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COVID-19

1. **COVID-19 pandemic reveals persistent disparities in nitrogen dioxide pollution.** Kerr GH, Goldberg DL, Anenberg SC. Proc Natl Acad Sci U S A. 2021 Jul 27;118(30):e2022409118. doi:10.1073/pnas.2022409118.
   https://www.pnas.org/content/118/30/e2022409118
   The unequal spatial distribution of ambient nitrogen dioxide ([Formula: see text]), an air pollutant related to traffic, leads to higher exposure for minority and low socioeconomic status communities. We exploit the unprecedented drop in urban activity during the COVID-19 pandemic and use high-resolution, remotely sensed [Formula: see text] observations to investigate disparities in [Formula: see text] levels across different demographic subgroups in the United States. We show that, prior to the pandemic, satellite-observed [Formula: see text] levels in the least White census tracts of the United States were nearly triple the [Formula: see text] levels in the most White tracts. During the pandemic, the largest lockdown-related [Formula: see text] reductions occurred in urban neighborhoods that have 2.0 times more non-White residents and 2.1 times more Hispanic residents than neighborhoods with the smallest reductions. [Formula: see text] reductions were likely driven by the greater density of highways and interstates in these racially and ethnically diverse areas. Although the largest reductions occurred in marginalized areas, the effect of lockdowns on racial, ethnic, and socioeconomic [Formula: see text] disparities was mixed and, for many cities, nonsignificant. For example, the least White tracts still experienced ∼1.5 times higher [Formula: see text] levels during the lockdowns than the most White tracts experienced prior to the pandemic. Future policies aimed at eliminating pollution disparities will need to look beyond reducing emissions from only passenger traffic and also consider other collocated sources of emissions such as heavy-duty vehicles.

2. **Interplay between climate, pollution and COVID-19 on ST-elevation myocardial infarction in a large metropolitan region.** Biondi-Zoccai G et al. Minerva Med. 2021 Jul 26. doi: 10.23736/S0026-4806.21.07748-X. Online ahead of print.
BACKGROUND: Collective risk factors such as climate and pollution impact on the risk of acute cardiovascular events, including ST-elevation myocardial infarction (STEMI). There is limited data however on the precise temporal and independent association between these factors and STEMI, and the potentially interacting role of government policies against Coronavrus Disease 2019 (COVID-19), especially for Latin America.
METHODS: We retrospectively collected aggregate data on daily STEMI admissions at 10 tertiary care centers in the Buenos Aires metropolitan area, Argentina, from January 1, 2017 to November 30, 2020. Daily measurements for temperature, humidity, atmospheric pressure, wind direction, wind speed, and rainfall, as well as carbon monoxide (CO), nitrogen dioxide, and particulate matter <10 µm (PM10), were retrieved. Exploratory analyses focused on key COVID-19-related periods (eg first case, first lockdown), and stringency index quantifying the intensity of government policy response against COVID-19.
RESULTS: A total of 1498 STEMI occurred over 1430 days, for an average of 0.12 STEMI per center (decreasing from 0.130 in 2018 to 0.102 in 2020, p=0.016). Time series analysis showed that lower temperature and higher concentration of CO and PM10 were all significantly associated with an increased rate of STEMI (all p<0.05), whereas COVID-19 outbreak, lockdown, and stringency of government policies were all inversely associated with STEMI (all p<0.05). Notably, environmental features impacted as early as 28 days before the event (all p<0.05), even if same or prior day associations proved stronger (all p<0.05). Multivariable analysis suggested that maximum temperature (p=0.001) and PM10 (p=0.033) were the strongest predictor of STEMI, even after accounting for COVID-19-related countermeasures (p=0.043).
CONCLUSIONS: Lower temperature and higher concentrations of CO and PM10 are associated with significant increases in the rate of STEMI in a large Latin American metropolitan area. The reduction in STEMI cases seen during the COVID-19 pandemic is at least in part mediated by improvements in pollution, especially reductions in PM10.

3. **The ecology of COVID-19 and related environmental and sustainability issues.** Guo Q, Lee DC. Ambio. 2021 Jul 19:1-8. doi: 10.1007/s13280-021-01603-0. Online ahead of print.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8287844/
Around the globe, human behavior and ecosystem health have been extensively and sometimes severely affected by the unprecedented COVID-19 pandemic. Most efforts to study these complex and heterogenous effects to date have focused on public health and economics. Some studies have evaluated the pandemic's influences on the environment, but often on a single aspect such as air or water pollution. The related research opportunities are relatively rare, and the approaches are unique in multiple aspects and mostly retrospective. Here, we focus on the diverse research opportunities in disease ecology and ecosystem sustainability related to the (intermittent) lockdowns that drastically reduced human activities. We discuss several key knowledge gaps and questions to address amid the ongoing pandemic. In principle, the common knowledge accumulated from invasion biology could also be effectively applied to COVID-19, and the findings could offer much-needed information for future pandemic prevention and management.

4. **Plastic and its consequences during the COVID-19 pandemic.** de Sousa FDB. Environ Sci Pollut Res Int. 2021 Jul 19:1-12. doi: 10.1007/s11356-021-15425-w. Online ahead of print.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8287553/
During the pandemic outbreak of COVID-19, the important role of plastic becomes evident since vital equipment such as respirators have plastic parts, as well as personal protective equipment (PPE), which avoids the transmission of the SARS-CoV-2 virus, is made of plastic. So, plastic during a pandemic is considered a life savior in the struggle against the virus. However, the same material that is a protector becomes a polluter when inadequately disposed of in the environment, generating or worsening socio-environmental problems, such as pollution of water bodies by plastic. This work proposes a reflection about the role and the importance of plastic in our society, bringing an overview of its main applications and consequences during the COVID-19 pandemic, correlating its use with aspects related to environmental problems and public health. Some questions revolving around the concerns caused by plastic pollution are posed, and some possible solutions to the problems are outlined.

5. **COVID-19, the Built Environment, and Health.** Frumkin H. Environ Health Perspect. 2021 Jul;129(7):75001. doi: 10.1289/EHP8888. Epub 2021 Jul 21.
https://ehp.niehs.nih.gov/doi/10.1289/EHP8888
BACKGROUND: Since the dawn of cities, the built environment has both affected infectious disease transmission and evolved in response to infectious diseases. COVID-19 illustrates both dynamics. The pandemic presented an opportunity to implement health promotion and disease prevention strategies in numerous elements of the built environment.
OBJECTIVES: This commentary aims to identify features of the built environment that affect the risk of COVID-19 as well as to identify elements of the pandemic response with implications for the built environment (and, therefore, for long-term public health).
DISCUSSION: Built environment risk factors for COVID-19 transmission include crowding, poverty, and racism (as they manifest in housing and neighborhood features), poor indoor air circulation, and ambient air pollution. Potential long-term implications of COVID-19 for the built environment include changes in building design, increased teleworking, reconfigured streets, changing modes of travel, provision of parks and greenspace, and population shifts out of urban centers. Although it is too early to predict with confidence which of these responses may persist, identifying and monitoring them can help health professionals, architects, urban planners, and decision makers, as well as members of the public, optimize healthy built environments during and after recovery from the pandemic. https://doi.org/10.1289/EHP8888.

6. **Facemasks: A Looming Microplastic Crisis.** Dissanayake J, Torres-Quiroz C, Mahato J, Park J. Int J Environ Res Public Health. 2021 Jul 1;18(13):7068. doi: 10.3390/ijerph18137068.
https://www.mdpi.com/1660-4601/18/13/7068/htm
Single-use disposable facemasks have been used as a preventive measure against the ongoing COVID-19 pandemic. However, many researchers have found evidence that these facemasks are being dumped into lakes, rivers, and open garbage dumps. Facemasks have the potential of releasing microplastic fibers into the environment; a phenomenon that has been poorly investigated. Moreover, microplastic fibers composed of plastics have the potential of affecting

the flora and fauna of many ecosystems. In this preliminary study, we investigate how many microplastic fibers had been released to the water by KF-AD, KF94, surgical, and FFP1 standard facemasks, which are the most widely available facemask standards in South Korea. The waterbody in our research was mechanically agitated for 24, 48, and 72 h. Findings showed that most of the layers of facemasks are composed of polypropylene. The surgical and KF94 standard facemasks released the highest number of microplastic fibers. Furthermore, under our research conditions, a single facemask can release at least 47 microplastic fibers per day (e.g., KF-AD standard mask), which can lead to the release of at least 1381 million microplastic fibers per day in total in South Korea if 70% of the urban population uses a single mask every day. Moreover, the released microplastic fibers significantly increased when the agitation time extended from 24 to 48 h. This finding suggests that the number of released microplastic fibers is likely to increase drastically.

7. **Sustaining COVID-19 pandemic lockdown era air pollution impact through utilization of more renewable energy resources.** Rita E, Chizoo E, Cyril US. Heliyon. 2021 Jun 30;7(7):e07455. doi: 10.1016/j.heliyon.2021.e07455. eCollection 2021 Jul.
https://www.sciencedirect.com/science/article/pii/S2405844021015589
The lock down engendered by COVID-19 pandemic has impacted positively on the environment through reduction of the emissions of green house gases, CO2, CO and other pollutants into the atmosphere below the pre-COVID-19 levels. There are fears that the gains made in the environment during COVID-19 may be frittered away as nations around the world make serious efforts to boost the COVID-19 recessed economy through massive investments in the sectors of the economy that are not environmentally friendly. This paper emphasizes on the essence of maintaining the COVID-19 pandemic era environmental impact levels in post COVID-19 era without retarding the efforts towards economic recovery. World health organization (WHO) data from six regions between April and August 2020 was evaluated. Emission levels during the COVID-19 lockdown were reviewed. The global renewable energy potentials were ascertained. The paper suggests that investment in renewable energy resources for various countries' energy needs will help sustain the green and clean environment created by the COVID-19 lockdown even after COVID-19 era lockdown. Also, building large scale and distributed energy storage infrastructure and application of artificial intelligence would ensure security of energy supply and handle unstable nature of solar and wind energy. The COVID-19 lockdown significantly reduced air pollution. The application of biofuels to generate energy and power was found to significantly reduce air pollutant emissions similar to COVID-19 lockdown.

8. **The Association Between COVID-19, Air Pollution, and Climate Change.** Amnuaylojaroen T, Parasin N. Front Public Health. 2021 Jul 6;9:662499. doi: 10.3389/fpubh.2021.662499. eCollection 2021.
https://www.frontiersin.org/articles/10.3389/fpubh.2021.662499/full
This mini-review aims to highlight both the positive and negative relationship between COVID-19 and air pollution and climate change based on current studies. Since, COVID-19 opened a bibliographic door to scientific production, so there was a limit to research at the moment. There were two sides to the relationship between COVID-19 and both air pollution and climate change. The associated with climate change, in particular, defines the relationship very loosely.

Many studies have revealed a positive correlation between COVID-19 and each air pollutants, while some studies shown a negative correlation. There were a few studies that focused on the relationship between COVID-19 in terms of climate. Meanwhile, there were many studies explained the relationship with meteorological factors instead.

Health Impacts of Climate Change

9. **Health effects from heat waves in France: an economic evaluation.** Adélaïde L, Chanel O, Pascal M. Eur J Health Econ. 2021 Jul 25:1-13. doi: 10.1007/s10198-021-01357-2. Online ahead of print.
https://link.springer.com/article/10.1007/s10198-021-01357-2
BACKGROUND: Scarcity of data on the health impacts and associated economic costs of heat waves may limit the will to invest in adaptation measures. We assessed the economic impact associated with mortality, morbidity, and loss of well-being during heat waves in France between 2015 and 2019.
METHODS: Health indicators monitored by the French national heat wave plan were used to estimate excess visits to emergency rooms and outpatient clinics and hospitalizations for heat-related causes. Total excess mortality and years of life loss were considered, as well as the size of the population that experienced restricted activity. A cost-of-illness and willingness-to-pay approach was used to account for associated costs.
RESULTS: Between 2015 and 2019, the economic impact of selected health effects of heat waves amounts to €25.5 billion, mainly in mortality (€23.2 billion), minor restricted activity days (€2.3 billion), and morbidity (€0.031 billion).
CONCLUSION: The results highlight a significant economic burden on the French health system and the population. A better understanding of the economic impacts of climate change on health is required to alert decision-makers to the urgency of mitigation and to support concrete adaptation actions.

10. **Heat-Related Emergency Department Visits During the Northwestern Heat Wave - United States, June 2021.** Schramm PJ, Vaidyanathan A, Radhakrishnan L, Gates A, Hartnett K, Breysse P. MMWR Morb Mortal Wkly Rep. 2021 Jul 23;70(29):1020-1021. doi: 10.15585/mmwr.mm7029e1.
https://www.cdc.gov/mmwr/volumes/70/wr/mm7029e1.htm
Record high temperatures are occurring more frequently in the United States, and climate change is causing heat waves to become more intense (1), directly impacting human health, including heat-related illnesses and deaths. On average, approximately 700 heat-related deaths occur in the United States each year (2). In the northwestern United States, increasing temperatures are projected to cause significant adverse health effects in the coming years (3). During June 25-30, 2021, most of Oregon and Washington were under a National Weather Service excessive heat warning.* Hot conditions persisted in parts of Oregon, Washington, or Idaho through at least July 14, 2021. The record-breaking heat had the largest impact in Oregon and Washington, especially the Portland metropolitan area, with temperatures reaching 116°F (46.7°C), which is 42°F (5.6°C) hotter than the average daily maximum June temperature.

11. **Gastrointestinal tissue as a "new" target of pollution exposure.** Pambianchi E, Pecorelli A, Valacchi G. IUBMB Life. 2021 Jul 21. doi: 10.1002/iub.2530. Online ahead of print.
Airborne pollution has become a leading cause of global death in industrialized cities and the exposure to environmental pollutants has been demonstrated to have adverse effects on human health. Among the pollutants, particulate matter (PM) is one of the most toxic and although its exposure has been more commonly correlated with respiratory diseases, gastrointestinal (GI) complications have also been reported as a consequence to PM exposure. Due to its composition, PM is able to exert on intestinal mucosa both direct damaging effects, (by reaching it either via direct ingestion of contaminated food and water or indirect inhalation and consequent macrophagic mucociliary clearance) and indirect ones via generation of systemic inflammation. The relationship between respiratory and GI conditions is well described by the lung-gut axis and more recently, has become even clearer during coronavirus disease 2019 (COVID-19) pandemic, when respiratory symptoms were associated with gastrointestinal conditions. This review aims at pointing out the mechanisms and the models used to evaluate PM induced GI tract damage.

12. **Cumulative effects of ambient particulate matter pollution on deaths: A multicity analysis of mortality displacement.** Chen Q, Wang Q, Xu B, Xu Y, Ding Z, Zhou J, Sun H. Chemosphere. 2021 Jul 20;286(Pt 1):131615. doi: 0.1016/j.chemosphere.2021.131615. Online ahead of print.
https://www.sciencedirect.com/science/article/pii/S0045653521020877
BACKGROUND: Systematic evaluations of the cumulative effects and mortality displacement of ambient particulate matter (PM) pollution on deaths are lacking. We aimed to discern the cumulative effect profile of PM exposure, and investigate the presence of mortality displacement in a large-scale population.
METHODS: We conducted a time-series analysis with different exposure-lag models on 13 cities in Jiangsu, China, to estimate the effects of PM pollution on non-accidental, cardiovascular, and respiratory mortality (2015-2019). Over-dispersed Poisson generalized additive models were integrated with distributed lag models to estimate cumulative exposure effects, and assess mortality displacement.
RESULTS: Pooled cumulative effect estimates with lags of 0-7 and 0-14 days were substantially larger than those with single-day and 2-day moving average lags. For each 10 μg/m3 increment in PM2.5 concentration with a cumulative lag of 0-7 days, we estimated an increase of 0.50 % (95 % CI: 0.29, 0.72), 0.63 % (95 % CI: 0.38, 0.88), and 0.50 % (95 % CI: 0.01, 1.01) in pooled estimates of non-accidental, cardiovascular, and respiratory mortality, respectively. Both PM10 and PM2.5 were associated with significant increases in non-accidental and cardiovascular mortality with a cumulative lag of 0-14 days. We observed mortality displacement within 30 days for non-accidental, cardiovascular, and respiratory deaths.
CONCLUSIONS: Our findings suggest that risk assessment based on single-day or 2-day moving average lag structures may underestimate the adverse effects of PM pollution. The cumulative effects of PM exposure on non-accidental and cardiovascular mortality can last up to 14 days. Evidence of mortality displacement for non-accidental, cardiovascular, and respiratory deaths was found.

13. **Suicide and Associations with Air Pollution and Ambient Temperature: A Systematic Review and Meta-Analysis.**Heo S, Lee W, Bell ML. Int J Environ Res Public Health. 2021 Jul 20;18(14):7699. doi: 10.3390/ijerph18147699.
https://www.mdpi.com/1660-4601/18/14/7699
Given health threats of climate change, a comprehensive review of the impacts of ambient temperature and ar pollution on suicide is needed. We performed systematic literature review and meta-analysis of suicide risks associated with short-term exposure to ambient temperature and air pollution. Pubmed, Scopus, and Web of Science were searched for English-language publications using relevant keywords. Observational studies assessing risks of daily suicide and suicide attempts associated with temperature, particulate matter with aerodynamic diameter ≤10 μm (PM10) and ≤2.5 mm (PM2.5), ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), and carbon monoxide (CO) were included. Data extraction was independently performed in duplicate. Random-effect meta-analysis was applied to pool risk ratios (RRs) for increases in daily suicide per interquartile range (IQR) increase in exposure. Meta-regression analysis was applied to examine effect modification by income level based on gross national income (GNI) per capita, national suicide rates, and average level of exposure factors. In total 2274 articles were screened, with 18 studies meeting inclusion criteria for air pollution and 32 studies for temperature. RRs of suicide per 7.1 °C temperature was 1.09 (95% CI: 1.06, 1.13). RRs of suicide per IQR increase in PM2.5, PM10, and NO2 were 1.02 (95% CI: 1.00, 1.05), 1.01 (95% CI: 1.00, 1.03), and 1.03 (95% CI: 1.00, 1.07). O3, SO2, and CO were not associated with suicide. RR of suicide was significantly higher in higher-income than lower-income countries (1.09, 95% CI: 1.07, 1.11 and 1.20, 95% CI: 1.14, 1.26 per 7.1 °C increased temperature, respectively). Suicide risks associated with air pollution did not significantly differ by income level, national suicide rates, or average exposure levels. Research gaps were found for interactions between air pollution and temperature on suicide risks.

14. **Pre- and postnatal household air pollution exposures and pneumonia risk: Evidence from GRAPHS.** Kinney PL, Asante KP, Lee AG, Ae-Ngibise KA, Burkart K, Boamah-Kaali E, Twumasi M, Gyaase S, Quinn A, Oppong FB, Wylie BJ, Kaali S, Chillrud S, Yawson A, Jack D, Owusu-Agyei S. Chest. 2021 Jul 20:S0012-3692(21)01363-5. doi: 10.1016/j.chest.2021.06.080. Online ahead of print.
https://journal.chestnet.org/article/S0012-3692(21)01363-5/fulltext
BACKGROUND: Nearly 40% of the world's population is exposed daily to household air pollution. The relative impact of prenatal and postnatal household air pollution exposure on early childhood pneumonia, a leading cause of mortality, is unknown.
RESEARCH QUESTION: Are prenatal and/or postnatal household air pollution associated with pneumonia risk in the first year of life?
STUDY DESIGN AND METHODS: The Ghana Randomized Air Pollution and Health Study (GRAPHS) enrolled 1,414 non-smoking, pregnant women prior to 24 weeks gestation with prospective follow-up to child age one. We measured 72-hour personal household air pollution exposures, indexed by carbon monoxide (CO), four times prenatally and three times postnatally. Weekly fieldworker surveillance identified ill-appearing children for physician pneumonia assessment. We employed quasi-Poisson models to examine associations between

prenatal and postnatal CO and physician-diagnosed pneumonia and severe pneumonia. Sex-specific effects were examined.
RESULTS: Of the 1,306 live births, 1,141 infants were followed with 55,605 child-weeks of fieldworker surveillance. The estimated risk for pneumonia and severe pneumonia in the first year of life increased by 10% (RR 1.10, 95% CI 1.04-1.16) and 15% (RR 1.15, 95% CI 1.03-1.28), respectively, per 1ppm increase in average prenatal CO exposure and by 6% (RR 1.06, 95% CI 0.99, 1.13) per 1ppm increase in average postnatal CO exposure. Females appeared more vulnerable.
INTERPRETATION: Prenatal household air pollution exposure increased risk for pneumonia and severe pneumonia in the first year of life. Clean burning interventions may be most effective when begun prenatally.

15. **Particulate Matter and Premature Mortality: A Bayesian Meta-Analysis.** Waidyatillake NT, Campbell PT, Vicendese D, Dharmage SC, Curto A, Stevenson M. Int J Environ Res Public Health. 2021 Jul 19;18(14):7655. doi: 10.3390/ijerph18147655.
https://www.mdpi.com/1660-4601/18/14/7655
BACKGROUND: We present a systematic review of studies assessing the association between ambient particulate matter (PM) and premature mortality and the results of a Bayesian hierarchical meta-analysis while accounting for population differences of the included studies.
METHODS: The review protocol was registered in the PROSPERO systematic review registry. Medline, CINAHL and Global Health databases were systematically searched. Bayesian hierarchical meta-analysis was conducted using a non-informative prior to assess whether the regression coefficients differed across observations due to the heterogeneity among studies.
RESULTS: We identified 3248 records for title and abstract review, of which 309 underwent full text screening. Thirty-six studies were included, based on the inclusion criteria. Most of the studies were from China (n = 14), India (n = 6) and the USA (n = 3). PM2.5 was the most frequently reported pollutant. PM was estimated using modelling techniques (22 studies), satellite-based measures (four studies) and direct measurements (ten studies). Mortality data were sourced from country-specific mortality statistics for 17 studies, Global Burden of Disease data for 16 studies, WHO data for two studies and life tables for one study. Sixteen studies were included in the Bayesian hierarchical meta-analysis. The meta-analysis revealed that the annual estimate of premature mortality attributed to PM2.5 was 253 per 1,000,000 population (95% CI: 90, 643) and 587 per 1,000,000 population (95% CI: 1, 39,746) for PM10.
CONCLUSION: 253 premature deaths per million population are associated with exposure to ambient PM2.5. We observed an unstable estimate for PM10, most likely due to heterogeneity among the studies. Future research efforts should focus on the effects of ambient PM10 and premature mortality, as well as include populations outside Asia. Key messages: Ambient PM2.5 is associated with premature mortality. Given that rapid urbanization may increase this burden in the coming decades, our study highlights the urgency of implementing air pollution mitigation strategies to reduce the risk to population and planetary health.

16. **Residential exposure to traffic-borne pollution as a risk factor for acute cardiocerebrovascular events: a population-based retrospective cohort study in a highly urbanized area.** Magnoni P,

Murtas R, Russo AG. Int J Epidemiol. 2021 Jul 19:dyab068. doi: 10.1093/ije/dyab068. Online ahead of print.
https://academic.oup.com/ije/advance-article/doi/10.1093/ije/dyab068/6323933
BACKGROUND: Long-term exposure to traffic-borne noise and air pollution has been variably associated with incidence of acute vascular events, namely acute myocardial infarction, ischaemic stroke and haemorrhagic stroke. This study aims at exploring this association within a highly urbanized city.
METHODS: This is a population-based retrospective dynamic cohort study including all residents aged ≥ 35 years in the municipality of Milan over the years 2011-18 (1 087 110 inhabitants). Residential exposure to road traffic noise (day-evening-night levels) and nitrogen dioxide was estimated using a noise predictive model and a land use regression model, respectively. Cox proportional hazards regression analyses were performed to assess the incidence of acute vascular events and specific outcomes in single-exposure and two-exposure models including adjustment for sociodemographic confounders, fine particulate matter and surrounding greenness.
RESULTS: A total of 27 282 subjects (2.5%) had an acute vascular event. Models using nitrogen dioxide produced inconsistent results. The strongest effect was observed for noise, with an optimal cut-off for dichotomization set at 70 dBA (hazard ratio 1.025, 95% confidence interval 1.000-1.050). This association was observed specifically for ischaemic and haemorrhagic stroke. When stratifying by age group and sex, a remarkable effect was found for haemorrhagic stroke in men aged <60 years (hazard ratio 1.439, 95% confidence interval 1.156-1.792).
CONCLUSIONS: Living by roads with a day-evening-night noise level above 70 dBA exerts a small but tangible independent effect on the risks of both ischaemic and haemorrhagic stroke. It is urgent to propose mitigation measures against pollution and noise originating from vehicular traffic in order to reduce their impact, especially in the population younger than 60 years.

17. **Long-term exposure to air pollution and liver cancer incidence in six European cohorts.** So R et al. Int J Cancer. 2021 Jul 18. doi: 10.1002/ijc.33743. Online ahead of print.
https://onlinelibrary.wiley.com/doi/10.1002/ijc.33743?af=R
Particulate matter air pollution and diesel engine exhaust have been classified as carcinogenic for lung cancer, yet few studies have explored associations with liver cancer. We used six European adult cohorts which were recruited between 1985 and 2005, pooled within the 'Effects of low-level air pollution: A study in Europe' (ELAPSE) project, and followed for the incidence of liver cancer until 2011 to 2015. The annual average exposure to nitrogen dioxide (NO_2), particulate matter with diameter < 2.5 µm ($PM_{2.5}$), black carbon (BC), warm-season ozone (O_3), and eight elemental components of $PM_{2.5}$ (copper, iron, zinc, sulfur, nickel, vanadium, silicon, potassium) were estimated by European-wide hybrid land-use regression models at participants' residential addresses. We analyzed the association between air pollution and liver cancer incidence by Cox proportional hazards models adjusting for potential confounders. Of 330,064 cancer-free adults at baseline, 512 developed liver cancer during a mean follow-up of 18.1 years. We observed positive linear associations between NO_2 (hazard ratio, 95% confidence interval: 1.17, 1.02-1.35 per 10 µg/m3), $PM_{2.5}$ (1.12, 0.92-1.36 per 5 µg/m3), and BC (1.15, 1.00-1.33 per 0.5 10-5 /m) and liver cancer incidence. Associations with NO_2 and BC persisted in two-pollutant models with $PM_{2.5}$. Most components of $PM_{2.5}$ were

associated with the risk of liver cancer, with the strongest associations for sulfur and vanadium, which were robust to adjustment for PM2.5 or NO2 . Our study suggests that ambient air pollution may increase the risk of liver cancer, even at concentrations below current EU standards. This article is protected by copyright. All rights reserved.

18. **Impact of Climate Change on Eye Diseases and Associated Economical Costs.** Echevarría-Lucas L, Senciales-González JM, Medialdea-Hurtado ME, Rodrigo-Comino J. Int J Environ Res Public Health. 2021 Jul 5;18(13):7197. doi: 10.3390/ijerph18137197.
https://www.mdpi.com/1660-4601/18/13/7197
Climate change generates negative impacts on human health. However, little is known about specific impacts on eye diseases, especially in arid and semi-arid areas where increases in air temperatures are expected. Therefore, the main goals of this research are: (i) to highlight the association between common eye diseases and environmental factors; and (ii) to analyze, through the available literature, the health expenditure involved in combating these diseases and the savings from mitigating the environmental factors that aggravate them. Mixed methods were used to assess the cross-variables (environmental factors, eye diseases, health costs). Considering Southern Spain as an example, our results showed that areas with similar climatic conditions could increase eye diseases due to a sustained increase in temperatures and torrential rains, among other factors. We highlight that an increase in eye diseases in Southern Spain is conditioned by the effects of climate change by up to 36.5%; the economic burden of the main eye diseases, extrapolated to the rest of the country, would represent an annual burden of 0.7% of Spain's Gross Domestic Product. In conclusion, the increase in eye diseases has a strong economic and social impact that could be reduced with proper management of the effects of climate change. We propose a new concept: disease sink, defined as any climate change mitigation action which reduces the incidence or morbidity of disease.

19. **Climate Change and Mental Health of Older Persons: A Human Rights Imperative.** Ayalon L, Keating N, Pillemer K, Rabheru K. Am J Geriatr Psychiatry. 2021 Jun 30:S1064-7481(21)00379-1. doi: 10.1016/j.jagp.2021.06.015. Online ahead of print.
Climate change threatens the basic prerequisites for wellbeing, including clean air and water, food supply and the adequacy and security of shelter. Climate change is a powerful and ongoing presence in the lives of older persons, both creating and exacerbating vulnerabilities. The absence of a legally binding international instrument specifically protecting the human rights of older persons and minimal references to older persons in key international climate instruments attest to the lack of attention to and visibility of older persons in national and international law. There is a need to integrate the areas of older people and environmental sustainability to ensure that the rights of older people are preserved especially now, as the effects of the climate change crisis become more pronounced.

20. **Global distribution and coincidence of pollution, climate impacts, and health risk in the Anthropocene.** Marcantonio R, Javeline D, Field S, Fuentes A. PLoS One. 2021 Jul 21;16(7):e0254060. doi: 10.1371/journal.pone.0254060. eCollection 2021.
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0254060

Previous research demonstrates that low-income countries face higher risks than high-income countries from toxic pollution and climate change. However, the relationship between these two risks is little explored or tested, and efforts to address the risks are often independent and uncoordinated. We argue that the global risks from toxic pollution and climate change are highly correlated and should be jointly analyzed in order to inform and better target efforts to reduce or mitigate both risks. We provide such analysis for 176 countries and found a strong (rs = -0.798;95%CI -0.852, -0.727) and significant (p<0.0001) relationship between the distribution of climate risk and toxic pollution. We also found that inequities in pollution production, economic status, and institutional readiness are interconnected and exacerbate risk for countries already in the highest risk categories for both toxic and non-toxic (greenhouse gas) pollution. The findings have policy implications, including the use of the proposed Target assessment to decide where best to address toxic and non-toxic pollution simultaneously, based on the need to minimize human suffering and maximize return on effort.

WE ACT

21. **Nurses´ and nurse managers´ perceptions of sustainable development in perioperative work: A qualitative study.** Leppänen T, Kvist T, McDermott-Levy R, Kankkunen P. J Clin Nurs. 2021 Jul 18. doi: 10.1111/jocn.15970. Online ahead of print.
https://onlinelibrary.wiley.com/doi/full/10.1111/jocn.15970
AIMS AND OBJECTIVES: To describe how nurses and nurse managers consider sustainable development principles in their daily work, how well they recognise these principles and how these principles are considered in decision-making in perioperative work.
BACKGROUND: Sustainable development involves interpersonal social and cultural relations and long-term economic and ecological thinking in societal decision-making. These dimensions are well-suited for a foundation of decision-making in acute health care. No previous research has been performed on perioperative work from the sustainable development perspective.
DESIGN: Qualitative descriptive design was used. Data were collected from perioperative nurses (n = 20) and nurse managers (n = 6) working in five surgical departments in a Finnish university hospital. Data were analysed by content analysis. The reporting follows qualitative research checklist (COREQ).
RESULTS: The principles of sustainable development were poorly known among the participants. Nurse managers considered their opportunities to influence decision-making were reduced by their limited economic knowledge. Resource use, individuality, and ecological viewpoints were emphasised in the decision-making process in perioperative work.
CONCLUSIONS: Findings reveal that perioperative nurses and nurse managers are aware of economic and ecological sustainability, but they do not actively consider it as part of their work. Social and cultural sustainability must be developed further in decision-making in perioperative work.
RELEVANCE TO CLINICAL PRACTICE: Perioperative nurses and nurse managers consider that it is important to develop the principles of sustainable development in perioperative work. This research indicates that economic understanding is not guiding decision-making, and there is a lack of knowledge about the benefits of ecological procedures. Social and cultural sustainability are not connected in perioperative work, although there is collaboration between the surgical

team and the patient is essential. This study helps to organise operating room management effectively and diversely.

22. **Thinking green: modelling respirator reuse strategies to reduce cost and waste.** Chu J, Ghenand O, Collins J, Byrne J, Wentworth A, Chai PR, Dadabhoy F, Hur C, Traverso G. BMJ Open. 2021 Jul 18;11(7):e048687. doi: 10.1136/bmjopen-2021-048687.
https://bmjopen.bmj.com/content/11/7/e048687
OBJECTIVES: To compare the impact of respirator extended use and reuse strategies with regard to cost and sustainability during the COVID-19 pandemic.
DESIGN: Cost analysis.
SETTING: USA.
PARTICIPANTS: All healthcare workers within the USA.
INTERVENTIONS: Not applicable.
MAIN OUTCOME MEASURES: A model was developed to estimate usage, costs and waste incurred by several respirator usage strategies over the first 6 months of the pandemic in the USA. This model assumed universal masking of all healthcare workers. Estimates were taken from the literature, government databases and commercially available data from approved vendors.
RESULTS: A new N95 respirator per patient encounter would require 7.41 billion respirators, cost $6.38 billion and generate 84.0 million kg of waste in the USA over 6 months. One respirator per day per healthcare worker would require 3.29 billion respirators, cost $2.83 billion and generate 37.22 million kg of waste. Decontamination by ultraviolet germicidal irradiation would require 1.64 billion respirators, cost $1.41 billion and accumulate 18.61 million kg of waste. H2O2 vapour decontamination would require 1.15 billion respirators, cost $1.65 billion and produce 13.03 million kg of waste. One reusable respirator with daily disposable filters would require 18 million respirators, cost $1.24 billion and generate 15.73 million kg of waste. Pairing a reusable respirator with H2O2 vapour-decontaminated filters would reduce cost to $831 million and generate 1.58 million kg of waste. The use of one surgical mask per healthcare worker per day would require 3.29 billion masks, cost $460 million and generate 27.92 million kg of waste.
CONCLUSIONS: Decontamination and reusable respirator-based strategies decreased the number of respirators used, costs and waste generated compared with single-use or daily extended-use of disposable respirators. Future development of low-cost,simple technologies to enable respirator and/or filter decontamination is needed to further minimise the economic and environmental costs of masks.

23. **Variability in the Use of Disposable Surgical Supplies: A Surgeon Survey and Life Cycle Analysis.** Baxter NB, Yoon AP, Chung KC. J Hand Surg Am. 2021 Jul 15:S0363-5023(21)00364-6. doi: 10.1016/j.jhsa.2021.05.027. Online ahead of print.
https://www.jhandsurg.org/article/S0363-5023(21)00364-6/fulltext
PURPOSE: A substantial amount of waste is generated during surgery, yet few studies have investigated this problem. Therefore, we conducted a multicenter survey to investigate how the variation in the use of disposable supplies contributes to the environmental and financial burdens of health care.

METHODS: We created a questionnaire to identify differences in supply use and practice characteristics among hand surgeons who participated in the Wrist and Radius Injury Surgical Trial. We determined the average cumulative cost of 10 key surgical items based on the responses. Subsequently, we estimated the kilograms of carbon dioxide emitted during the life cycle of supplies, from raw material extraction to production and disposal, using economic input-output life cycle analysis.
RESULTS: Thirty-five surgeons from 19 institutions responded to the survey (65% response rate). Based on the difference in costs between surgeons who used the fewest and the most supplies, we determined that expenditures and carbon dioxide emissions could decrease by $22.47 and 10.9 kg per procedure, respectively, with leaner use of 10 key items. Furthermore, assuming that surgeon variation in supply use is present in other surgical subspecialties, we estimated that $2.4 billion in savings and an 800.6 thousand metric ton reduction in carbon emissions could be achieved if all US surgeons reduced their supply use by this amount.
CONCLUSIONS: This study revealed considerable variations in the use of disposable supplies among hand surgeons, highlighting the need for evidence-based tools, policies, and education campaigns to reduce hospital waste across health care systems.
CLINICAL RELEVANCE: Optimal use of disposable supplies is necessary to reduce the cost and environmental burden of hand surgery care.

24. **Big Data-Enabled Solutions Framework to Overcoming the Barriers to Circular Economy Initiatives in Healthcare Sector.** Kazançoğlu Y, Sağnak M, Lafcı Ç, Luthra S, Kumar A, Taçoğlu C. Int J Environ Res Public Health. 2021 Jul 14;18(14):7513. doi: 10.3390/ijerph18147513.
https://www.mdpi.com/1660-4601/18/14/7513
Ever-changing conditions and emerging new challenges affect the ability of the healthcare sector to survive with the current system, and to maintain its processes effectively. In the healthcare sector, the conservation of the natural resources is being obstructed by insufficient infrastructure for managing residual waste resulting from single-use medical materials, increased energy use, and its environmental burden. In this context, circularity and sustainability concepts have become essential in healthcare to meliorate the sector's negative impacts on the environment. The main aim of this study is to identify the barriers related to circular economy (CE) in the healthcare sector, apply big data analytics in healthcare, and provide solutions to these barriers. The contribution of this research is the detailed examination of the current healthcare literature about CE adaptation, and a proposal for a big data-enabled solutions framework to barriers to circularity, using fuzzy best-worst Method (BWM) and fuzzy VIKOR. Based on the findings, managerial, policy, and theoretical implementations are recommended to support sustainable development initiatives in the healthcare sector.

25. **An investigation into hospital prescribers' knowledge and confidence to provide high-quality, sustainable respiratory care.** Walpole SC, Smith K, McElvaney J, Taylor J, Doe S, Tedd H. Future Healthc J. 2021 Jul;8(2):e272-e276. doi: 10.7861/fhj.2020-0251.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8285139/
The number and range of inhaler combinations and brand names has increased significantly over recent years, making prescribing more complex. Inhalers contribute 3% of the NHS's

carbon footprint, therefore appropriate inhaler prescribing, use and disposal could contribute significantly towards the NHS's target of net zero carbon emissions by 2040. We developed a survey to assess prescriber knowledge of inhaled medications, inhalation devices and environmental impacts of inhalers. One-hundred and two secondary care prescribers from one NHS trust responded. Knowledge of the contents and device types of inhalers, and of the environmental impacts of inhalers was lacking. Only 9% of respondents discuss the environmental impact of inhalers with patients and 13% have discussed inhaler disposal with patients, but 46% of respondents expressed that they would educate patients about the environmental impacts of inhalers if they were provided with education and support to do so.

26. **Mitigating the Effects of Climate Change on Health and Health Care: The Role of the Emergency Nurse.** Kolbuk ME, Gillespie GL, Hilderbrand L, Stone EL. J Emerg Nurs. 2021 Jul;47(4):621-626. doi: 10.1016/j.jen.2021.05.004.
https://www.ena.org/docs/default-source/resource-library/practice-resources/position-statements/mitigating-the-effects-of-climate-change.pdf?sfvrsn=4062b975_6
Earth's climate is changing more rapidly than at any other point in the history of modern civilization and it is largely a result of human activity (American Academy of Pediatrics [AAP], Council on Environmental Health, 2015; Chao & Feng, 2018; Jay et al., 2018; Lovejoy & Hannah, 2019; Pachauri & Meyer, 2014; Ziegler et al., 2017). The impact of climate change is being experienced globally and is projected to intensify in the future (Jay et al., 2018; Pachauri & Meyer, 2014). Climate change affects communities in many ways: the economy, social systems, quality of water, indigenous communities, ecosystems, agriculture and food, infrastructures, oceans and coasts, tourism, human health, and quality of life (Jay et. al., 2018; Pachauri & Meyer, 2014; Ziegler et al., 2017).

27. **Health professional's willingness to advocate for strengthening global commitments to the Paris climate agreement: Findings from a multi-nation survey.** Lee HR, Pagano I, Borth A, Campbell E, Hubbert B, Kotcher J, Maibach E. J Clim Chang Health. 2021 May;2:None. doi: 10.1016/j.joclim.2021.100016.
https://www.sciencedirect.com/science/article/pii/S2667278221000146
Health professionals have the potential to address the health threats posed by climate change in many ways. This study sought to understand the factors that influence health professionals' willingness to engage in climate advocacy. We hypothesized and tested a model with six antecedent factors predicting willingness to engage in advocacy for strengthening global commitments to the Paris Agreement. Using survey data from members of health professional associations in 12 nations (n = 3,977), we tested the hypothesized relationships with structural equation modeling. All of the hypothesized relationships were confirmed. Specifically, higher rates of perceived expert consensus about human-caused climate change predicted greater climate change belief certainty and belief in human causation. In turn, all three of these factors, including higher levels of perceived health harms from climate change, positively predicted affective involvement with the issue. Affective involvement positively predicted the feeling that health professionals have a responsibility to deal with climate change. Lastly, this sense that climate advocacy is a responsibility of health professionals strongly predicted willingness to advocate. As a unique study of predictors of health professionals' willingness to advocate for

climate change, our findings provide unique insight into how an influential set of trusted voices might be activated to address what is arguably the world's most pressing public health threat. Limitations of the study and suggestions for future research are presented, and implications for message development are discussed.

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News & Commentary

How to win big for the climate: rein in the 'super polluters'. Nature. 2021 Jul;595(7869):628. doi: 10.1038/d41586-021-01983-z.

Commentary on "A CLIMATE: A Tool for Assessment of Climate-Change-Related Health Consequences in the Emergency Department". Linstadt H, Sorensen C, Balbus JM. J Emerg Nurs. 2021 Jul;47(4):518-520. doi: 10.1016/j.jen.2021.04.004.

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