

## Environmental Stewardship Resource Desk

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### New Research

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#### COVID-19

1. **Time-varying associations between COVID-19 case incidence and community-level sociodemographic, occupational, environmental, and mobility risk factors in Massachusetts.**

Tieskens KF, Patil P, Levy JI, Brochu P, Lane KJ, Fabian MP, Carnes F, Haley BM, Spangler KR, Leibler JH. BMC Infect Dis. 2021 Jul 16;21(1):686. doi: 10.1186/s12879-021-06389-w.

<https://www.researchsquare.com/article/rs-237622/v1>

**BACKGROUND:** Associations between community-level risk factors and COVID-19 incidence have been used to identify vulnerable subpopulations and target interventions, but the variability of these associations over time remains largely unknown. We evaluated variability in the associations between community-level predictors and COVID-19 case incidence in 351 cities and towns in Massachusetts from March to October 2020.

**METHODS:** Using publicly available sociodemographic, occupational, environmental, and mobility datasets, we developed mixed-effect, adjusted Poisson regression models to depict associations between these variables and town-level COVID-19 case incidence data across five distinct time periods from March to October 2020. We examined town-level demographic variables, including population proportions by race, ethnicity, and age, as well as factors related to occupation, housing density, economic vulnerability, air pollution (PM2.5), and institutional facilities. We calculated incidence rate ratios (IRR) associated with these predictors and compared these values across the multiple time periods to assess variability in the observed associations over time.

**RESULTS:** Associations between key predictor variables and town-level incidence varied across the five time periods. We observed reductions over time in the association with percentage of Black residents (IRR = 1.12 [95%CI: 1.12-1.13] in early spring, IRR = 1.01 [95%CI: 1.00-1.01] in early fall) and COVID-19 incidence. The association with number of long-term care facility beds per capita also decreased over time (IRR = 1.28 [95%CI: 1.26-1.31] in spring, IRR = 1.07 [95%CI: 1.05-1.09] in fall). Controlling for other factors, towns with higher percentages of essential workers experienced elevated incidences of COVID-19 throughout the pandemic (e.g.,

IRR = 1.30 [95%CI: 1.27-1.33] in spring, IRR = 1.20 [95%CI: 1.17-1.22] in fall). Towns with higher proportions of Latinx residents also had sustained elevated incidence over time (IRR = 1.19 [95%CI: 1.18-1.21] in spring, IRR = 1.14 [95%CI: 1.13-1.15] in fall).

**CONCLUSIONS:** Town-level COVID-19 risk factors varied with time in this study. In Massachusetts, racial (but not ethnic) disparities in COVID-19 incidence may have decreased across the first 8 months of the pandemic, perhaps indicating greater success in risk mitigation in selected communities. Our approach can be used to evaluate effectiveness of public health interventions and target specific mitigation efforts on the community level.

- 2. Plastic waste footprint in the context of COVID-19: Reduction challenges and policy recommendations towards sustainable development goals.** Mallick SK, Pramanik M, Maity B, Das P, Sahana M. *Sci Total Environ.* 2021 Jul 10;796:148951. doi:

10.1016/j.scitotenv.2021.148951. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S0048969721040237>

The sudden surge in demand to use plastic products due to COVID-19 pandemic has increased plastic pollution. It has resulted into degradation of a broad range of habitats and ecosystems by destroying natural functions, water quality, and environmental sustainability. However, the government agencies, scientific communities, and the public, have started to give attention to this issue. So, in the present study, we used the correlation methods to check the relationship between COVID-19 affected population with the medical plastic waste (MPW) that has developed a conceptual model of the inter-linkages between the preventive measures of COVID-19 pandemic problems and the reduction challenges of plastic waste during and after pandemic scenarios. Emerging issues in the waste management during and after the COVID-19 are established by reviewing the literature, reports, policy briefs, and information from the website concerning COVID-19. Considering MPW management issues, we selected India as a case study to analyse the plastic waste footprint (PWF) due to COVID-19 pandemic. The correlation results showed COVID-19 affected population and MPW; COVID-19 affected population and PWF have a significant relationship ( $R^2 = 0.60$ ; Area under ROC curve 81.4%). It suggests an urgent need for plastic waste management initiatives. Moreover, substantial plastic products, human awareness, strict government regulations, and inclusive research can check plastic waste footprints in India and worldwide. Then discuss the specific pathways through which the immediate and long-term impacts operate and highlight the issues of hampering the sustainable development goals (SDGs) progress in India and beyond. Finally, call for coordinated assessment, support and appropriate short- and long-term mitigation and the policy measures of plastic waste problems during and after the COVID-19 pandemic.

- 3. Environmental impact of increased soap consumption during COVID-19 pandemic: Biodegradable soap production and sustainable packaging.** Chirani MR, Kowsari E, Teymourian T, Ramakrishna S. *Sci Total Environ.* 2021 Jul 10;796:149013. doi:

10.1016/j.scitotenv.2021.149013. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S0048969721040857>

A year into the coronavirus disease 2019 pandemic, the role of washing hands with soap and hand disinfectants is unavoidable as a primary way to control the infection spread in communities and healthcare facilities. The extraordinary surge in demand for handwashing

products has led to environmental concerns. Since soaps are complex mixtures of toxic and persistent active ingredients, the prudent option is to promote eco-friendly replacements for the current products. On the other hand, with the increase in soap packaging waste production, soap packaging waste management and recycling become essential to reduce environmental impact. This systematic review aimed to collect some recent methods for identifying biodegradable and sustainable raw materials to produce and package cleaning agents, especially soap.

4. **Face masks as a source of nanoplastics and microplastics in the environment: Quantification, characterization, and potential for bioaccumulation.** Ma J, Chen F, Xu H, Jiang H, Liu J, Li P, Chen CC, Pan K. *Environ Pollut.* 2021 Jul 8;288:117748. doi: 10.1016/j.envpol.2021.117748. Online ahead of print.

<https://www.sciencedirect.com/science/article/abs/pii/S0269749121013300>

Billions of disposable face masks are consumed daily due to the COVID-19 pandemic. The role of these masks as a source of nanoplastics (NPs) and microplastics (MPs) in the environment has not been studied in previous studies. We quantified and characterized face mask released particles and evaluated their potential for accumulation in humans and marine organisms. More than one billion of NPs and MPs were released from each surgical or N95 face mask. These irregularly-shaped particles sized from c. 5 nm to c. 600  $\mu\text{m}$ . But most of them were nano scale sized  $<1 \mu\text{m}$ . The middle layers of the masks had released more particles than the outer and inner layers. That MPs were detected in the nasal mucus of mask wearers suggests they can be inhaled while wearing a mask. Mask released particles also adsorbed onto diatom surfaces and were ingested by marine organisms of different trophic levels. This data is useful for assessing the health and environmental risks of face masks.

### Health Impacts of Climate Change

5. **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.

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 ( $\text{NO}_2$ ), particulate matter with diameter  $< 2.5 \mu\text{m}$  ( $\text{PM}_{2.5}$ ), black carbon (BC), warm-season ozone ( $\text{O}_3$ ), and eight elemental components of  $\text{PM}_{2.5}$  (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  $\text{NO}_2$  (hazard ratio, 95% confidence interval: 1.17, 1.02-1.35 per  $10 \mu\text{g}/\text{m}^3$ ),  $\text{PM}_{2.5}$  (1.12, 0.92-1.36 per  $5 \mu\text{g}/\text{m}^3$ ), and BC (1.15, 1.00-1.33 per  $0.5 \text{ } 10^{-5} /\text{m}$ ) and liver cancer incidence. Associations with  $\text{NO}_2$  and BC persisted in two-pollutant models with  $\text{PM}_{2.5}$ . Most components of  $\text{PM}_{2.5}$  were

associated with the risk of liver cancer, with the strongest associations for sulfur and vanadium, which were robust to adjustment for PM<sub>2.5</sub> or NO<sub>2</sub>. 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.

6. **A Review of Dengue's Historical and Future Health Risk from a Changing Climate.** Soneja S, Tsarouchi G, Lumbroso D, Tung DK. *Curr Environ Health Rep.* 2021 Jul 16. doi: 10.1007/s40572-021-00322-8. Online ahead of print.

<https://link.springer.com/article/10.1007/s40572-021-00322-8>

**PURPOSE OF REVIEW:** The purpose of this review is to summarize research articles that provide risk estimates for the historical and future impact that climate change has had upon dengue published from 2007 through 2019.

**RECENT FINDINGS:** Findings from 30 studies on historical health estimates, with the majority of the studies conducted in Asia, emphasized the importance of temperature, precipitation, and relative humidity, as well as lag effects, when trying to understand how climate change can impact the risk of contracting dengue. Furthermore, 35 studies presented findings on future health risk based upon climate projection scenarios, with a third of them showcasing global level estimates and findings across the articles emphasizing the need to understand risk at a localized level as the impacts from climate change will be experienced inequitably across different geographies in the future. Dengue is one of the most rapidly spreading viral diseases in the world, with ~390 million people infected worldwide annually. Several factors have contributed towards its proliferation, including climate change. Multiple studies have previously been conducted examining the relationship between dengue and climate change, both from a historical and a future risk perspective. We searched the U.S. National Institute of Environmental Health (NIEHS) Climate Change and Health Portal for literature (spanning January 2007 to September 2019) providing historical and future health risk estimates of contracting dengue infection in relation to climate variables worldwide. With an overview of the evidence of the historical and future health risk posed by dengue from climate change across different regions of the world, this review article enables the research and policy community to understand where the knowledge gaps are and what areas need to be addressed in order to implement localized adaptation measures to mitigate the health risks posed by future dengue infection.

7. **Association between exposure to fine particulate matter and osteoporosis: a population-based cohort study.** Adami G, Cattani G, Rossini M, Viapiana O, Olivi P, Orsolini G, Bertoldo E, Fracassi E, Gatti D, Fassio A. *Osteoporos Int.* 2021 Jul 15. doi: 10.1007/s00198-021-06060-9. Online ahead of print.

<https://link.springer.com/article/10.1007%2Fs00198-021-06060-9>

Long-term environmental air pollution exposure was associated with osteoporosis' risk in a cohort of women at high risk of fracture. Cortical sites seemed to be more susceptible to the exposure's effect.

**INTRODUCTION:** Environmental air pollution has been associated with disruption of bone health at a molecular level. Particulate matter (PM) exposure can simultaneously stimulate bone resorption and halt bone formation. The primary aim of the present study is to describe

the association between long-term exposure to PM and osteoporosis in a large cohort of women at high risk of fracture.

**METHODS:** Clinical, demographic, and densitometric data were extracted from the DeFRAlc79 dataset, which gathers data on women at risk for osteoporosis. Data on the monitoring of PM<sub>10</sub> and PM<sub>2.5</sub> concentrations were retrieved from the Italian institute of environment protection and research (Istituto Superiore per la Protezione e la Ricerca Ambientale, ISPRA). Generalized linear models with robust estimators were employed to determine the relationship between BMD and PM long-term exposure.

**RESULTS:** A total 59,950 women from 110 Italian provinces were included in the study. PM 2.5 exposure was negatively associated with T-score levels at the femoral neck ( $\beta$  -0.005, 95 CI -0.007 to -0.003) and lumbar spine ( $\beta$  -0.003, 95% CI -0.006 to -0.001). Chronic exposure to PM<sub>2.5</sub> above 25  $\mu\text{g}/\text{m}^3$  was associated with a 16% higher risk of having osteoporotic T-score at any site (aOR 1.161, 95% CI 1.105 to 1.220), and exposure to PM<sub>10</sub> above 30  $\mu\text{g}/\text{m}^3$  was associated with a 15% higher risk of having osteoporotic T-score at any site (aOR 1.148, 95% CI 1.098 to 1.200).

**CONCLUSION:** Long-term exposure to air pollution was associated with higher risk of osteoporosis. Femoral neck site seemed to be more susceptible to the detrimental effect of PM exposure than lumbar spine site.

**KEY MESSAGE:** Exposure to air pollution is associated with osteoporosis, mainly at femoral site.

8. **Association between water and sanitation, air and emission pollution and climate change and neurological disease distribution: A study based on GBD data.** Sarmadi M, Rahimi S, Rezaeiemanesh MR, Yektay S. *Chemosphere*. 2021 Jul 13;285:131522. doi: 10.1016/j.chemosphere.2021.131522. Online ahead of print.

Along with the urbanization and industrialization of countries, the prevalence of chronic diseases has increased. There is ample evidence that ambient pollution can play a major role in these diseases. This study aimed to investigate the association between neurological disorders (NDs) and their subtypes with environmental factors. In this country-level study, we used the age-standardized prevalence and incidence rate (per 100,000 populations) of NDs and its subtypes that have been taken from the Global Burden of Disease (GBD) database in 2019. We used correlation and regression analysis to assess the association between variables. Also, multivariable regression analysis was performed to identify the most important variables in NDs distribution. Age-adjusted NDs incidence rate was significantly higher in developed countries compared to developing countries (11345.25 (95% CI: 11634.88-11055.62) and 9956.37 (95% CI: 10138.66-9774.08)). Association results indicated that the impact of water and sanitation could be more effective than air pollution on NDs. The increase in water and sanitation index levels was positively correlated with NDs incidence rate and prevalence (regression coefficient ( $b$ ) = 38.011 (SE = 6.50) and  $b$  = 118.84 (SE = 20.64),  $p$  < 0.001, respectively) after adjusting socio-economic and demographic factors. Furthermore, the incidence of NDs was negatively correlated with the increase in air quality ( $b$  = -16.30 (SE = 7.25),  $p$  = 0.008). Water and sanitation and their related factors are plausible factors in the distribution of NDs, which may be linked to the potential role of air and water pollution, such as heavy metals and particle matters. These results can be used by politicians and municipal service planners for future planning.

**9. Systematic mapping of global research on climate and health: a machine learning review.**

Berrang-Ford L, Sietsma AJ, Callaghan M, Minx JC, Scheelbeek PFD, Haddaway NR, Haines A, Dangour AD. *Lancet Planet Health*. 2021 Jul 13:S2542-5196(21)00179-0. doi: 10.1016/S2542-5196(21)00179-0. Online ahead of print.

[https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(21\)00179-0/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(21)00179-0/fulltext)

**BACKGROUND:** The global literature on the links between climate change and human health is large, increasing exponentially, and it is no longer feasible to collate and synthesise using traditional systematic evidence mapping approaches. We aimed to use machine learning methods to systematically synthesise an evidence base on climate change and human health.

**METHODS:** We used supervised machine learning and other natural language processing methods (topic modelling and geoparsing) to systematically identify and map the scientific literature on climate change and health published between Jan 1, 2013, and April 9, 2020. Only literature indexed in English were included. We searched Web of Science Core Collection, Scopus, and PubMed using title, abstract, and keywords only. We searched for papers including both a health component and an explicit mention of either climate change, climate variability, or climate change-relevant weather phenomena. We classified relevant publications according to the fields of climate research, climate drivers, health impact, date, and geography. We used supervised and unsupervised machine learning to identify and classify relevant articles in the field of climate and health, with outputs including evidence heat maps, geographical maps, and narrative synthesis of trends in climate health-related publications. We included empirical literature of any study design that reported on health pathways associated with climate impacts, mitigation, or adaptation.

**FINDINGS:** We predict that there are 15 963 studies in the field of climate and health published between 2013 and 2019. Climate health literature is dominated by impact studies, with mitigation and adaptation responses and their co-benefits and co-risks remaining niche topics. Air quality and heat stress are the most frequently studied exposures, with all-cause mortality and infectious disease incidence being the most frequently studied health outcomes.

Seasonality, extreme weather events, heat, and weather variability are the most frequently studied climate-related hazards. We found major gaps in evidence on climate health research for mental health, undernutrition, and maternal and child health. Geographically, the evidence base is dominated by studies from high-income countries and China, with scant evidence from low-income countries, which often suffer most from the health consequences of climate change.

**INTERPRETATION:** Our findings show the importance and feasibility of using automated machine learning to comprehensively map the science on climate change and human health in the age of big literature. These can provide key inputs into global climate and health assessments. The scant evidence on climate change response options is concerning and could significantly hamper the design of evidence-based pathways to reduce the effects on health of climate change. In the post-2015 Paris Agreement era of climate solutions, we believe much more attention should be given to climate adaptation and mitigation options and their effects on human health.

**FUNDING:** Foreign, Commonwealth & Development Office.



- 10. Air pollution and metabolic syndrome risk: Evidence from nine observational studies.** Zang ST, Luan J, Li L, Wu QJ, Chang Q, Dai HX, Zhao YH. *Environ Res.* 2021 Jul 12:111546. doi: 10.1016/j.envres.2021.111546. Online ahead of print.

**BACKGROUND AND AIMS:** Globally, the number of metabolic syndrome (MetS) cases has increased substantially over time. However, the association between air pollution (AP) and MetS risk has been contradictory in observational studies. This is the first reported meta-analysis quantitatively exploring the aforementioned association.

**METHODS:** We searched PubMed, Embase, and Web of Science database entries up to September 14, 2020, and searches were updated up to December 6, 2020 to identify eligible articles on the AP-MetS risk association. No language restriction was imposed. Random-effects models were applied to estimate summary and subgroup effect sizes with 95% confidence intervals (CIs). PROSPERO registration number: CRD42020210431.

**RESULTS:** Eight articles (nine studies) were eligible for the meta-analysis. Increased MetS prevalence was not found to be associated with particulate matter less than 1  $\mu\text{m}$  (PM<sub>1</sub>), 2.5  $\mu\text{m}$  (PM<sub>2.5</sub>), and 10  $\mu\text{m}$  (PM<sub>10</sub>) in diameter or nitrogen dioxide (NO<sub>2</sub>), and the summary effect sizes were 1.33 (95% CI: 0.95-1.85), 1.34 (95% CI: 0.96-1.89), 1.18 (95% CI: 0.98-1.19), and 1.28 (95% CI: 0.89-1.82), respectively, based on cross-sectional studies. The summary results indicated no association between each 10  $\mu\text{g}/\text{m}^3$  increase in PM<sub>2.5</sub> and MetS incidence (effect size 2.78 [95% CI: 0.70-11.02]), based on cohort studies. Subgroup analysis demonstrated that MetS incidence in older men increased dramatically by 992% with each 10  $\mu\text{g}/\text{m}^3$  increase in PM<sub>2.5</sub>.

**CONCLUSIONS:** The evidence presented here suggests that although exposure to PM<sub>1</sub>, PM<sub>2.5</sub>, PM<sub>10</sub>, or NO<sub>2</sub> was not found to have a significant association with the occurrence of MetS, the statistical significance of the relationship between exposure to PM<sub>1</sub>, PM<sub>2.5</sub>, or PM<sub>10</sub> and MetS prevalence was approximately borderline. More studies on AP-MetS risk association in low-/middle-income countries, as well as on the association between other air pollutants and MetS risk, are warranted. A sufficient number of high-quality studies is required to perform a meaningful meta-analysis of the relationship between air pollutants and MetS.

- 11. Air pollution and children's health-a review of adverse effects associated with prenatal exposure from fine to ultrafine particulate matter.** Johnson NM, Hoffmann AR, Behlen JC, Lau C, Pendleton D, Harvey N, Shore R, Li Y, Chen J, Tian Y, Zhang R. *Environ Health Prev Med.* 2021 Jul 12;26(1):72. doi: 10.1186/s12199-021-00995-5.

<https://environhealthprevmed.biomedcentral.com/articles/10.1186/s12199-021-00995-5>

**BACKGROUND:** Particulate matter (PM), a major component of ambient air pollution, accounts for a substantial burden of diseases and fatality worldwide. Maternal exposure to PM during pregnancy is particularly harmful to children's health since this is a phase of rapid human growth and development.

**METHOD:** In this review, we synthesize the scientific evidence on adverse health outcomes in children following prenatal exposure to the smallest toxic components, fine (PM<sub>2.5</sub>) and ultrafine (PM<sub>0.1</sub>) PM. We highlight the established and emerging findings from epidemiologic studies and experimental models.

**RESULTS:** Maternal exposure to fine and ultrafine PM directly and indirectly yields numerous adverse birth outcomes and impacts on children's respiratory systems, immune status, brain

development, and cardiometabolic health. The biological mechanisms underlying adverse effects include direct placental translocation of ultrafine particles, placental and systemic maternal oxidative stress and inflammation elicited by both fine and ultrafine PM, epigenetic changes, and potential endocrine effects that influence long-term health.

CONCLUSION: Policies to reduce maternal exposure and health consequences in children should be a high priority. PM<sub>2.5</sub> levels are regulated, yet it is recognized that minority and low socioeconomic status groups experience disproportionate exposures. Moreover, PM<sub>0.1</sub> levels are not routinely measured or currently regulated. Consequently, preventive strategies that inform neighborhood/regional planning and clinical/nutritional recommendations are needed to mitigate maternal exposure and ultimately protect children's health.

**12. High Ambient Air Pollution Exposure Among Never Smokers Versus Ever Smokers with Lung**

**Cancer.** Myers R, Brauer M, Dummer T, Atkar-Khattra S, Yee J, Melosky B, Ho C, McGuire AL, Sun S, Grant K, Lee A, Lee M, Yuchi W, Tammemagi M, Lam S. *J Thorac Oncol.* 2021 Jul 10:S1556-0864(21)02256-5. doi: 10.1016/j.jtho.2021.06.015. Online ahead of print.

<https://www.sciencedirect.com/science/article/pii/S1556086421022565>

BACKGROUND: Air pollution may play an important role in development of lung cancers in people who have never smoked, especially among East Asian women. The aim of this study was to compare cumulative ambient air pollution exposure between ever and never smokers with lung cancer.

METHODS: A consecutive cases series of never and ever smokers with newly diagnosed lung cancer were compared regarding their sex, race, outdoor and household air pollution exposure. Using individual residential history, cumulative exposure to outdoor particulate matter (PM<sub>2.5</sub>) over a period of 20 years was quantified with a high spatial resolution global exposure model.

RESULTS: Of the 1,005 lung cancer patients, 56% were females and 33% were never smokers. Compared to ever smokers with lung cancer, never smokers with lung cancer were significantly younger, more frequently Asian, less likely to have chronic obstructive pulmonary disease or a family history of lung cancer and had higher exposure to outdoor PM<sub>2.5</sub> but lower exposure to secondhand smoke. Multivariable logistic regression analysis showed a significant association with never-smoker lung cancer and being female (odds ratio (OR) 4.01, 95% CI 2.76-5.82,  $p < 0.001$ ), Asian (OR<sub>Asian vs non-Asian</sub> 6.48, 95% CI 4.42-9.50,  $p < 0.001$ ), and greater exposure to air pollution (OR<sub>ln\_PM2.5</sub> 1.79, 95% CI 1.10-7.2.90,  $p = 0.019$ ).

CONCLUSION: Compared to ever-smoking patients with lung cancer, never smoking patients had strong associations with being female, Asian and air pollution exposures. Our results suggest incorporation of cumulative exposure to ambient air pollutants be considered when assessing lung cancer risk in combination with traditional risk factors.

**13. Maternal air pollution exposure increases the risk of preterm birth: Evidence from the meta-analysis of cohort studies.** Ju L, Li C, Yang M, Sun S, Zhang Q, Cao J, Ding R. *Environ Res.* 2021 Jul 9;202:111654. doi: 10.1016/j.envres.2021.111654. Online ahead of print.

Preterm birth (PTB), a major public health impact, has been shown to be associated with prenatal air pollution exposure, but the results are still inconsistent. This meta-analysis was performed to quantitatively evaluate the correlation between maternal air pollutant exposure and PTB, and provide evidence of higher grade to help improving the pregnancy outcomes.



Databases including Web of Science and PubMed were searched to retrieve eligible studies published up to October 2020. The quality of the articles was assessed by the Newcastle-Ottawa Quality Score (NOS), after which the pooled estimate of the effect was calculated. The robustness of the joint estimates was confirmed by sensitivity analysis of excluded studies one by one, and the sources of heterogeneity were discussed by stratification analysis. Egger's and Begg's tests were performed to examine publication bias. Sixty studies that met the eligible criteria were finally included in this study. The findings showed combined relative risks of 1.032-1.070 for PTB, 0.859-1.081 for moderate PTB, 1.119-1.194 for very PTB and 1.128-1.259 for extremely PTB when mothers were exposed to PM<sub>2.5</sub>, PM<sub>10</sub>, NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, CO and NO<sub>x</sub> during pregnancy, while the sensitive windows varied for different air pollutants. Notably, PM<sub>2.5</sub> exposure in only the 2nd trimester, NO<sub>2</sub> exposure in only the 3rd trimester, and O<sub>3</sub> exposure in all three trimesters were positively associated with PTB, while NO<sub>2</sub> exposure in the 1st trimester was negatively associated with PTB. In addition, exposure of PM<sub>2.5</sub> and PM<sub>10</sub> in the 2nd trimester was positively associated with moderate PTB, and in the 1st and 2nd trimesters were positively associated with very PTB. These findings demonstrated that PM<sub>2.5</sub>, PM<sub>10</sub>, O<sub>3</sub>, NO<sub>2</sub> were associated with PTB (including moderate PTB, very PTB, and/or extremely PTB), while NO<sub>x</sub> was not, and the relationship between CO and SO<sub>2</sub> and PTB was not stable.

- 14. Long-term association of ambient air pollution and hypertension in adults and in children: A systematic review and meta-analysis.** Qin P, Luo X, Zeng Y, Zhang Y, Li Y, Wu Y, Han M, Qie R, Wu X, Liu D, Huang S, Zhao Y, Feng Y, Yang X, Hu F, Sun X, Hu D, Zhang M. *Sci Total Environ.* 2021 Jul 7;796:148620. doi: 10.1016/j.scitotenv.2021.148620. Online ahead of print.
- AIMS:** The association of long-term ambient air pollution and hypertension has been inconsistently reported. We performed an updated systematic review and meta-analysis to assess the association between long-term exposure to ambient air pollution and risk of hypertension in adults and in children.
- METHODS:** PubMed, EMBASE, and Web of Science were searched up to August 7, 2020 for published articles examining the association of long-term exposure to ambient air pollution, including particulate matter (PM; ultrafine particles, PM<sub>1</sub>, PM<sub>1-2.5</sub>, PM<sub>2.5</sub>, PM<sub>2.5-10</sub> and PM<sub>10</sub>), nitrogen dioxide (NO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), carbon monoxide (CO) and hypertension. Pooled odds ratios (ORs) and 95% confidence intervals (CIs) for hypertension with each 10- $\mu\text{g}/\text{m}^3$  increase in air pollutants were calculated by random-effects models.
- RESULTS:** We included 57 studies (53 of adults and 4 of children) in the meta-analysis. Risk of hypertension was significantly increased in adults with each 10- $\mu\text{g}/\text{m}^3$  increase in exposure to PM<sub>2.5</sub> (OR 1.10, 95% CI 1.07-1.14; I<sup>2</sup> = 93.1%; n = 37), PM<sub>10</sub> (1.04, 1.02-1.07; I<sup>2</sup> = 44.8%; n = 22), and SO<sub>2</sub> (1.21, 1.08-1.36; I<sup>2</sup> = 96.6%; n = 3). Hypertension was not significantly associated with PM<sub>1</sub> (n = 2), PM<sub>2.5-10</sub> (n = 16), NO<sub>2</sub> (n = 27), or NO<sub>x</sub> (n = 17). In children, the summary ORs (95% CIs) for each 10- $\mu\text{g}/\text{m}^3$  increase in PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub> and O<sub>3</sub> were 2.82 (0.51-15.68; I<sup>2</sup> = 83.8%; n = 2), 1.15 (1.01-1.32; I<sup>2</sup> = 0; n = 2), 8.57 (0.13-575.58; I<sup>2</sup> = 94.2%; n = 2), and 1.26 (0.81-1.09, I<sup>2</sup> = 91.6%; n = 2), respectively.
- CONCLUSIONS:** Long-term ambient air pollution is a potential risk factor for hypertension in adults. More studies are needed to explore the effects of long-term air pollution on hypertension in children.

**15. Urban Air Pollution and Mental Stress: A Nationwide Study of University Students in China.**

Zhang W, Peng S, Fu J, Xu K, Wang H, Jin Y, Yang T, Cottrell RR. *Front Public Health*. 2021 Jul 2;9:685431. doi: 10.3389/fpubh.2021.685431. eCollection 2021.

<https://www.frontiersin.org/articles/10.3389/fpubh.2021.685431/full>

**Background:** Studies exploring the relationship between air pollution levels and mental stress have rarely been done, and no studies have been done comparing university student mental stress levels based on regional air pollution levels. **Objectives:** The objective of this study was to evaluate the association between air pollution and mental stress among university students. **Methods:** Participants were 11,942 students, who were identified through a multistage survey sampling process conducted in 50 universities. Regional air pollution levels were retrieved from a national database, and mental stress was measured using a perceived stress scale. Both unadjusted and adjusted methods were utilized in the data analyses. **Results:** Mental stress prevalence was 36.9% (95% Confidence Interval: 24.4-49.5%). The final model indicated that regional air pollution levels were positively associated with students' mental stress. **Conclusions:** This study provided new and direct evidence of the health hazards of air pollution. The findings underscore the need to develop and implement stringent environmental protection policies, while simultaneously raising public awareness of environmental protection.

**WE ACT**

**16. 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/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.

17. **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. H<sub>2</sub>O<sub>2</sub> 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 H<sub>2</sub>O<sub>2</sub> 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.

18. **Design of Automatic Isolated Medical Waste Bin Cover for Drying Waste.** Lee J, Kwon S, Park J, Kim KG. *Surg Innov*. 2021 Jul 16:15533506211033139. doi: 10.1177/15533506211033139. Online ahead of print.

[https://journals.sagepub.com/doi/10.1177/15533506211033139?url\\_ver=Z39.88-2003](https://journals.sagepub.com/doi/10.1177/15533506211033139?url_ver=Z39.88-2003)

Background. The recent outbreak of COVID-19 has led to an increase in isolated medical waste, making the disposal of isolated medical waste a significant problem. There is the dedicated waste bin with four-sided locking-type at the top, causing contact during waste disposal. And it has infection possibility with high humidity. Purpose. In this article, we suggest automatic isolated medical waste bin cover for drying waste.

#### 19. **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.clinicalkey.com#!/content/journal/1-s2.0-S0363502321003646>

**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.

#### 20. **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>

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).

21. **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

[Daily briefing: How climate change boosted the Pacific Northwest heatwave.](#) Graham F. *Nature*. 2021 Jul 9. doi: 10.1038/d41586-021-01918-8. Online ahead of print.

[Racism is magnifying the deadly impact of rising city heat.](#) Witze A. *Nature*. 2021 Jul;595(7867):349-351. doi: 10.1038/d41586-021-01881-4.

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