Relevant research article summaries

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1. Braithwaite, I. et al., 2019, *Air Pollution (Particulate Matter) Exposure and Associations with Depression, Anxiety, Bipolar, Psychosis and Suicide Risk: A Systematic Review and Meta-Analysis*, Environmental Health Perspectives, 127(2): 126002.

The study findings support the hypothesis of an association between long-term PM_{2.5} exposure and depression, as well as supporting hypotheses of possible associations between long-term PM_{2.5} exposure and anxiety and between short-term PM₁₀ exposure and suicide.

2. Hystad, P. et al., 2019, *Health Effects of Household Solid Fuel Use: Findings from 11 Countries within the Prospective Urban and Rural Epidemiology Study*, Environmental Health Perspectives, 127(2): 057003.

Researchers studied 91,350 adults 35–70 years of age from 467 urban and rural communities in 11 countries (Bangladesh, Brazil, Chile, China, Colombia, India, Pakistan, Philippines, South Africa, Tanzania, and Zimbabwe). With a median follow-up period of 9.1 years, the study recorded 6,595 deaths, 5,472 incident cases of CVD (CVD death or nonfatal myocardial infarction, stroke, or heart failure) and 2,436 incident cases of respiratory disease (respiratory death or nonfatal chronic obstructive pulmonary disease, pulmonary tuberculosis, pneumonia, or lung cancer). Researchers found that 41.8% of participants lived in households using solid fuels as their primary cooking fuel. Compared with electricity or gas, solid fuel use was associated with fully adjusted hazard ratios of 1.12 for all-cause mortality, 1.08 for fatal or nonfatal CVD, 1.14 for fatal or nonfatal respiratory disease, and 1.12 for mortality from any cause or the first incidence of a nonfatal cardiorespiratory outcome. Use of solid fuels for cooking is a risk factor for mortality and cardiorespiratory disease. Continued efforts to replace solid fuels with cleaner alternatives are needed to reduce premature mortality and morbidity in developing countries.

3. Herkert, N.J. et al., 2020, *Assessing the Effectiveness of Point-of-Use Residential Drinking Water Filters for Perfluoroalkyl Substances (PFASs)*, Environmental Science & Technology Letter. doi: 10.1021/acs.estlett.0c00004

Per- and polyfluoroalkyl substances (PFASs) have come under increased scrutiny due to concerns about their potential toxicity and prevalence in the environment, particularly in drinking water. PFASs are difficult to remove in full-scale water treatment

systems because of their physicochemical properties. Researchers evaluated the effectiveness of point-of-use (POU) and point-of-entry (POE) residential drinking water filters in removing a suite of three perfluoroalkyl sulfonic acids, seven perfluoroalkyl carboxylic acids, and six per- and polyfluoroalkyl ether acids in homes. POU systems included countertop and pitcher filters, faucet-mounted filters, activated carbon block refrigerator filters, activated carbon block under-sink filters, under-sink dual-stage filters, and under-sink reverse osmosis filters. All under-sink dual-stage and reverse osmosis filters tested showed near complete removal for all PFASs evaluated. In contrast, all other filters containing activated carbon exhibited variable PFAS removal. In these filters, PFAS removal efficiency was dependent on chain length, with long-chain PFASs (~60–70% removal) being more efficiently removed than short-chain PFASs (~40% removal). A few whole-house activated carbon POE systems were also evaluated; however, results were variable, and in some cases, increased PFAS levels were observed in the filtered water.

4. Evlampidu, I. et al., 2020, *Trihalomethanes in Drinking Water and Bladder Cancer Burden in the European Union*, Environmental Health Perspectives, 128(1): 017001.

Researchers assessed THM levels in drinking water in the EU as a marker of DBP exposure and estimated the attributable burden of bladder cancer. Researchers collected recent annual mean THM levels in municipal drinking water in 28 European countries and estimated a linear exposure–response function for average residential THM levels and bladder cancer by pooling data from studies to estimate odds ratios for bladder cancer associated with the mean THM level in each country. Assuming a causal association, current levels in certain countries still could lead to a considerable burden of bladder cancer that could potentially be avoided by optimizing water treatment, disinfection, and distribution practices, among other possible measures.

5. Ettinger, A.S. et al., 2020, *Blood Lead Levels in US Women of Childbearing Age, 1976–2016*, Environmental Health Perspectives, 128(1): 017012.

Data from the National Health and Nutrition Examination Survey were used to describe the distribution of BLLs in U.S. women 15–49 years of age between 1976 and 2016. The most recent GM BLLs (2007–2010 and 2011–2016, respectively) were 0.81 µg/dL and 0.61 µg/dL. In comparison, GM BLLs in earlier periods (1976–1980, 1988–1991, and 1991–1994) were 10.37 µg/dL, 1.85 µg/dL, and 1.53 µg/dL, respectively. In 2011–2016, 0.7% of

women of childbearing age had BLLs ≥ 5 $\mu\text{g}/\text{dL}$, and higher BLLs were associated with older age, other race or ethnicity, birthplace outside the United States, four or more live births, exposure to second-hand tobacco smoke, and ever pregnant or not currently pregnant. Lead exposure in U.S. women of childbearing age is generally low and has substantially decreased over this 40-year period. However, based on these estimates, there are still at least 500,000 U.S. women being exposed to lead at levels that may harm developing fetuses or breastfeeding infants.

6. Matta, M.K. et al., 2020, *Effect of Sunscreen Application Under Maximal Use Conditions on Plasma Concentration of Sunscreen Active Ingredients. A Randomized Clinical Trial*, JAMA, 323(3): 256–267.

A prior pilot study demonstrated the systemic absorption of 4 sunscreen active ingredients; additional studies are needed to determine the systemic absorption of additional active ingredients and how quickly systemic exposure exceeds 0.5 ng/mL as recommended by the US Food and Drug Administration (FDA). The study assessed the systemic absorption and pharmacokinetics of the 6 active ingredients (avobenzone, oxybenzone, octocrylene, homosalate, octisalate, and octinoxate) in 4 sunscreen products under single- and maximal-use conditions. Geometric mean maximum plasma concentrations of all 6 active ingredients were greater than 0.5 ng/mL, and this threshold was surpassed on day 1 after a single application for all active ingredients. Research was conducted in a clinical pharmacology unit and in examining sunscreen application among healthy participants, all 6 of the tested active ingredients administered in 4 different sunscreen formulations were systemically absorbed and had plasma concentrations that surpassed the FDA threshold for potentially waiving some of the additional safety studies for sunscreens.

7. Shrestha, P.R. et al., 2019, *Impact of Outdoor Air Pollution on Indoor Air Quality in Low-Income Homes during Wildfire Seasons*, International Journal of Environmental Research and Public Health, 16(19): 3535.

Indoor and outdoor number concentrations of fine particulate matter ($\text{PM}_{2.5}$), black carbon (BC), carbon monoxide (CO), and nitrogen dioxide (NO_2) were monitored continuously for two to seven days in 28 low-income homes in Denver, Colorado, during the 2016 and 2017 wildfire seasons. In the absence of indoor sources, all outdoor pollutant concentrations were higher than indoors except for CO. Results showed that long-range wildfire plumes elevated median indoor $\text{PM}_{2.5}$ concentrations by up to 4.6 times higher than outdoors. BC, CO, and NO_2 mass concentrations were higher indoors in homes closer to roadways compared to those further away. Four of the homes with mechanical ventilation systems had 18% higher indoor/outdoor (I/O) ratios of $\text{PM}_{2.5}$ and 4% higher I/O ratios of BC compared to other homes. Homes with exhaust stove hoods had $\text{PM}_{2.5}$ I/O ratios 49% less than the homes with recirculating hoods and 55% less than the homes with no stove hoods installed. Homes with windows open for more than 12 hours a day during sampling had indoor BC 2.4 times higher than homes with windows closed. This study provides evidence that long-range wildfire

plumes, road proximity, and occupant behavior have a combined effect on indoor air quality in low-income homes.

8. Charoenkul, K. et al., 2020, *Human Norovirus Infection in Dogs, Thailand*, Emerging Infectious Diseases, 26(2): 350–352.

In July 2018, recombinant norovirus GII.Pe-GII.4 Sydney was detected in dogs in a kennel who had diarrhea and in children living on the same premises in Thailand. Genome sequencing showed the canine norovirus was closely related to human, suggesting human-to-canine transmission.

9. Alleyne, L. et al., 2020, *Epidemiology of Cryptosporidiosis, New York City, New York, USA, 1995–2018*, Emerging Infectious Diseases, 26(3): 409–419.

Researchers assessed trends in incidence and demographic characteristics for the 3,984 cryptosporidiosis cases diagnosed during 1995–2018 in New York City. Reported cryptosporidiosis incidence decreased with HIV/AIDS treatment rollout in the mid-1990s, but the introduction of syndromic multiplex diagnostic panels in 2015 led to a major increase in incidence and to a shift in the demographic profile of reported patients. Incidence was highest among men 20–59 years of age, who consistently represented most (54%) reported patients. In addition, 30% of interviewed patients reported recent international travel. The burden of cryptosporidiosis in New York City is probably highest among men who have sex with men.

10. Christidis, T. et al., 2020, *A Comparative Exposure Assessment of Foodborne, Animal Contact and Waterborne Transmission Routes of Salmonella in Canada*, Food Control. doi: 10.1016/j.foodcont.2019.106899

Salmonella is one of the leading causes of gastro-enteric disease in Canada, second only to *Campylobacter*. The mean exposure of *Salmonella* measured in cells ingested per person per day, from 15 transmission routes, including foodborne, animal contact, and waterborne routes, was estimated for Canada using data inputs from 2005 to 2015. Chicken meat was estimated to have the highest exposure at $1.75\text{E}+00$ cells per person per day. Other foodborne and waterborne transmission routes were roughly 3 log lower than the chicken meat exposure. Exposure at petting zoos and visiting a farm were at the bottom of the list at less than $1.00\text{E}-06$ cells per person per day.

11. Florenza, E.A. et al., 2020, *It's a Wormy World: Meta-Analysis Reveals Several Decades of Change in the Global Abundance of the Parasitic Nematodes Anisakis spp. and Pseudoterranova spp. in Marine Fishes and Invertebrates*, Global Change Biology. doi: 10.1111/gcb.15048

The Anthropocene has brought substantial change to ocean ecosystems, but whether this age will bring more or less marine disease is unknown. In recent years, the accelerating tempo of epizootic and zoonotic disease events has made it seem as if disease is on the rise. Researchers examined the literature to

track long-term change in the abundance of two parasitic nematode genera with zoonotic potential: *Anisakis* spp. and *Pseudoterranova* spp. These anisakid nematodes cause the disease anisakidosis and are transmitted to humans in undercooked and raw marine seafood. Researchers extracted 755 host–parasite–location–year combinations and identified 123 papers published between 1967 and 2017. Meta-regression revealed an increase in *Anisakis* spp. abundance (average number of worms/fish) over a 53-year period from 1962 to 2015 and no significant change in *Pseudoterranova* spp. abundance over a 37-year period from 1978 to 2015. By standardizing changes to the period of 1978–2015, so that the results are comparable between genera, data showed a 283-fold increase in *Anisakis* spp. abundance and no change in the abundance of *Pseudoterranova* spp. This increase in *Anisakis* spp. abundance may have implications for human health, marine mammal health, and fisheries profitability. (Note: *Anisakis* spp. is commonly found in sushi and sashimi)

12. Casey, J.A. et al., 2020, *Improved Asthma Outcomes Observed in the Vicinity of Coal Power Plant Retirement, Retrofit and Conversion to Natural Gas*, Nature Energy. doi: 10.1038/s41560-020-0600-2

Coal-fired power plants release substantial air pollution, which included over 60% of U.S. sulfur dioxide emissions in 2014. Such air pollution may exacerbate asthma, but direct studies of the health impacts linked to power plant air pollution are rare. In Louisville, Kentucky, one coal-fired power plant was retired and converted to natural gas, and three others installed SO₂ emission control systems between 2013 and 2016. Dispersion modelling indicated that exposure to SO₂ emissions from these power plants decreased after the energy transitions. Modelling showed that the emissions control installations and plant retirements were associated with a reduced asthma disease burden related to hospitalizations and emergency room visits at the ZIP-code level, and to individual-level medication use as measured by digital medication sensors.

13. Turner, A. et al., 2020, *Weathering and Persistence of Plastic in the Marine Environment: Lessons from LEGO*, Environmental Pollution, 262: 114299.

Classic LEGO bricks constructed of acrylonitrile butadiene styrene (ABS) and washed up on beaches of southwest England were subjected to X-ray fluorescence (XRF) analysis. Modeling estimated that a LEGO block would take between 100 and 1,300 years to completely disintegrate.