Relevant research article summaries

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1. Tack, D.M. 2019. *Preliminary Incidence and Trends of Infections with Pathogens Transmitted Commonly Through Food – Foodborne Diseases Active Surveillance Network, 10 US Sites, 2015–2018*, MMWR, 68(16): 369–373.

The report summarized 2018 data and changes since 2015. In 2018, FoodNet identified 25,606 infections, 5893 hospitalizations, and 120 deaths traced to foodborne illness. The incidence rate of most infections is increasing. The incidence of infection (per 100,000 population) was highest for *Campylobacter* (19.5) and *Salmonella* (18.3), followed by STEC (5.9), *Shigella* (4.9), and *Vibrio* (1.1). The incidence of *Cyclospora* infections increased markedly compared with 2015–399%, in part related to large outbreaks associated with produce. The number of bacterial infections diagnosed increased by 65% in 2018 compared with the average annual number diagnosed during 2015–2017. The incidence of infections with *S. Enteritidis*, the most common *Salmonella* serotype, has not declined in over 10 years.

2. Ostle, C. et al., 2019. *The Rise in Ocean Plastics Evidenced from a 60-Year Time Series*, Nature Communications. doi: 10.1038/s41467-019-09506-1

Plastic production has increased exponentially since its use became widespread in the 1950s. Researchers presented a time series of plastic entanglement from 1957 to 2016, covering over 6.5 million nautical miles. Data confirmed a significant increase in open ocean plastics in recent decades.

3. Casillas, S.M. et al., 2019. *Cyclosporiasis Surveillance – US, 2011–2015*, MMWR, 68(3): 1–12.

During 2011–2015, CDC was notified by 37 states and New York City of 2207 cases of cyclosporiasis (1988 confirmed). The annual number of reported cases ranged from 130 in 2012 to 798 in 2013; 18.8% of patients had a documented history of international travel during the 14 days before illness onset and 62.7% did not have a history of international travel. Among the 1359 domestically acquired cases with available information, 92.9% occurred among persons who became ill during May–August. During 2011–2015, a total of 10 outbreaks associated with 438 reported cases were investigated. Food vehicles included a berry salad, cilantro imported from Mexico (at least three outbreaks), and a prepackaged salad mix from Mexico. Other outbreaks before this surveillance period included raspberries from Guatemala (1996, 1997, and 2000),

snow peas from Guatemala (2004), mesclun lettuce from Peru (1997), and basil from Peru (2005).

4. Stokdyk, J.P. et al., 2019. *Cryptosporidium Incidence and Surface Water Influence of Groundwater Supplying Public Water Systems in Minnesota, USA*, Environmental Science & Technology, 53: 3391–3398.

Groundwater is assumed free of *Cryptosporidium* unless surface water is entering supply wells. Researchers examined the incidence of *Cryptosporidium* in 145 public water system wells with varying surface water influence. Surface water influence was assessed by stable isotopes and expert judgment of hydrogeologists using site-specific data. Forty percent of wells and 11% of samples were positive for *Cryptosporidium* by qPCR. *Cryptosporidium* incidence was not associated with surface water influence as assessed by stable isotopes or expert judgment. Sequencing of 45 of the 107 positive samples identified *C. parvum* (41), *C. andersoni* (2), and *C. hominis* (2). Results indicated that *Cryptosporidium* is not uncommon in groundwater, even when surface water influence is absent.

5. Napper, I.E. and Thompson, R.C., 2019. *Environmental Deterioration of Biodegradable, Oxo-biodegradable, Compostable, and Conventional Plastic Carrier Bags in the Sea, Soil, and Open-Air Over a 3-Year Period*, Environmental Science & Technology. doi: 10.1021/acs.est.8n06984

This study examined biodegradable, oxo-biodegradable, compostable, and high-density polyethylene materials over a 3-year period. The materials were exposed in three natural environments: open-air, buried in soil, and submersed in seawater, as well as in controlled laboratory conditions. In the marine environment, the compostable bag completely disappeared within 3 months. However, the same compostable bag type was still present in the soil environment after 27 months but could no longer hold weight without tearing. Fragments or whole samples of each bag material type were present in all environments after 27 months and some of the whole bag samples were still functional as plastic bags after 3 years in the natural environment. The tensile stress of bags exposed to sunlight outdoors decreased faster than in the other environments. Between 9 and 18 months, all of the samples exposed in the open air had fragmented and could no longer hold their original shape because they were too brittle. Samples buried in soil were found to lose tensile stress significantly faster than samples in the control environment, while deterioration in the marine environment was slow. The study showed that oxo-biodegradable, degradable, and conventional

carrier bag materials did not degrade quickly in any of the natural environments examined, and in some cases, formulations merely disintegrated into small pieces. There are considerable concerns about the accumulation of microplastics in the environment from these bags.

6. Montiel-Leon, J.M. et al., 2019. *Widespread Occurrence and Spatial Distribution of Glyphosate, Atrazine, and Neonicotinoids Pesticides in the St. Lawrence and Tributary Rivers*, Environmental Pollution, 250: 29–39.

Researchers tested for selected pesticides along a 200-km reach of the St. Lawrence River (SLR) and tributaries in Quebec. Overall, 99% of the 68 surface water samples were positive to at least one of the targeted pesticides. The most recurrent compound was glyphosate with detection frequency at 84%, ATZ at 82%, thiamethoxam at 59%, and DEA at 47%.

7. Schraufnagel, D.E. et al., 2019. *Air Pollution and Noncommunicable Diseases*, Chest, 155(2): 409–416.

Air pollution poses a great environmental risk to health. Outdoor fine particulate matter (PM_{2.5}) exposure is the fifth leading risk factor for death in the world, accounting for 4.2 million deaths and >103 million disability-adjusted life years lost according to the Global Burden of Disease Report. The World Health Organization attributes 3.8 million additional deaths to indoor air pollution. Air pollution can harm acutely, usually manifested by respiratory or cardiac symptoms, and chronically, potentially affecting every organ in the body. It can cause, complicate, or exacerbate many adverse health conditions. Tissue damage may result directly from pollutant toxicity because the fine and ultrafine particles can gain access to organs, or indirectly through systemic inflammatory processes. Susceptibility is partly under genetic and epigenetic regulation. Although air pollution affects people of all regions, ages, and social groups, it is likely to cause greater illness in those with heavy exposure and greater susceptibility. Persons are more vulnerable to air pollution if they have other illnesses or less social support. Harmful effects occur on a continuum of dosage and even at levels below air quality standards previously considered to be safe.

8. Wang, M. et al., 2019. *Progression of Subclinical Arterial Disease: The Multi-Ethnic Study of Atherosclerosis and Air Pollution*, Environmental Health Perspectives. doi: 10/1289/EHP3325.

Long-term ozone exposure is associated with cardiovascular mortality. With almost a decade of follow-up, this study found outdoor ozone concentrations were associated with increased rate of carotid wall thickness progression and risk of new plaque formation, suggesting arterial injury.

9. Song, G. et al., 2018. *Packaging Waste from Food Delivery in China's Mega Cities*, Resources, Conservation & Recycling, 130: 225–227.

Door-to-door fast food delivery service has become increasingly popular in Chinese cities due to the fast development of

e-commerce and the fast-paced life in China. This in turn has resulted in significant environmental concerns for the waste packaging materials. Researchers estimated and predicted the volume and composition of food delivery packaging waste in China. Results showed the total amount of packaging waste surged from 0.2 million metric tons in 2015 to 1.5 million metric tons in 2017.

10. Ludwig, A. et al., 2019. *Increased Risk of Endemic Mosquito-Borne Disease in Canada due to Climate Change*, CCDC, 45(4): 90–97.

There are currently over 80 species of mosquito endemic in Canada. Only a few of these carry pathogens that can cause diseases in humans, including West Nile virus, Eastern Equine Encephalitis virus, and the California serogroup viruses (Jamestown Canyon and Snowshoe Hare viruses). Over the last 20 years, the incidence of most of these endemic mosquito-borne diseases (MBD) has increased approximately 10% in Canada, due in large part to climate change. Climate change has resulted in an increase in both the range and local abundance of several important mosquito species. The increases in ambient temperatures, changes in precipitation and extreme weather events associated with climate change will likely continue to drive mosquito vector and MBD range expansion, increasing the duration of transmission seasons and leading to MBD-related epidemics.

11. Vianello, A. et al., 2019. *Simulating Human Exposure to Indoor Airborne Microplastics using a Breathing Thermal Manikin*, Nature, Scientific Reports, 9: #8670.

Humans are potentially exposed to microplastics (MP) through food, drink, and air. The first two pathways have received quite some scientific attention. Researchers examined the exposure of humans to indoor airborne microplastics in three apartments. Testing found all samples were contaminated with microplastics with concentrations between 1.7 and 16.2 particles/m³. Synthetic fragments and fibres accounted, on average, 4% of total identified particles. Non-synthetic particles of protein (shed skin) and cellulose constituted 91% and 4%, respectively. Polyester was the predominant synthetic polymer in all samples (81%), followed by polyethylene (5%) and nylon (3%). The study showed that MP constitutes a non-negligible fraction of indoor airborne particulates, which can be inhaled and ingested.

12. Myoda, S.P. et al., 2019. *Occurrence and Levels of Salmonella, Enterohemorrhagic Escherichia coli, and Listeria in Raw Wheat*, Journal of Food Protection, 2(6): 1022–1027.

Researchers examined the prevalence of pathogens in wheat flour. Testing found *Salmonella* in 1.23% of the samples (average level of 0.110 MPN/g), EHECs in 0.44% of the samples (0.039 MPN/g), and *Listeria* spp. in 0.08% of samples (0.020 MPN/g), but *L. monocytogenes* was not detected. The findings suggested that the microbial contamination is coming from diverse sources and contamination of wheat with pathogens is clearly evident and poses a foodborne illness risk.

13. Cox, K.D. et al., 2019. *Human Consumption of Microplastics*, *Environmental Science & Technology*, 53(12): 7068–7074.

Focusing on the American diet, researchers evaluated the number of microplastic particles in commonly consumed foods in relation to their recommended daily intake. Evaluating approximately 15% of Americans' caloric intake, researchers estimated that annual microplastics consumption ranged from 39,000 to 52,000 particles depending on age and sex. These estimates increased to 74,000 and 121,000 when inhalation is considered. Additionally, individuals who meet their recommended water intake through only bottled sources may be ingesting an additional 90,000 microplastics annually, compared to 4000 microplastics for those who consume only tap water. Researchers noted methodological and data limitations and concluded these values are likely underestimated.

14. LeChevallier, M.W., 2019. *Occurrence of Culturable Legionella pneumophila in Drinking Water Distribution Systems*, *AWWA Water Science* 1(3). doi: 10.1002/aws2.1139

A prior study of 12 potable water distribution systems detected *L. pneumophila* in only 0.17% of samples, but the survey was conducted during winter and spring months when water temperatures were generally below 15°C. Ten utilities participated in a second round of testing during the summer and early fall months when the water temperatures averaged 23°C

(ranged 14°C to 29°C). *L. pneumophila* was detected in 2 of 50 source water samples, 0 of 46 plant effluents, and 14 of 573 distribution system samples with 13 from free chlorinated systems and one from a chloraminated system. All occurrences of *L. pneumophila* were observed when water temperatures were >18°C. Concentrations of *L. pneumophila* were <10 MPN/100 mL except when chlorine residuals were less than 0.1 mg/L. Based on the results, it is recommended that water utilities maintain at least 0.1 mg/L chlorine residual, particularly when the water temperatures are >18°C.

15. Gharpure, R. et al., 2019. *Cryptosporidiosis Outbreaks – US, 2009–2017*, *MMWR*, 68(25): 568–572.

For the period 2009–2017, there were 444 cryptosporidiosis outbreaks in the United States resulting in 7465 cases. Exposure to treated recreational water (pools and water playgrounds) was associated with 35.1% of outbreaks and 56.7% of cases. Most waterborne outbreaks occurred in summer months. Other predominant outbreak exposures included contact with cattle (coinciding with calving season in the spring) and contact with infected persons in childcare settings (July to September, associated with recreational swimming). Foodborne outbreaks were related to unpasteurized milk and apple cider. The annual number of reported cryptosporidiosis outbreaks overall increased an average of approximately 13% per year over time. *Cryptosporidium* is the leading etiology of waterborne outbreaks and the third leading etiology of enteric infections attributable to animal contact.