI 0.39-0.78). Further research is necessary to understand how these and other exposures (e.g., diet) perturb an individuals' inherited sleep patterns and contribute to downstream health outcomes.

8. **Long-Term Exposure to Air Pollution, Road Traffic Noise, and Heart Failure Incidence: The Danish Nurse Cohort.** Lim YH et al. *J Am Heart Assoc.* 2021 Oct 6:e021436. doi:

10.1161/JAHA.121.021436. Online ahead of print.

<https://www.ahajournals.org/doi/10.1161/JAHA.121.021436>

Using data on female nurses from the Danish Nurse Cohort (aged >44 years), we investigated associations between 3-year mean exposures to air pollution and road traffic noise and incident HF using Cox regression models, adjusting for relevant confounders. Incidence of HF was defined as the first hospital contact (inpatient, outpatient, or emergency) between cohort baseline (1993 or 1999) and December 31, 2014, based on the Danish National Patient Register. Annual mean levels of particulate matter with a diameter <2.5 µm since 1990 and NO<sub>2</sub> and road traffic noise since 1970 were estimated at participants' residences. Of the 22 189 nurses, 484 developed HF. We detected associations with all 3 pollutants, with hazard ratios (HRs) of 1.17 (95% CI, 1.01-1.36), 1.10 (95% CI, 0.99-1.22), and 1.12 (95% CI, 0.99-1.26) per increase of 5.1 µg/m<sup>3</sup> in particulate matter with a diameter <2.5 µm, 8.6 µg/m<sup>3</sup> in NO<sub>2</sub>, and 9.3 dB in road traffic noise, respectively. We observed an enhanced risk of HF incidence for those exposed to high levels of the 3 pollutants; however, the effect modification of coexposure was not statistically significant. Former smokers and nurses with hypertension showed the strongest associations with particulate matter with a diameter <2.5 µm (P<sub>effect modification</sub><0.05). **Conclusions** We found that long-term exposures to air pollution and road traffic noise were independently associated with HF.

9. **Association between long term exposure to particulate matter and incident hypertension in Spain.** Doulatram-Gamgaram V et al. *Sci Rep.* 2021 Oct 5;11(1):19702. doi: 10.1038/s41598-021-99154-7.

<https://www.nature.com/articles/s41598-021-99154-7>

We analyzed 1103 individuals, participants in a Spanish nationwide population based cohort study (di@bet.es), who were free of hypertension at baseline (2008-2010) and completed a follow-up exam of the cohort (2016-2017). Cohort participants were assigned air pollution concentrations for particulate matter < 10 µm (PM<sub>10</sub>) and < 2.5 µm (PM<sub>2.5</sub>) during follow-up (2008-2016) obtained through modeling combined with measurements taken at air quality stations (CHIMERE chemistry-transport model). Mean and SD concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> were 20.17 ± 3.91 µg/m<sup>3</sup> and 10.83 ± 2.08 µg/m<sup>3</sup> respectively. During follow-up 282 cases of incident hypertension were recorded. In the fully adjusted model, compared with the lowest quartile of PM<sub>10</sub>, the multivariate weighted ORs (95% CIs) for developing hypertension

with increasing PM10 exposures were 0.82 (0.59-1.14), 1.28 (0.93-1.78) and 1.45 (1.05-2.01) in quartile 2, 3 and 4 respectively (p for a trend of 0.003). The corresponding weighted ORs according to PM2.5 exposures were 0.80 (0.57-1.13), 1.11 (0.80-1.53) and 1.48 (1.09-2.00) (p for trend 0.004). For each 5- $\mu\text{g}/\text{m}^3$  increment in PM10 and PM2.5 concentrations, the odds for incident hypertension increased 1.22 (1.06-1.41) p = 0.007 and 1.39 (1.07-1.81) p = 0.02 respectively. In conclusion, our study contributes to assessing the impact of particulate pollution on the incidence of hypertension in Spain, reinforcing the need for improving air quality as much as possible in order to decrease the risk of cardiometabolic disease in the population.

10. **Environmental risk factors and cardiovascular diseases: a comprehensive review.** Münzel T et al. *Cardiovasc Res.* 2021 Oct 5:cvab316. doi: 10.1093/cvr/cvab316. Online ahead of print.

<https://academic.oup.com/cardiovasces/advance-article/doi/10.1093/cvr/cvab316/6381568>

The risk of NCDs is strongly associated with exposure to environmental stressors such as pollutants in the air, noise exposure, artificial light at night and climate change, including heat extremes, desert storms and wildfires. In addition to the traditional risk factors for cardiovascular disease such as diabetes, arterial hypertension, smoking, hypercholesterolemia and genetic predisposition, there is a growing body of evidence showing that physicochemical factors in the environment contribute significantly to the high NCD numbers. Furthermore, urbanization is associated with accumulation and intensification of these stressors. This comprehensive expert review will summarize the epidemiology and pathophysiology of environmental stressors with a focus on cardiovascular NCDs. We will also discuss solutions and mitigation measures to lower the impact of environmental risk factors with focus on cardiovascular disease.

11. **The Potential Impact of Climate Change on the Micronutrient-Rich Food Supply.** Semba RD, Askari S, Gibson S, Bloem MW, Kraemer K. *Adv Nutr.* 2021 Oct 4:nmab104. doi: 10.1093/advances/nmab104. Online ahead of print.

<https://academic.oup.com/advances/advance-article-abstract/doi/10.1093/advances/nmab104/6381241?redirectedFrom=fulltext>

The goals of this review are to summarize the potential effects of climate change and its consequences on agricultural yield and micronutrient quality, primarily zinc, iron, and vitamin A, of plant foods and upon the availability of animal foods, to discuss the implications for micronutrient deficiencies in the future, and to present possible mitigation and adaptive strategies. In general, the combination of increasing atmospheric carbon dioxide and rising temperature is predicted to reduce the overall yield of major staple crops, fruits, vegetables, and nuts, more than altering their micronutrient content. Crop yield is also reduced by elevated ground-level ozone and increased extreme weather events. Pollinator loss is expected to reduce the yield of many pollinator-dependent crops such as fruits, vegetables, and nuts. Sea-level rise resulting from melting of ice sheets and glaciers is predicted to result in coastal inundation, salt intrusion, and loss of coral reefs and mangrove forests, with an adverse impact upon coastal rice production and coastal fisheries. Global ocean fisheries catch is predicted to decline because of ocean warming and declining oxygen. Freshwater warming is also expected to alter ecosystems and reduce inland fisheries catch. In addition to limiting greenhouse gas

production, adaptive strategies include postharvest fortification of foods; micronutrient supplementation; biofortification of staple crops with zinc and iron; plant breeding or genetic approaches to increase zinc, iron, and provitamin A carotenoid content of plant foods; and developing staple crops that are tolerant of abiotic stressors such as elevated carbon dioxide, elevated temperature, and increased soil salinity.

**12. High temperatures trigger suicide mortality in Brussels, Belgium: A case-crossover study**

**(2002-2011).** Casas L, Cox B, Nemery B, Deboosere P, Nawrot TS. *Environ Res.* 2021 Oct 2:112159. doi: 10.1016/j.envres.2021.112159. Online ahead of print.

**METHODS:** We conducted a bidirectional time-stratified case-crossover study with cases being suicide deaths occurring among Brussels residents aged 5 years or older. Cases were matched by day of the week with control days from the same month and year. The exposure was the daily average temperature measured at the Uccle station (Brussels) and obtained from the Belgian Royal Meteorological Institute. We combined conditional logistic regression with distributed lag non-linear models (DLNM) to obtain one week (lag 0-6) cumulative risk ratios (RR) and their 95% confidence intervals (CI) for the effects of moderate and extreme cold (5th and 1st percentiles of temperature, respectively) and moderate and extreme heat (95th and 99th percentiles of temperature, respectively), relative to the median temperature.

**RESULTS:** In total, 1891 suicide deaths were included. The median temperature was 11.6 °C, moderate and extreme cold temperatures were 0 and -3.1 °C, respectively, and moderate and extreme high temperatures were 20.9 and 24.4 °C, respectively. The cumulative risk of suicide mortality was almost twice higher among lags 0 to 6 for both moderate and extreme heat, relative to the period median temperature (e.g. moderate heat RR = 1.80 CI:1.27-2.54). No statistically significant associations were observed for cold temperatures.

**CONCLUSIONS:** In Brussels, a western European city with temperate climate, high temperatures may trigger suicide deaths up to one week later. In the context of climate change, adaptation strategies must take into consideration the effects of temperature on mental health.

**13. Association of Ambient Fine Particulate Matter Air Pollution With Kidney Transplant**

**Outcomes.** Chang SH, Merzkani M, Murad H, Wang M, Bowe B, Lentine KL, Al-Aly Z, Alhamad T. *JAMA Netw Open.* 2021 Oct 1;4(10):e2128190. doi: 10.1001/jamanetworkopen.2021.28190.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2784784>

**CONCLUSIONS AND RELEVANCE:** This cohort study found that PM<sub>2.5</sub> level was an independent risk factor associated with acute rejection, graft failure, and death among patients with KTs. These findings suggest that efforts toward decreasing levels of PM<sub>2.5</sub> concentration may be associated with improved outcomes after KT.

**14. Health risk and disease burden attributable to long-term global fine-mode particles.** Yang X, Wang Y, Zhao C, Fan H, Yang Y, Chi Y, Shen L, Yan X. *Chemosphere.* 2021 Oct 1;287(Pt 4):132435. doi: 10.1016/j.chemosphere.2021.132435. Online ahead of print.

Particulate matter 2.5 (PM<sub>2.5</sub>) pollution has long been a global environmental problem and still poses a great threat to public health. This study investigates global spatiotemporal variations in PM<sub>2.5</sub> using the newly developed satellite-derived PM<sub>2.5</sub> dataset from 1998 to 2018. An integrated exposure-response (IER) model was employed to examine the characteristics of

PM2.5-related deaths caused by chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD), lung cancer (LC), and stroke in adults (age $\geq$ 25), as well as lower respiratory infection (LRI) in children (age $\leq$ 5). The results showed that high annual PM2.5 concentrations were observed mainly in East Asia and South Asia. Over the 19-year period, PM2.5 concentrations constantly decreased in developed regions, but increased in most developing regions. Approximately 84% of the population lived in regions where PM2.5 concentrations exceeded 10  $\mu\text{g}/\text{m}^3$ . Meanwhile, the vast majority of the population (>60%) in East and South Asia was consistently exposed to PM2.5 levels above 35  $\mu\text{g}/\text{m}^3$ . PM2.5 exposure was linked to 3.38 (95% UI: 3.05-3.70) million premature deaths globally in 2000, a number that increased to 4.11 (95% UI: 3.55-4.69) million in 2018. Premature deaths related to PM2.5 accounted for 6.54%-7.79% of the total cause of deaths worldwide, with a peak in 2011. Furthermore, developing regions contributed to the majority (85.95%-95.06%) of PM2.5-related deaths worldwide, and the three highest-ranking regions were East Asia, South Asia, and Southeast Asia. Globally, IHD and stroke were the two main contributors to total PM2.5-related deaths, followed by COPD, LC, and LRI.

15. **Sex-difference in air pollution-related acute circulatory and respiratory mortality and hospitalization.** Shin HH, Maquiling A, Thomson EM, Park IW, Stieb DM, Dehghani P. *Sci Total Environ.* 2021 Sep 24;806(Pt 3):150515. doi: 10.1016/j.scitotenv.2021.150515. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S0048969721055923>

RESULTS: Sex-differences were more frequently observed for hospitalization than mortality, respiratory than circulatory health outcomes, and warm than cold season. For hospitalization, males were at higher risk (M > F) for warm season (OHD and InfPn from O<sub>3</sub>; IHD from NO<sub>2</sub>; and InfPn from PM<sub>2.5</sub>), but F > M for cold season (CEV from O<sub>3</sub> and OHD from NO<sub>2</sub>). For mortality, we found F > M only for circulatory diseases from ozone during the warm season. Among the above-mentioned sex-differences, three cases showed consistent time trends over the years: while M > F for OHD from O<sub>3</sub> and IHD from NO<sub>2</sub>, F > M for OHD from NO<sub>2</sub>.

CONCLUSIONS: We found that sex-differences in effect of ambient air pollution varied over health outcome, cause, season and time. In particular, the consistent trends (either F > M or M > F) across 17 years provide stronger evidence of sex-differences in hospitalizations, and warrant investigation in other populations.

16. **Association Between Air Pollution and Lung Lobar Emphysema in COPD.** Tung NT et al. *Front Med (Lausanne).* 2021 Sep 21;8:705792. doi: 10.3389/fmed.2021.705792. eCollection 2021.

<https://www.frontiersin.org/articles/10.3389/fmed.2021.705792/full>

This study examined the association of particulate matter <2.5  $\mu\text{m}$  in aerodynamic diameters (PM<sub>2.5</sub>) ( $\leq$ 2.5  $\mu\text{m}$ ), nitrogen dioxide (NO<sub>2</sub>), and ozone (O<sub>3</sub>) level of exposure with the presence of emphysema in 86 patients with chronic obstructive pulmonary disease (COPD). Exposure to the air pollution estimated using the land-use regression model was associated with lung function, BODE (a body mass index, degree of obstruction, dyspnea severity, and exercise capacity index) quartiles, and emphysema measured as low-attenuation areas on high-resolution CT (HR-CT) lung scans. Using paraseptal emphysema as the reference group, we observed that a 1 ppb increase in O<sub>3</sub> was associated with a 1.798-fold increased crude odds

ratio of panlobular emphysema ( $p < 0.05$ ). We observed that PM<sub>2.5</sub> was associated with BODE quartiles, modified Medical Research Council (mMRC) dyspnea score, and exercise capacity (all  $p < 0.05$ ). We found that PM<sub>2.5</sub>, NO<sub>2</sub>, and O<sub>3</sub> were associated with an increased degree of upper lobe emphysema and lower lobe emphysema (all  $p < 0.05$ ). Furthermore, we observed that an increase in PM<sub>2.5</sub>, NO<sub>2</sub>, and O<sub>3</sub> was associated with greater increases in upper lobe emphysema than in lower lobe emphysema. In conclusion, exposure to O<sub>3</sub> can be associated with a higher risk of panlobular emphysema than paraseptal emphysema in patients with COPD. Emphysema severity in lung lobes, especially the upper lobes, may be linked to air pollution exposure in COPD.

17. **Ambient air pollution and endocrinologic disorders in childhood.** Heo YJ, Kim HS. *Ann Pediatr Endocrinol Metab.* 2021 Sep;26(3):158-170. doi: 10.6065/apem.2142132.066. Epub 2021 Sep 30.

<https://e-apem.org/journal/view.php?doi=10.6065/apem.2142132.066>

Comment in

*Ann Pediatr Endocrinol Metab.* 2021 Sep;26(3):135.

Ambient air pollution has been proposed as an important environmental risk factor that increases global mortality and morbidity. Over the past decade, several human and animal studies have reported an association between exposure to air pollution and altered metabolic and endocrine systems in children. However, the results for these studies were mixed and inconclusive and did not demonstrate causality because different outcomes were observed due to different study designs, exposure periods, and methodologies for exposure measurements. Current proposed mechanisms include altered immune response, oxidative stress, neuroinflammation, inadequate placental development, and epigenetic modulation. In this review, we summarized the results of previous pediatric studies that reported effects of prenatal and postnatal air pollution exposure on childhood type 1 diabetes mellitus, obesity, insulin resistance, thyroid dysfunction, and timing of pubertal onset, along with underlying related mechanisms.

18. **Association of indoor air pollution on cognitive dysfunction among elderly.** Bin Mahfoz TM, Alzahrani M, Shaik RA, Ahmad MS, Ahmad RK, Yusuf M, Khan M, Almutairi AB, Alghuyaythat WKZ, Almutairi SB. *Eur Rev Med Pharmacol Sci.* 2021 Sep;25(18):5664-5673. doi: 10.26355/eurrev\_202109\_26785.

<https://www.europeanreview.org/article/26785>

CONCLUSIONS: Exposure to indoor air pollution through fuels used for cooking and heating was significantly associated with cognitive dysfunction among elderly women. Given the limitations, a more extensive meta-analysis and longitudinal studies are recommended to investigate the biological mechanism behind the impact of indoor air pollution on cognitive health.

## WE ACT

19. **Uniting the Global Gastroenterology Community to Meet the Challenge of Climate Change and Nonrecyclable Waste.** Leddin D et al. *J Clin Gastroenterol.* 2021 Nov-Dec 01;55(10):823-829. doi: 10.1097/MCG.0000000000001619.



[https://www.gastrojournal.org/article/S0016-5085\(21\)03339-4/fulltext](https://www.gastrojournal.org/article/S0016-5085(21)03339-4/fulltext)

Climate change has been described as the greatest public health threat of the 21st century. It has significant implications for digestive health. A multinational team with representation from all continents, excluding Antarctica and covering 18 countries, has formulated a commentary which outlines both the implications for digestive health and ways in which this challenge can be faced.

**20. Action in Healthcare Sustainability is a Surgical Imperative: This is a Novel Way to Do It.**

Vacharathit V, Walsh RM, Utech J, Asfaw SH. J Surg Educ. 2021 Sep 29:S1931-7204(21)00248-8. doi:

10.1016/j.jsurg.2021.09.002. Online ahead of print.

**OBJECTIVE:** The healthcare system accounts for 8%-10% of all greenhouse gas emissions in the United States and hospital buildings are significant contributors. Operating rooms account for 20%-33% of all hospital waste. This may contribute to significant climate change and negatively affect public health. Physicians and surgeons must act to reduce our collective carbon footprint to improve the health of our patients. The traditional graduate medical education curriculum does not routinely train future generations of physicians in healthcare sustainability. We describes a fellowship program designed to change this.

**DESIGN AND SETTING:** The Cleveland Clinic surgical residency has implemented a unique educational program. Here we describe the 5-year results of our novel fellowship program in health care sustainability, primarily focused on greening the operating room.

**PARTICIPANTS:** Selected General Surgery residents interested in healthcare sustainability and greening the operating room.

**RESULTS:** We have successfully implemented a novel resident focused fellowship program in healthcare sustainability. Fellowship projects have led to significant reductions in our hospitals' collective carbon footprint.

**CONCLUSIONS:** Surgeons have a unique responsibility to reduce the carbon footprint of the Operating Room. Implementing a dedicated fellowship program or similar intensive educational experience in healthcare sustainability within the framework of a graduate medical education curriculum will help to ensure future generations of surgeons are thoughtful leaders in environmental stewardship.

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**[Lancet Planetary Health](#) – open-access, interdisciplinary journal focused on sustainability**

**News & Commentary**

**[Outdoor Air Pollution and Your Health.](#)** Rice M, Balmes J, Malhotra A. Am J Respir Crit Care Med. 2021 Oct 1;204(7):P13-P14. doi: 10.1164/rccm.2046P13.

**[Clean air for a sustainable world.](#)** Nat Commun. 2021 Oct 4;12(1):5824. doi: 10.1038/s41467-021-25885-w.

[The Good, Bad, and Ugly of Climate Change: A Timely Opportunity for Nursing Professional Development Practitioners.](#) Lockhart JS. J Contin Educ Nurs. 2021 Oct;52(10):447-448. doi: 10.3928/00220124-20210913-01. Epub 2021 Oct 1.

[Climate change, science and COP26: have your say.](#) Tollefson J. Nature. 2021 Oct 7. doi: 10.1038/d41586-021-02746-6. Online ahead of print.

[Covid-19, climate change, and the environment: a sustainable, inclusive, and resilient global recovery.](#) Stern N, Patel IG, Ward B. BMJ. 2021 Oct 6;375:n2405. doi: 10.1136/bmj.n2405.

[Air pollution-time to address the silent killer.](#) The Lancet Respiratory Medicine. 2021 Oct 5:S2213-2600(21)00448-3. doi: 10.1016/S2213-2600(21)00448-3. Online ahead of print.

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