

## Environmental Stewardship Resource Desk

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### New Research

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#### COVID-19

1. **Hand hygiene with hand sanitizer versus handwashing: what are the planetary health consequences?** Duane B, Pilling J, Saget S, Ashley P, Pinhas AR, Lyne A. Environ Sci Pollut Res Int. 2022 Feb 23:1-12. doi: 10.1007/s11356-022-18918-4. Online ahead of print.

<https://link.springer.com/article/10.1007/s11356-022-18918-4>

In order to reduce the transmission of pathogens, and COVID-19, WHO and NHS England recommend hand washing (HW) and/or the use of hand sanitizer (HS). The planetary health consequences of these different methods of hand hygiene have not been quantified. A comparative life cycle assessment (LCA) was carried out to compare the environmental impact of the UK population practising increased levels of hand hygiene during the COVID-19 pandemic for 1 year. Washing hands with soap and water was compared to using hand sanitizer (both ethanol and isopropanol based sanitizers were studied). The isopropanol-based HS had the lowest environmental impact in 14 out of the 16 impact categories used in this study. For climate change, hand hygiene using isopropanol HS produced the equivalent of 1060 million kg CO<sub>2</sub>, compared to 1460 million for ethanol HS, 2300 million for bar soap HW, and 4240 million for liquid soap HW. For both the ethanol and isopropanol HS, the active ingredient was the greatest overall contributing factor to the environmental impact (83.24% and 68.68% respectively). For HW with liquid soap and bar soap, there were additional contributing factors other than the soap itself: for example tap water use (28.12% and 48.68% respectively) and the laundering of a hand towel to dry the hands (10.17% and 17.92% respectively). All forms of hand hygiene have an environmental cost, and this needs to be weighed up against the health benefits of preventing disease transmission. When comparing hand sanitizers to handwashing with soap and water, this study found that using isopropanol based hand sanitizer is better for planetary health. However, no method of hand hygiene was ideal; isopropanol had a greater fossil fuel resource use than ethanol based hand sanitizer. More research is needed to find hand hygiene sources which do not diminish planetary health, and environmental impact is a consideration for public health campaigns around hand hygiene.

- 2. Environmental risks of disposable face masks during the pandemic of COVID-19: Challenges and management.** Li B, Huang Y, Guo D, Liu Y, Liu Z, Han JC, Zhao J, Zhu X, Huang Y, Wang Z, Xing B. *Sci Total Environ.* 2022 Feb 18;825:153880. doi: 10.1016/j.scitotenv.2022.153880. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S004896972200972X>

Since the COVID-19 outbreak in early 2020, face mask (FM) has been recognized as an effective measure to reduce the infection, increasing its consumption across the world. However, the large amount of at-home FM usage changed traditional medical waste management practices, lack of improper management. Currently, few studies estimate FM consumption at a global scale, not to say a comprehensive investigation on the environmental risks of FM from a life cycle perspective. Therefore, global FM consumption and its associated environmental risks are clarified in the present study. Our result shows that 449.5 billion FMs were consumed from January 2020 to March 2021, with an average of 59.4 FMs per person worldwide. This review also provides a basis to understand the environmental risk of randomly disposed of FM and highlights the urgent requirement for the attention of FMs waste management to prevent pollution in the near future.

- 3. Impact of COVID-19 Pandemic on Air Quality: A Systematic Review.** Silva ACT, Branco PTBS, Sousa SIV. *Int J Environ Res Public Health.* 2022 Feb 10;19(4):1950. doi: 10.3390/ijerph19041950.

<https://www.mdpi.com/1660-4601/19/4/1950>

With the emergence of the COVID-19 pandemic, several governments imposed severe restrictions on socio-economic activities, putting most of the world population into a general lockdown in March 2020. Although scattered, studies on this topic worldwide have rapidly emerged in the literature. Hence, this systematic review aimed to identify and discuss the scientifically validated literature that evaluated the impact of the COVID-19 pandemic and associated restrictions on air quality. Thus, a total of 114 studies that quantified the impact of the COVID-19 pandemic on air quality through monitoring were selected from three databases. The most evaluated countries were India and China; all the studies intended to evaluate the impact of the pandemic on air quality, mainly concerning PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, O<sub>3</sub>, CO, and SO<sub>2</sub>. Most of them focused on the 1st lockdown, comparing with the pre- and post-lockdown periods and usually in urban areas. Many studies conducted a descriptive analysis, while others complemented it with more advanced statistical analysis. Although using different methodologies, some studies reported a temporary air quality improvement during the lockdown. More studies are still needed, comparing different lockdown and lifting periods and, in other areas, for a definition of better-targeted policies to reduce air pollution.

- 4. Wired to Doubt: Why People Fear Vaccines and Climate Change and Mistrust Science.** Dobson GP. *Front Med (Lausanne).* 2022 Jan 28;8:809395. doi: 10.3389/fmed.2021.809395. eCollection 2021.

<https://www.frontiersin.org/articles/10.3389/fmed.2021.809395/full>

We all want to be right in our thinking. Vaccine hesitancy and global warming denial share much in common: (1) both are threats to personal, community and global health, (2) action is

contingent on co-operation and social policy, and (3) public support relies on trust in science. The irony is, however, as the science has become more convincing, public opinion has become more divided. A number of early polls showed that ~70% of people supported COVID-19 vaccine use and global warming, ~20% adopted a wait-and-see approach, and ~10% were staunch objectors. Although these percentages are approximate, what factors are responsible for the differences in engagement, doubt and distrust? How can we reduce the consensus gap? One approach is to return to grass roots and provide a brief history of the issues, understand the difference between fact and opinion, truth and falsehood, the problem of certainty, and how scientific consensus is reached. To doubt is a healthy response to new information, and it too has a scientific basis. Doubt and distrust reside in that region of the brain called the dorsolateral prefrontal cortex, which is responsible for suppressing unwanted representations. Bridging the consensus gap requires shifting human thinking patterns from doubt to belief, and belief to action. Education and improved public messaging are key, and social media providers require urgent oversight or regulation to remove false and harmful/dangerous content from our digital lives. Delays to vaccinate and failure to reduce greenhouse gases will dramatically change the way we live. The new norm may be more deadly COVID variants, strained healthcare systems, extreme weather patterns, diminished food supply, delays in goods and services, damage to world's economies and widespread global instability.

### Health Impacts of Climate Change

5. **Long-term effects of PM(2.5) components on incident dementia in the northeastern United States.** Li J, Wang Y, Steenland K, Liu P, van Donkelaar A, Martin RV, Chang HH, Caudle WM, Schwartz J, Koutrakis P, Shi L. *Innovation (N Y)*. 2022 Jan 17;3(2):100208. doi: 10.1016/j.xinn.2022.100208. eCollection 2022 Mar 29.

<https://www.sciencedirect.com/science/article/pii/S2666675822000042>

Growing evidence has linked long-term fine particulate matter (PM<sub>2.5</sub>) exposure to neurological disorders. Less is known about the individual effects of PM<sub>2.5</sub> components. A population-based cohort study investigated the association between long-term (1-year average) exposure to PM<sub>2.5</sub> components and dementia incidence among the elderly population (age, ≥65 years) in the United States. We used data from the Medicare Chronic Conditions Warehouse and a high-resolution PM<sub>2.5</sub> components dataset of the northeastern United States (2000-2017). We identified dementia diagnoses from patients' hospital and medical insurance records and carried out Cox proportional hazards regression to investigate their association with PM<sub>2.5</sub> components. Among ~2 million participants, 15.1% developed dementia. From the single-pollutant models, hazard ratios per interquartile range increase were 1.10 (95% confidence interval [CI]: 1.09-1.11) for black carbon, 1.08 (95% CI: 1.07, 1.10) for inorganic nitrate, 1.03 (95% CI: 1.02, 1.04) for organic matter, 1.13 (95% CI: 1.11, 1.15) for sulfate, 1.07 (95% CI: 1.06, 1.07) for soil particles, and 1.04 (95% CI: 1.03, 1.05) for sea salt. Increase in exposure to black carbon and sulfate per interquartile range had the strongest associations with dementia incidence. Penalized spline models indicated that dementia incidence increased linearly with elevated black carbon concentrations, whereas the incidence of dementia was only elevated significantly following sulfate concentrations above ~2 µg/m<sup>3</sup>. Our study suggests that long-term exposure to PM<sub>2.5</sub> components is significantly associated with

increased dementia incidence and that different components have different neurotoxicity. Reduction of PM2.5 emissions, especially for main sources of black carbon and sulfate, may reduce the burden of dementia in the aging United States population.

6. **Growing impact of wildfire on western US water supply.** Williams AP, Livneh B, McKinnon KA, Hansen WD, Mankin JS, Cook BI, Smerdon JE, Varuolo-Clarke AM, Bjarke NR, Juang CS, Lettenmaier DP. Proc Natl Acad Sci U S A. 2022 Mar 8;119(10):e2114069119. doi: 10.1073/pnas.2114069119.  
<https://www.pnas.org/doi/10.1073/pnas.2114069119>  
Streamflow often increases after fire, but the persistence of this effect and its importance to present and future regional water resources are unclear. This paper addresses these knowledge gaps for the western United States (WUS), where annual forest fire area increased by more than 1,100% during 1984 to 2020. Among 72 forested basins across the WUS that burned between 1984 and 2019, the multibasin mean streamflow was significantly elevated by 0.19 SDs ( $P < 0.01$ ) for an average of 6 water years postfire, compared to the range of results expected from climate alone. Significance is assessed by comparing prefire and postfire streamflow responses to climate and also to streamflow among 107 control basins that experienced little to no wildfire during the study period. The streamflow response scales with fire extent: among the 29 basins where >20% of forest area burned in a year, streamflow over the first 6 water years postfire increased by a multibasin average of 0.38 SDs, or 30%. Postfire streamflow increases were significant in all four seasons. Historical fire-climate relationships combined with climate model projections suggest that 2021 to 2050 will see repeated years when climate is more fire-conducive than in 2020, the year currently holding the modern record for WUS forest area burned. These findings center on relatively small, minimally managed basins, but our results suggest that burned areas will grow enough over the next 3 decades to enhance streamflow at regional scales. Wildfire is an emerging driver of runoff change that will increasingly alter climate impacts on water supplies and runoff-related risks.
7. **Health Benefits of Strategies for Carbon Mitigation in US Transportation, 2017–2050.** Maizlish N, Rudolph L, Jiang C. Am J Public Health. 2022 Mar;112(3):426-433. doi: 10.2105/AJPH.2021.306600.  
<https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=c8h&AN=155395316&site=ehost-live&scope=site&authtype=ip,shib&custid=ns247570>  
Objectives. To quantify health benefits and carbon emissions of 2 transportation scenarios that contrast optimum levels of physical activity from active travel and minimal air pollution from electric cars. Methods. We used data on burden of disease, travel, and vehicle emissions in the US population and a health impact model to assess health benefits and harms of physical activity from transportation-related walking and cycling, fine particulate pollution from car emissions, and road traffic injuries. We compared baseline travel with walking and cycling a median of 150 weekly minutes for physical activity, and with electric cars that minimized carbon pollution and fine particulates. Results. In 2050, the target year for carbon neutrality, the active travel scenario avoided 167 000 deaths and gained 2.5 million disability-adjusted life years, monetized at \$1.6 trillion using the value of a statistical life. Carbon emissions were reduced by 24% from baseline. Electric cars avoided 1400 deaths and gained 16 400 disability-

adjusted life years, monetized at \$13 billion. Conclusions. To achieve carbon neutrality in transportation and maximize health benefits, active travel should have a prominent role along with electric vehicles in national blueprints.

8. **Deterioration of air quality associated with the 2020 US wildfires.** Filonchyk M, Peterson MP, Sun D. *Sci Total Environ.* 2022 Feb 23:154103. doi: 10.1016/j.scitotenv.2022.154103. Online ahead of print.

The wildfires of August and September 2020 in the western part of the United States were characterized by an unparalleled duration and wide geographical coverage. A particular consequence of massive wildfires includes serious health effects due to short and long-term exposure to poor air quality. Using a variety of data sources including aerosol optical depth (AOD) and ultraviolet aerosol index (UVAI), obtained with the Moderate-Resolution Imaging Spectroradiometer (MODIS), Multi-Angle Implementation of Atmospheric Correction (MAIAC) and Tropospheric Monitoring Instrument (TROPOMI), combined with meteorological information from the European Center for Medium-Range Weather Forecasts (ECMWF) and other supporting data, the impact of wildfires on air quality is examined in the three western US states, California, Oregon, and Washington, and areas to the east. The results show that smoke aerosols not only led to a significant deterioration in air quality in these states but also affected all other states, Canada, and surrounding ocean areas. The wildfires increased the average daily surface concentration of PM<sub>2.5</sub> posing significant health risks, especially for vulnerable populations. Large amounts of black carbon (BC) aerosols were emitted into the atmosphere. AOD and UVAI exceeded 1 and 2 over most of the country. In parts of the three western states, those values reached 3.7 and 6.6, respectively. Moreover, a reanalysis based on MERRA-2 (Modern-Era Retrospective Analysis for Research and Applications, version 2) showed that the maximum values of BC surface mass concentration during the wildfires were about 370 µg/m<sup>3</sup>. These various indicators provide a better understanding of the extent of environmental and atmospheric degradation associated with these forest fires.

9. **Drowning risk and climate change: a state-of-the-art review.** Sindall R, Mecrow T, Queiroga AC, Boyer C, Koon W, Peden AE. *Inj Prev.* 2022 Feb 23:injuryprev-2021-044486. doi: 10.1136/injuryprev-2021-044486. Online ahead of print.

<https://injuryprevention.bmj.com/content/early/2022/02/22/injuryprev-2021-044486>

Drowning and climate change are both significant global health threats, yet little research links climate change to drowning risk. Research into the epidemiology, risk factors and preventive strategies for unintentional drowning in high-income and in low-income and middle-income countries has expanded understanding, but understanding of disaster and extreme weather-related drowning needs research focus. As nation states and researchers call for action on climate change, its impact on drowning has been largely ignored. This state-of-the-art review considers existing literature on climate change as a contributor to changes in drowning risks globally. Using selected climate change-related risks identified by the World Meteorological Organization and key risks to the Sustainable Development Goals as a framework, we consider the drowning risks associated with heat waves, hydrometeorological hazards, drought and water scarcity, damaged infrastructure, marine ecosystem collapse, displacement, and rising poverty and inequality. Although the degree of atmospheric warming remains uncertain, the

impact of climate change on drowning risk is already taking place and can no longer be ignored. Greater evidence characterising the links between drowning and climate change across both high-income and low-income and middle-income contexts is required, and the implementation and evaluation of drowning interventions must reflect climate change risks at a local level, accounting for both geographical variation and the consequences of inequality. Furthermore, collaboration between the injury prevention, disaster risk reduction and climate change mitigation sectors is crucial to both prevent climate change from stalling progress on preventing drowning and further advocate for climate change mitigation as a drowning risk reduction mechanism.

10. **The past, present, and future of plastic pollution.** Williams AT, Rangel-Buitrago N. *Mar Pollut Bull.* 2022 Feb 22;176:113429. doi: 10.1016/j.marpolbul.2022.113429. Online ahead of print. Plastic production is an essential part of the world economy that has mushroomed exponentially with c.9.2 billion tonnes estimated to have been made between 1950 and 2017. Now, each year c.8-11 million tonnes of plastic waste escapes into the oceans. Plastic usage is varied but the packaging industry accounts for 47%. Recycling and the circular economy are seen as keys to unlocking the plastic problem, for example, via the Extended Producer Responsibility scheme; a Deposit Return Scheme. The circular economy is a fine idea and has been around a long time, but has it made any real difference? The amount of plastic in circulation keeps getting bigger and bigger. More thought must be given to creating technologies and designs that can deal with waste management, integrate international collaboration and cut waste to a bare minimum at its source point upstream. No single solution exists, but there is a need for a legally binding global governance arrangement that would effectively and measurably limit and control plastic pollution. Many governments are in favour of this.
  
11. **The Changing Climate and Pregnancy Health.** Ha S. *Curr Environ Health Rep.* 2022 Feb 22. doi: 10.1007/s40572-022-00345-9. Online ahead of print. <https://link.springer.com/article/10.1007/s40572-022-00345-9>  
RECENT FINDINGS: Accumulating evidence suggests that the changing climate affects pregnancy health directly via discrete environmental disasters (i.e., wildfire, extreme heat, hurricane, flood, and drought), and indirectly through changes in the natural and social environment. Although studies vary greatly in design, analytic methods, and assessment strategies, they generally converge to suggest that climate-related disasters are associated with increased risk of gestational complication, pregnancy loss, restricted fetal growth, low birthweight, preterm birth, and selected delivery/newborn complications. Window(s) of exposure with the highest sensitivity are not clear, but both acute and chronic exposures appear important. Furthermore, socioeconomically disadvantaged populations may be more vulnerable. Policy, clinical, and research strategies for adaptation and mitigation should be continued, strengthened, and expanded with cross-disciplinary efforts. Top priorities should include (a) reinforcing and expanding policies to further reduce emission, (b) increasing awareness and education resources for healthcare providers and the public, (c) facilitating access to quality population-based data in low-resource areas, and (d) research efforts to better understand mechanisms of

effects, identify susceptible populations and windows of exposure, explore interactive impacts of multiple exposures, and develop novel methods to better quantify pregnancy health impacts.

12. **Air Pollution, Ultrafine Particles, and Your Brain: Are Combustion Nanoparticle Emissions and Engineered Nanoparticles Causing Preventable Fatal Neurodegenerative Diseases and Common Neuropsychiatric Outcomes?** Calderón-Garcidueñas L, Ayala A. *Environ Sci Technol*. 2022 Feb 22. doi: 10.1021/acs.est.1c04706. Online ahead of print. <https://pubs.acs.org/doi/10.1021/acs.est.1c04706>

Exposure to particulate matter (PM) pollution damages the human brain. Fossil fuel burning for transportation energy accounts for a significant fraction of urban air and climate pollution. While current United States (US) standards limit PM ambient concentrations and emissions, they do not regulate explicitly ultrafine particles (UFP  $\leq 100$  nm in diameter). There is a growing body of evidence suggesting UFP may play a bigger role inflicting adverse health impacts than has been recognized, and in this perspective, we highlight effects on the brain, particularly of young individuals. UFP penetrate the body through nasal/olfactory, respiratory, gastrointestinal, placenta, and brain-blood barriers, translocating in the bloodstream and reaching the lymphatic and central nervous systems. We discuss one case study. The 21.8 million residents in the Metropolitan Mexico City (MMC) are regularly exposed to fine PM (PM<sub>2.5</sub>) above the US 12  $\mu\text{g}/\text{m}^3$  annual average standards. Alzheimer's disease (AD), Parkinson's disease (PD), and TAR DNA-binding protein (TDP-43) pathologies and nanoparticles (NP  $\leq 50$  nm in diameter) in critical brain organelles have been documented in MMC children and young adult autopsies. MMC young residents have cognitive and olfaction deficits, altered gait and equilibrium, brainstem auditory evoked potentials, and sleep disorders. Higher risk of AD and vascular dementia associated with residency close to high traffic roadways have been documented. The US is not ready or prepared to adopt ambient air quality or emission standards for UFP and will continue to focus regulations only on the total mass of PM<sub>2.5</sub> and PM<sub>10</sub>. Thus, this approach raises the question: are we dropping the ball? As research continues to answer the remaining questions about UFP sources, exposures, impacts, and controls, the precautionary principle should call us to accelerate and expand policy interventions to abate or eliminate UFP emissions and to mitigate UFP exposures. For residents of highly polluted cities, particularly in the developing world where there is likely older and dirtier vehicles, equipment, and fuels in use and less regulatory oversight, we should embark in a strong campaign to raise public awareness of the associations between high PM pollution, heavy traffic, UFP, NP, and neuropsychiatric outcomes, including dementia. Neurodegenerative diseases evolving from childhood in polluted, anthropogenic, and industrial environments ought to be preventable.

13. **Current and future burdens of heat-related hyponatremia - a nationwide register-based study.** Mannheimer B, Sterea-Grossu A, Falhammar H, Calissendorff J, Skov J, Lindh JD. *J Clin Endocrinol Metab*. 2022 Feb 22:dgac103. doi: 10.1210/clinem/dgac103. Online ahead of print. <https://academic.oup.com/jcem/advance-article/doi/10.1210/clinem/dgac103/6534473>  
DESIGN, SETTING AND PATIENTS: Nationwide cohort study. All patients hospitalized with a first-ever principal diagnosis of hyponatremia between October 2005 and December 2014 were identified. Incidence rates for hyponatremia were calculated as number of hospitalizations

divided by person-days at risk in the adult Swedish population at a given temperature, in increments of 1 °C.

**RESULTS:** The incidence of hyponatremia was stable at 0.3 per million person-days from -10°C to 10°C, but increased rapidly at 24h mean temperatures above 15°C, with 1.96 hospitalizations per million days at the highest recorded temperature of 26°C. Women and elderly carried the greatest risk, with an incidence of 30 hospitalizations per million days in individuals ≥80 years old on the hottest days, corresponding to a 15-fold increase in incidence compared to cool days. A future 1°C or 2°C increase in mean temperature is expected to increase the incidence of hyponatremia by 6.3% and 13.9%, respectively.

**CONCLUSION:** The risk of hospitalization due to hyponatremia increases rapidly at temperatures above 15°C, indicating a threshold effect. Over the next decades, rising global temperatures are expected to increase the inpatient burden of hyponatremia by approximately 10%. Strategies for protecting vulnerable groups are necessary to reduce this risk.

**14. Environmental health impacts of microplastics exposure on structural organization levels in the human body.** Yang X, Man YB, Wong MH, Owen RB, Chow KL. *Sci Total Environ.* 2022 Feb 21:154025. doi: 10.1016/j.scitotenv.2022.154025. Online ahead of print.

The ubiquitous prevalence of microplastics pollution has raised concerns about microplastics' potential risks and impacts on the global environment. However, the potential human health risks and impacts of microplastics remain largely unexplored. By providing an overview regarding the interaction of microplastics and human health, this review extends current knowledge on the potential impacts of microplastics pollution on humans from an environmental health perspective. The paper firstly presents the characteristics of microplastics as well as the status of global microplastics pollution. As for human health, the potential hazards of microplastics are reflected by toxic chemical components, vectors of contaminants, and physical damage. Extensive microplastic pollution on ecosystems due to human activities leads to inevitable human exposure, which may occur by dietary, inhalation and/or skin contact. Accordingly, microplastics exposure is closely associated with human health. This study explores the potential interactions of microplastics with the biological organization at various levels, including chemical, cellular, tissue, organ, and system levels. The review concludes by highlighting five urgent perspectives and implications for future research on microplastics: 1) Developing a standard terminology and research methods; 2) Reinforcing microplastics pollution governance; 3) Exploring innovative strategies and technologies; 4) Engaging the public and change behaviour; and 5) Adopting a transdisciplinary approach.

**15. Environmental Nanoparticles Reach Human Fetal Brains.** Calderón-Garcidueñas L et al. *Biomedicines.* 2022 Feb 9;10(2):410. doi: 10.3390/biomedicines10020410.

<https://www.mdpi.com/2227-9059/10/2/410>

Anthropogenic ultrafine particulate matter (UFP) and industrial and natural nanoparticles (NPs) are ubiquitous. Normal term, preeclamptic, and postconceptional weeks(PCW) 8-15 human placentas and brains from polluted Mexican cities were analyzed by TEM and energy-dispersive X-ray spectroscopy. We documented NPs in maternal erythrocytes, early syncytiotrophoblast, Hofbauer cells, and fetal endothelium (ECs). Fetal ECs exhibited caveolar NP activity and widespread erythroblast contact. Brain ECs displayed micropodial extensions



reaching luminal NP-loaded erythroblasts. Neurons and primitive glia displayed nuclear, organelle, and cytoplasmic NPs in both singles and conglomerates. Nanoscale Fe, Ti, and Al alloys, Hg, Cu, Ca, Sn, and Si were detected in placentas and fetal brains. Preeclamptic fetal blood NP vesicles are prospective neonate UFPM exposure biomarkers. NPs are reaching brain tissues at the early developmental PCW 8-15 stage, and NPs in maternal and fetal placental tissue compartments strongly suggests the placental barrier is not limiting the access of environmental NPs. Erythroblasts are the main early NP carriers to fetal tissues. The passage of UFPM/NPs from mothers to fetuses is documented and fingerprinting placental single particle composition could be useful for postnatal risk assessments. Fetal brain combustion and industrial NPs raise medical concerns about prenatal and postnatal health, including neurological and neurodegenerative lifelong consequences.

**16. Plague risk in the western United States over seven decades of environmental change.**

Carlson CJ, Bevins SN, Schmid BV. *Glob Chang Biol.* 2022 Feb;28(3):753-769. doi: 10.1111/gcb.15966. Epub 2021 Nov 18.

<https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15966>

After several pandemics over the last two millennia, the wildlife reservoirs of plague (*Yersinia pestis*) now persist around the world, including in the western United States. Routine surveillance in this region has generated comprehensive records of human cases and animal seroprevalence, creating a unique opportunity to test how plague reservoirs are responding to environmental change. Here, we test whether animal and human data suggest that plague reservoirs and spillover risk have shifted since 1950. To do so, we develop a new method for detecting the impact of climate change on infectious disease distributions, capable of disentangling long-term trends (signal) and interannual variation in both weather and sampling (noise). We find that plague foci are associated with high-elevation rodent communities, and soil biochemistry may play a key role in the geography of long-term persistence. In addition, we find that human cases are concentrated only in a small subset of endemic areas, and that spillover events are driven by higher rodent species richness (the amplification hypothesis) and climatic anomalies (the trophic cascade hypothesis). Using our detection model, we find that due to the changing climate, rodent communities at high elevations have become more conducive to the establishment of plague reservoirs—with suitability increasing up to 40% in some places—and that spillover risk to humans at mid-elevations has increased as well, although more gradually. These results highlight opportunities for deeper investigation of plague ecology, the value of integrative surveillance for infectious disease geography, and the need for further research into ongoing climate change impacts.

**17. Air Pollution and Coronary Plaque Vulnerability and Instability: An Optical Coherence Tomography Study.**

Montone RA, Camilli M, Russo M, Termite C, La Vecchia G, Iannaccone G, Rinaldi R, Gurgoglione F, Del Buono MG, Sanna T, Trani C, Liuzzo G, Crea F, Niccoli G. *JACC Cardiovasc Imaging.* 2022 Feb;15(2):325-342. doi: 10.1016/j.jcmg.2021.09.008. Epub 2021 Oct 13.

RESULTS: We included 126 patients (median age: 67.0 years of age; IQR: 55.5-76.0; 97 male patients [77.0%]). Sixty-six patients (52.4%) had PR as the mechanism of plaque instability. Patients with PR were exposed to significantly higher PM<sub>2.5</sub> levels than to IFC, and PM<sub>2.5</sub> was

independently associated with PR (odds ratio: 1.194; 95% CI: 1.036 to 1.377; P = 0.015). Moreover, exposure to higher levels of PM<sub>2.5</sub> was independently associated with the presence of TCFA and of MØI at the culprit site. Interestingly, PM<sub>2.5</sub>, PM<sub>10</sub>, and Co levels were positively and significantly correlated with serum levels of C-reactive protein.

**CONCLUSIONS:** We provide novel insights into the missing link between air pollution and increased risk of coronary events. In particular, exposure to higher concentrations of air pollutants is associated with the presence of vulnerable plaque features and with plaque rupture as a mechanism of coronary instability. An enhanced systemic and plaque inflammatory activation may explain these findings.

- 18. The impact of climate change and emerging infectious diseases on the blood supply.** Jacobs JW. *Transfus Apher Sci.* 2021 Dec;60(6):103272. doi: 10.1016/j.transci.2021.103272. Epub 2021 Sep 6.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8420088/>

The blood supply is under constant threat from myriad infectious diseases, evidenced by the devastating consequences wrought by hepatitis and human immunodeficiency virus (HIV) during the mid-to-late 20th century. More recently, malaria, West Nile, and Zika have influenced the blood donation and infectious disease screening process. For the previous 18 months, attention has focused on COVID-19 as the most recent possible transfusion-transmitted infection. Fortunately, there is no evidence that this disease is transmitted via blood transfusion. Nevertheless, these examples illustrate the ever-present risk of the introduction of new or unknown pathogens into the blood supply.

- 19. Health impacts of air pollution exposure from 1990 to 2019 in 43 European countries.**

Juginović A, Vuković M, Aranza I, Biloš V. *Sci Rep.* 2021 Nov 18;11(1):22516. doi: 10.1038/s41598-021-01802-5.

<https://www.nature.com/articles/s41598-021-01802-5>

Air pollution is the fourth greatest overall risk factor for human health. Despite declining levels in Europe, air pollution still represents a major health and economic burden. We collected data from the Global Burden of Disease Study 2019 regarding overall, as well as ischemic heart disease (IHD), stroke, and tracheal, bronchus and lung cancer-specific disability adjusted life years (DALYs), years of life lost (YLL) and mortality attributable to air pollution for 43 European countries between 1990 and 2019. Concentrations of ambient particulate matter (aPM<sub>2.5</sub>), ozone, and household air pollution from solid fuels were obtained from State of Global Air 2020. We analysed changes in air pollution parameters, as well as DALYs, YLL, and mortality related to air pollution, also taking into account gross national income (GNI) and socio-demographic index (SDI). Using a novel calculation, aPM<sub>2.5</sub> ratio (PMR) change and DALY rate ratio (DARR) change were used to assess each country's ability to decrease its aPM<sub>2.5</sub> pollution and DALYs to at least the extent of the European median decrease within the analysed period. Finally, we created a multiple regression model for reliably predicting YLL using aPM<sub>2.5</sub> and household air pollution. The average annual population-weighted aPM<sub>2.5</sub> exposure in Europe in 1990 was 20.8 µg/m<sup>3</sup> (95% confidence interval (CI) 18.3-23.2), while in 2019 it was 33.7% lower at 13.8 µg/m<sup>3</sup> (95% CI 12.0-15.6). There were in total 368 006 estimated deaths in Europe in 2019 attributable to air pollution, a 42.4% decrease compared to 639 052 in 1990.

The majority (90.4%) of all deaths were associated with aPM2.5. IHD was the primary cause of death making up 44.6% of all deaths attributable to air pollution. The age-standardised DALY rate and YLL rate attributable to air pollution were more than 60% lower in 2019 compared to 1990. There was a strong positive correlation ( $r = 0.911$ ) between YLL rate and aPM2.5 pollution in 2019 in Europe. Our multiple regression model predicts that for 10% increase in aPM2.5, YLL increases by 16.7%. Furthermore, 26 of 43 European countries had a positive DARR change. 31 of 43 European countries had a negative PMR change, thus not keeping up with the European median aPM2.5 concentration decrease. When categorising countries by SDI and GNI, countries in the higher brackets had significantly lower aPM2.5 concentration and DALY rate for IHD and stroke. Overall, air pollution levels, air pollution-related morbidity and mortality have decreased considerably in Europe in the last three decades. However, with the growing European population, air pollution remains an important public health and economic issue. Policies targeting air pollution reduction should continue to be strongly enforced to further reduce one of the greatest risk factors for human health.

## WE ACT

20. **Carbon footprint modelling of national health systems: Opportunities, challenges and recommendations.** Booth A. *Int J Health Plann Manage.* 2022 Feb 24. doi: 10.1002/hpm.3447. Online ahead of print.  
<https://onlinelibrary.wiley.com/doi/10.1002/hpm.3447>  
Health care presents significant contributions towards climate change. An awareness of a health systems carbon footprint provides a quantification of its environmental impact, an understanding of carbon intensive areas to target with reduction measures and a means of mapping trends in emissions over time. Attempts at calculating the carbon footprint of national health systems are few, predominantly of developed nations, and are limited by data availability and methodological inadequacies. There is a need to mobilise countries to understand the role of health care in contributing towards climate change and for them to start engaging in ongoing calculations of their national health system carbon footprints. There is also a need to improve data availability and information systems to allow for such calculations, especially in developing countries where there may be differences in carbon hotspots. Finally, there is a need for continued improvements in the carbon footprint modelling methodology of health systems as data collection and available emission factors, especially of health care specific products and supply chain emissions, improves. Health systems need to join the global fight against climate change.
21. **Tackling the increasing contamination of the water supply by iodinated contrast media.** Dekker HM, Stroomberg GJ, Prokop M. *Insights Imaging.* 2022 Feb 24;13(1):30. doi: 10.1186/s13244-022-01175-x.  
<https://insightsimaging.springeropen.com/articles/10.1186/s13244-022-01175-x>  
Contrast media are essential for diagnostic and interventional procedures. Iodinated contrast media are the most commonly used agents, with CT requiring the largest overall quantities. Data show that these iodinated contrast media are found in sewage water, surface water and drinking water in many regions in the world. Because standard drinking water purification

techniques only provide poor to moderate removal of iodinated contrast media, these substances pose a problem for drinking water preparation that has not yet been solved. There is a growing body of evidence supporting the negative environmental effects of iodinated contrast media via their breakdown products. The environmental impact of iodinated contrast media can be mitigated by measures focusing on the application of contrast media or the excretion of contrast media. Measures with respect to contrast application include reducing the utilization of contrast media, reducing the waste of contrast media and collecting residues of contrast media at the point of application. The amount of contrast media excreted into the sewage water can be decreased by introducing urine bags and/or special urine collection and waste-water processing techniques in the hospital. To tackle the problem of contrast media in the water system in its entirety, it is necessary for all parties involved to cooperate, from the producer of contrast medium to the consumer of drinking water. This paper aims to make health professionals aware of the opportunity to take the lead now in more conscious decisions regarding use of contrast media and gives an overview of the different perspectives for action.

22. **An Innovative Framework for Sustainable Development in Healthcare: The Human Rights Assessment.** Moldovan F, Blaga P, Moldovan L, Bataga T. *Int J Environ Res Public Health*. 2022 Feb 16;19(4):2222. doi: 10.3390/ijerph19042222.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8872572/>

Healthcare providers are investing considerable resources for the development of quality management systems in hospitals. Contrary to these efforts, the number of tools that allow the evaluation of implementation efforts and the results of quality, security and sustainable development is quite limited. The purpose of the study is to develop a reference framework for quality and sustainable development in healthcare, Sanitary-Quality (San-Q) at the micro system level, which is compatible with applicable national and international standards in the field. The research method consisted of the study of literature, identification and analysis of good sustainability practices in healthcare, which allowed identification of the areas of the new San-Q framework: quality, economic, environmental, social, institutional and healthcare. These areas are incorporated into the core topics of social responsibility mentioned by ISO26000. A total of 57 indicators have been defined that make up the new reference framework. The evaluation format of the indicators is innovative through a couple of values: completion degree-significance. In the experimental part of the research, a pilot implementation of the San-Q framework at an emergency hospital was performed, the results recorded in terms of responsibility for human rights being presented. The conclusions of the study reveal the innovative aspects of the framework that facilitate the development of a sustainability strategy promoted through performance indicators, the results obtained after evaluation being useful in establishing a reference level of sustainability but also in developing sustainability policies.

23. **Principles of environmentally-sustainable anaesthesia: a global consensus statement from the World Federation of Societies of Anaesthesiologists.** White SM, Shelton CL, Gelb AW, Lawson C, McGain F, Muret J, Sherman JD; representing the World Federation of Societies of Anaesthesiologists Global Working Group on Environmental Sustainability in Anaesthesia. *Anaesthesia*. 2022 Feb;77(2):201-212. doi: 10.1111/anae.15598. Epub 2021 Nov 1.

<https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.15598>

The Earth's mean surface temperature is already approximately 1.1°C higher than pre-industrial levels. Exceeding a mean 1.5°C rise by 2050 will make global adaptation to the consequences of climate change less possible. To protect public health, anaesthesia providers need to reduce the contribution their practice makes to global warming. We convened a Working Group of 45 anaesthesia providers with a recognised interest in sustainability, and used a three-stage modified Delphi consensus process to agree on principles of environmentally sustainable anaesthesia that are achievable worldwide. The Working Group agreed on the following three important underlying statements: patient safety should not be compromised by sustainable anaesthetic practices; high-, middle- and low-income countries should support each other appropriately in delivering sustainable healthcare (including anaesthesia); and healthcare systems should be mandated to reduce their contribution to global warming. We set out seven fundamental principles to guide anaesthesia providers in the move to environmentally sustainable practice, including: choice of medications and equipment; minimising waste and overuse of resources; and addressing environmental sustainability in anaesthetists' education, research, quality improvement and local healthcare leadership activities. These changes are achievable with minimal material resource and financial investment, and should undergo re-evaluation and updates as better evidence is published. This paper discusses each principle individually, and directs readers towards further important references.

24. **Waste-derived biomaterials as building blocks in the biomedical field.** Jana S, Das P, Mukherjee J, Banerjee D, Ghosh PR, Kumar Das P, Bhattacharya RN, Nandi SK. *J Mater Chem B*. 2022 Jan 26;10(4):489-505. doi: 10.1039/d1tb02125g.

Recent developments in the biomedical arena have led to the fabrication of innovative biomaterials by utilizing bioactive molecules obtained from biological wastes released from fruit and beverage processing industries, and fish, meat, and poultry industries. These biological wastes that end up in water bodies as well as in landfills are an affluent source of animal- and plant-derived proteins, bio ceramics and polysaccharides such as collagens, gelatins, chitins, chitosans, eggshell membrane proteins, hydroxyapatites, celluloses, and pectins. These bioactive molecules have been intricately designed into scaffolds and dressing materials by utilizing advanced technologies for drug delivery, tissue engineering, and wound healing relevance. These biomaterials are environment-friendly, biodegradable, and biocompatible, and show excellent tissue regeneration attributes. Additionally, being cost-effective they can reduce the burden on the healthcare system as well as provide a sustainable solution to waste management. In this review, the current trends in the utilization of plant and animal waste-derived biomaterials in various biomedical fields are considered along with a separate section on their applications as xenografts.

25. **Sustainability of Heating, Ventilation and Air-Conditioning (HVAC) Systems in Buildings-An Overview.** Asim N, Badieli M, Mohammad M, Razali H, Rajabi A, Chin Haw L, Jameelah Ghazali M. *Int J Environ Res Public Health*. 2022 Jan 17;19(2):1016. doi: 10.3390/ijerph19021016.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8776175/>

Increasing demand on heating, ventilation, and air-conditioning (HVAC) systems and their importance, as the respiratory system of buildings, in developing and spreading various microbial contaminations and diseases with their huge global energy consumption share have forced researchers, industries, and policymakers to focus on improving the sustainability of HVAC systems. Understanding and considering various parameters related to the sustainability of new and existing HVAC systems as the respiratory system of buildings are vital to providing healthy, energy-efficient, and economical options for various building types. However, the greatest opportunities for improving the sustainability of HVAC systems exist at the design stage of new facilities and the retrofitting of existing equipment. Considering the high available percentage of existing HVAC systems globally reveals the importance of their retrofitting. The attempt has been made to gather all important parameters that affect decision-making to select the optimum HVAC system development considerations among the various opportunities that are available for sustainability improvement.

26. **What the Physical Activity Community Can Do for Climate Action and Planetary Health?** Reis R, Hunter RF, Garcia L, Salvo D. *J Phys Act Health*. 2022 Jan 1;19(1):2-3. doi: 10.1123/jpah.2021-0719. Epub 2021 Nov 16.

<https://journals.humankinetics.com/view/journals/jpah/19/1/article-p2.xml>

We are experiencing a planetary tipping point with global warming, environmental degradation, and losses in biodiversity. The burdens of these changes fall disproportionately on poor and marginalized populations. Physical activity promotion strategies need to be aligned with climate action commitments, incorporating the Intergovernmental Panel on Climate Change scenarios in physical activity action plans. The promotion strategies must consider equity a core value and promote physical activity to the most vulnerable populations so that they are protected from the ill-health impacts of a changing climate.

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### News & Commentary

[Climate change and the different roles of physicians: a critical response to "A Planetary Health Pledge for Health Professionals in the Anthropocene"](#). Wiesing U. *Med Health Care Philos*. 2022

Mar;25(1):161-164. doi: 10.1007/s11019-021-10051-2. Epub 2021 Sep 16.

[United Nations to tackle global plastics pollution](#). Stokstad E. *Science*. 2022 Feb 25;375(6583):801-802. doi: 10.1126/science.ada1551. Epub 2022 Feb 24.

[US EPA signals renewed regulatory scrutiny of toxic air pollution](#). Furlow B. *Lancet Respir Med*. 2022 Feb 21:S2213-2600(22)00065-0. doi: 10.1016/S2213-2600(22)00065-0. Online ahead of print.

[Identifying and Preparing for the Mental Health Burden of Climate Change](#). Obradovich N, Minor K. *JAMA Psychiatry*. 2022 Feb 23. doi: 10.1001/jamapsychiatry.2021.4280. Online ahead of print.

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