



SPECIAL ISSUE ARTICLES

Planetary Health and the Role of Nursing: A Call to Action

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Abstract

Purpose: To discuss the drivers of planetary health, responses, and the role of nursing in making health systems more resilient in an era of increasing stresses. As health providers, scientists, educators, and leaders, nurses have an obligation to prepare for climate change and other impacts of ecosystem strain on human health.

Design and Methods: Review of literature relevant to a planetary health framework.

Findings: Population displacement, new disease patterns and health needs, stresses on air quality, food production and water systems, and equity concerns, as well as the generation of sustainable energy, are all intimately related to health.

Conclusions: Nurses are key to achieving the sustainable development goals that, like the planetary health framework, focus on environmental sustainability and human well-being. Nurses contribute to resilient health systems, as trusted leaders and providers of health care, and as advocates and change makers impacting the world.

Clinical Relevance: It is critical that nurses and other health professionals consider the multiple effects of ecosystem strain on human health, and anticipate population health and health system planning and response.

The concept of human endeavor grouped under the rubric of global health has evolved over time. Following a quasicolonial model of tropical medicine that tended to focus on single diseases and achievements such as the eradication of smallpox, in the mid-20th century the term became international health—arguably still an “us and them” framing (Brown, Cueto, & Fee, 2006). By the 2000s there was a move to define global health in a way that embraced the interconnectedness of human communities, as “. . . an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide” (Koplan et al., 2009, p. 1995).

Health Improvements and Consequences

The United Nations’ (UN) millennium development goals (MDGs) were a further milestone in the evolution of global health. MDGs were established with focused,

quantifiable health goals, though their conceptual focus was only on low-income countries (Office of the High Commissioner for Human Rights [OHCHR], n.d.). By 2015, all 193 UN member countries transitioned from the MDG framework into sustainable development goals (SDGs) that are much broader (17 goals, 169 targets), intersectoral (beyond health), and apply to all countries, whether high-income country (HIC) or low- or middle-income country (LMIC) status (World Health Organization [WHO], 2015).

SDG 3, good health and well-being, includes newborn and maternal mortality goals, targets for reduction of noncommunicable diseases (NCDs), universal access to sexual and reproductive healthcare services, health workforce goals, and reduction of deaths and illness from environmental pollutants, among others (UN, n.d.).

Growing concern that economic development gains are undermined by humans’ transformation of the planet brought focus within the SDG framework to the coupled

priorities of environmental protection and poverty reduction (Griggs et al., 2013). The 17 SDGs in total outline goals for climate action, reduced inequalities, clean energy, and the achievement of equality and justice. Tacit recognition of health as a human right has driven a focus within the framework on equity, economics, and ecology (OHCHR, n.d.).

The One Health Initiative, a “worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals, and the environment,” is a milestone coalition and movement built upon older concepts of zoonotic disease and the connection between public health and the environment (One Health Initiative, n.d., para.1). And now many have begun to talk about planetary health, an organizing focus on health that considers both the benefits and the untoward consequences of economic development.

These organizing frameworks are occurring in the context of major global health trends. NCDs continue to grow at an alarming, rapid rate, including in LMICs. Urbanization is another clear trend. In 2007, more humans around the globe lived in cities than in rural areas, and predictions are that by 2050 another 2.5 billion people will live in cities, with 90% of this change occurring in Asia and Africa. By mid-century, 66% of the world’s population will be urban (UN, 2014). The number of people living in slums now approaches 1 billion, with projections indicating that number will double by 2030. If that prediction holds, most of the growth in human population in the next 15 years will be into urban slums through migration and natural growth (United Nations Human Settlements Programme, n.d.).

Global urbanization trends suggest growth in social and health inequality. Data from urban health researchers consistently demonstrate a monotonic positive association between measures of concentrated disadvantage and poor health outcomes (Vlahov et al., 2007). Urban areas are at the center of globalization, with the transmission of capital and innovation, but also at the center of transmission of energy use, infectious disease transmission, and pollution. Cities are both the main drivers of climate change (estimated to account for 60%–80% of energy consumption and 70% of human-induced greenhouse gas emissions) as well as the recipients of deleterious climate impacts (Bank, 2010).

The good news is that overall human health, in aggregate, is better than ever before, and poverty has been substantially reduced. Over the past three decades, most poverty reduction has occurred in China and India, with real increases in overall wealth and not only redistribution of wealth (Ortiz & Cummins, 2011). Despite real economic gains for many, however, growth has occurred

at disparate rates, and overall income inequality is increasing (Dabla-Norris, Kochhar, Suphaphiphat, Ricka, & Tsounta, 2015).

Health impacts of income inequality and social stratification are clear regardless of the country (Chetty et al., 2016). In the United States, the mean lifespan of the wealthiest 1% of males is 15 years longer than the poorest 1%. The wealthiest 1% of women in the United States live, on average, a decade longer. This gap has grown over the past 20 years (Chetty et al., 2016). Recent data show declines in all life expectancy for all ages for the first time in the United States since 1993. Unexpected mortality increases in the diseases marking distress (overdose, alcoholism, and suicide) among white middle-aged Americans are also occurring with substantial social and political implications (Case & Deaton, 2015). Despite these alarming trends in the United States, it is important to note that the global burden of disease is still vastly and disproportionately borne by LMICs in the developing world (Murray & Lopez, 2013).

Ecosystem strain is a key global trend that may be less visible but that will have an increasing and profound impact on health. Due to climate system complexity and system justification bias—the human tendency to find comfort in the status quo (Jost, 2015)—ecosystem strain tends to be difficult to recognize. But in the longer term, trends of these patterns as a kind of slower-moving disaster are clear. Because of human-induced ecosystem effects like pollution, climate change, eutrophication of water systems, species elimination, and habitat destruction, human civilization will encounter new and serious threats to the systems and practices that provide access to resources required for individual and social survival (Whitmee et al., 2015).

The emission of greenhouse gases, primarily CO₂ (and also methane, nitrous oxide, and other agents), are strong drivers of global warming leading to cryosphere melt and rising sea levels (Wei et al., 2016). The impact of climate change is creating forced migration of select populations (e.g., Alaska straits) in HICs like the United States. The Bulletin of the Atomic Scientists’ Science and Security Board publishes annually an assessment of long-term trends that may pose existential threats to humanity, and in 2017 set the so-called Doomsday clock to 2½ minutes to midnight—global catastrophe—the second closest approach to midnight since the clock was introduced in 1947 (Science and Security Board, 2017).

Unambiguous evidence of ecosystem impact is offered by geologists, who propose the termination of the Holocene epoch and the beginning of the Anthropocene era (Crutzen, 2006). This new interval started approximately in 1950 during the great acceleration period of shifting from Industrial Revolution coal use to

multiple fossil fuel use in the 20th century, leading to human-induced processes like global warming, ocean acidification, air pollution, and other effects. These impacts are clearly geologically identifiable in soil, ice, and rock samples (Zalasiewicz, Williams, Steffen, & Crutzen, 2010). Overwhelmingly, the scientific consensus is that the current global climate change warming trend is due to human activity (National Aeronautics and Space Administration, 2017). Globally, each of the past 3 years were the hottest ever recorded, with 2016 and 2017 measured as the warmest ever years in the 21st century (National Centers for Environmental Information, 2017). Likewise, the rise in global ocean surface temperature continues to accelerate (Reid & Beaugrand, 2012).

By the year 2100, at the present rate of climate change, we can expect mean temperature increases of 1°C to 6°C (Intergovernmental Panel on Climate Change, 2007) and concomitant expected sea level rise of between 7 and 23 inches. That amount of sea level rise will displace 100 million people, triggering global migration and local relocation of displaced persons. Sea level rise will further disrupt agriculture, water systems, tourism, and the disappearance of small island nations (Wong et al., 2014). Even with a hypothetical present-day global reduction in the emission of greenhouse gases, climate changes are time lagged: greenhouse gas emitted in 2016 will not be identifiable in changed climate until 2030. In short, temperature rise and some of its unstoppable consequences are already “baked in” to our system and future.

Climate change brings with it more frequent extreme weather events. In 2012, Hurricane Sandy (the largest diameter Atlantic hurricane ever recorded) made landfall just northeast of Atlantic City, New Jersey, bringing record rain, wind, and storm surges to the densely populated northeastern United States. In total, Sandy was the second-costliest natural disaster in U.S. history, with costs estimated well over \$50 billion (Blake, Kimberlain, Berg, Cangialosi, & Beven, 2012). The risks posed by extreme weather events, climate change, and anthropogenic impacts are societal as well as economic. Social cohesion itself can be undermined: “The fall of the Roman Empire, Mayan, and [others] are all testimony to the fact that advanced, sophisticated, complex, and creative civilizations can be both fragile and impermanent” (Motescharra, Rivasb, & Kalnayc, 2014, p. 91). Far from a new problem, human history is marked by both progress and innovation, as well as periods of strife and forced migration.

Actuarial modeling of uncertainty and risk provides a view into the accelerating stress of global carrying capacity using math, statistics, and financial theory to study future events. A U.K. government taskforce recently assessed the actuarial risk of civilization collapse by 2040, weighing the combined risk elements affecting

food shortage due to climate change, water scarcity, and political and energy system instability (Ahmed, 2015).

In 2015, the Rockefeller Foundation and Lancet commission on Planetary Health released a special report, “Safeguarding Human Health in the Anthropocene Epoch” (Whitmee et al., 2015). The organizing premise of planetary health is that, while the global human population is healthier than ever before, the ecological cost to attain this standard has required an unprecedented and unsustainable exploitation of the planet. The Lancet report summarized concerns that, on our current unsustainable trajectory, we could see a reversal of health progress made as well as destabilized governments due to resource scarcity and inequities.

The complexity of global systems, natural and human, as well as the unprecedented changes underway make difficult predictions of the exact relationship between isolated measures of ecosystem change and health impact. Nonetheless, we can anticipate some of the expected patterns. Planetary health encompasses broad aspects of the accelerating pressure on the global environment. Climate change—global warming and related atmospheric phenomena—is only one parameter, but other ecosystem changes and impairments, as summarized in **Figure S1**, also have significant health impacts. The effects related to the impairment of ecosystems may be divided into direct, ecosystem-mediated, and indirect health impacts.

Direct health impacts of ecosystem impairment follow acute or long-term environmental changes. Increased flooding is expected due to combined factors of rising sea level and cryosphere loss, extreme weather events, and changes in precipitation. Globally, 50% of the population lives within 37 miles of the coast. In the United States, 50% of the population is within 50 miles (Toro, 2012). Droughts of increased severity and frequency are affecting food production as well as water systems of all types. Direct heat especially affects the elderly and vulnerable. A 2003 heatwave in Paris caused 15,000 deaths (Canoui-Poitaine, Cadot, Spira, & Groupe Régional Canicule, 2006). Air pollutants are now responsible for 5.5 million excess deaths globally in 2016 (University of British Columbia, 2016).

All regions in the United States are already experiencing these direct impacts. Coastal areas are threatened by rising sea levels and more intense storms. Midwest farmlands routinely experience more crop-damaging heat waves and new or persistent pests. The U.S. West and Southwest experience drought and wildfires.

Trends related to ecosystem-mediated health impacts include the spread of vector-borne diseases like dengue fever and malaria as mean temperatures climb. Lyme disease is newly endemic in mid-latitudes. Mental health and psychiatric issues, including trauma and

post-traumatic stress disorder, anxiety, and depression, may increase as individuals and social networks experience stress brought about by these changes.

Changes in food availability, cost, and quality may result in new and widespread malnutrition (undernutrition, micronutrient deficiency, and metabolic disease). Nutrition is vulnerable and subject to change as the systems that deliver food are deeply interconnected and dependent on many factors. Expected challenges to nutrition include climate change, population displacement, collapse of fisheries, decline of pollinators and other wildlife, arable land degradation, and water scarcity (S. Meyers, personal communication, 2016). These not-entirely-predictable interactions may include process inflection points with effects that quickly cascade throughout systems of food production.

Indirect impacts are composed of the anthropogenic environmental effects that lead to other health consequences. New conflicts arise (Kelley, Mohtadi, Cane, Seager, & Kushnir, 2015) or local conditions force migration. Displaced populations shift to urban areas (often to slums, and frequently across national borders), straining health services. Globally, at present there are more than 65 million refugees—more than ever before—with predictions that another 60 million in arid zones could migrate by 2020. Increasingly, global conflicts are not based on religious differences, but on water scarcity: a study on the impact of heat and drought on human behavior, inclusive of economic productivity as well as violence, found that for each standard deviation in temperature and rainfall, there was a 14% increase in violence between groups, and a 4% increase in violence between individuals (Hsiang, Burke, & Miguel, 2013).

These changes will have a disproportionate impact on the poorest individuals, amplifying health inequities. It has been estimated that 88% of persons facing health consequences due to environmental threats reside in LMICs, though HICs contribute to the problem to a much larger extent. This is a foundational ethical problem: the most vulnerable are the most affected. Women, children, the elderly, marginalized communities, and those suffering from mental disorders—more broadly, LMICs—are feeling these pressures sooner and more intensely than HICs. Improving health for vulnerable people is a goal that is foundational to nursing.

Health System Resilience

A green economy and health system are not only necessary but economically viable. The shift toward clean energy and the sustainable use of life-giving resources and systems would bring benefits to the world and

the United States. Clean energy can create competitive advantage and create jobs: China, for instance, is the world's leading producer of renewable energy, with double the generation of the United States (Forsythe, 2017). These changes can result in improved health and other financial savings. Broad agreement among countries in the Paris Climate Agreement (with the notable exceptions of Syria, Nicaragua, and the United States) indicates growing understanding of the importance of this issue (United Nations Framework Convention on Climate Change [UNFCCC], n.d.). Some economic models indicate that countries can experience a net gain in economic terms from almost all actions needed to meet the Paris Climate Agreement's global warming limit of no more than 2°C above pre-industrial levels (Green, 2015).

Hallmarks of health system resiliency include “the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, re-organize if conditions require it” (Kruk, Myers, Varpilah, & Dahn, 2015, p. 1910). Models of resiliency provide a framework for the design and implementation of the healthcare system, given anticipated planetary health stresses. The healthcare workforce, especially nurses and midwives, are central to this framework of resilient and strengthened health systems. The opportunity is significant, with employment in the health sector viewed as counterforce to the world's growing inequalities in income (Chan, 2015).

As ecosystem-stress-induced changes occur, health systems need to anticipate and plan for them (e.g., see **Figure S2**). Questions to ask include how intersectoral your health system is (e.g., does it work closely with health departments?); how well defined and reachable and teachable are the patients in the health system catchment area (e.g., can older or chronically ill patients who might need cooling center support during a heatwave be mobilized?); and how might some of the coming changes look in daily work life in health systems? Nurses as leaders should consider their own health system settings for each of the direct, indirect, and ecosystem-mediated health factors, outline impacts, and develop anticipatory plans (Crimmins et al., 2016).

Nurses can lead local and regional adaptation efforts, partnering with local decision makers in the identification of at-risk populations, the creation of emergency plans, and monitoring. In the clinical environment, as well as in community health roles, nurses provide direct guidance to patients and families. Nurses manage and prepare health facilities and can lead efforts to anticipate surges in demand in emergency departments and outpatient facilities, as well as to make emergency action plans to develop ready access to generators and

emergency transport (Sayre, Rhazi, Carpenter, & Hughes, 2010).

Nurses and midwives can lead efforts for sustainability in the healthcare industry as well, identifying and encouraging sustainable practices within their practice domains and hospitals (e.g., Healthier Hospitals Initiative, Global Green and Healthy Hospitals, Health Care Without Harm, Alliance of Nurses for Healthy Environments). Sattler has written on nurses' leadership in lessening the significant ecological footprint of medical centers and the establishment of nurse-led "green teams" (Choiniere, 2011). Improvements in efficiency of food service (less meat, locally sourced), waste management (reduce-reuse-recycle or incineration alternatives), or transportation (avoidance of unnecessary trips, use of local suppliers) by leadership of nurses and midwives in local health systems can be effective (Sayre et al., 2010). Finally, accrediting bodies could significantly encourage widespread adoption by incorporating these standards in their review work.

Within a resilient healthcare system, individual actors themselves also must develop resiliency. Resilient nurses (International Council of Nurses, 2016) possess adaptability, confidence, purposefulness, and social support (Cooper, 2012). Nurses and midwives take care of the health system, but also need to take care of themselves, before, during, and after health crises.

Though planetary health as a multidisciplinary area of research is relatively new, nursing has been thinking about and leading in this area generally (see **Table S1**). Environmental nursing offers an important legacy, though planetary health issues are now broader than health solely in one's workplace or immediate environs.

The powerful Precautionary Principle from the American Nurses Association (ANA) "challenges nurses to protect those who are most vulnerable, those who are least powerful, and those who are the earth's future generations" (ANA, 2007, p. 19). The current mode of thinking about environmental matters asks, "How much harm is allowable?" but the precautionary approach asks to consider instead, "How can we meet our goals in the least harmful way? How can we protect public health and the environment?" (ANA, 2003).

A Call to Action

It falls to nurses and midwives, the most numerous and arguably most patient-centered component of the health workforce, to assume a leadership role in addressing planetary health. Leadership begins with educating ourselves, students, staff, patients, and communities. Engagement in political and policy processes are

needed—and can take many forms. Even small measures may have impact. Local level sustainability and readiness is meaningful at one's university, hospital, and or health system levels.

- Learning—and teaching—about planetary health is a key productive action. The collective changes possible with law and policy changes—in short, better governance—are necessary to limit further harm.
- Communication about planetary health matters requires special care to keep emotions even keeled and avoid an apocalyptic focus. Just as gain-framed messages are demonstrably more effective in health prevention strategies for individuals, prevention in the planetary health domain can include emphasis on improved economies, jobs, population health, and social justice.
- Finding common ground (leveraging beliefs, telling personal stories; see Figure S3) with an audience improves message receptivity. New research indicates "that it is possible to pre-emptively protect ('inoculate') public attitudes about climate change against real-world misinformation" (van der Linden, Leiserowitz, Rosenthal, & Maibach, 2017, p. 1). Nurses in educational, community, and clinical leadership roles can provide listeners with information about the nature of disinformation campaigns and why certain parties seek to confuse their audiences. This is the sort of health promotion ("inoculation") work in which nurses and midwives excel.
- The formal and continuing education of nurses and midwives must keep pace with the changing conditions, evolving science, and higher levels of engagement from populations and patients in planetary health matters. Medical and public health curricula have made shifts to include climate change and health matters. Nursing curricula are arriving: the Global Consortium on Climate and Health Education (n.d.), a collaborative of nursing, public health, and medical schools formed in 2017, is developing interprofessional curricula on climate change and health.
- Survey data show that Americans are concerned about global warming. A Yale survey in late 2016 shows the proportion of Americans "alarmed" about climate change has grown, and the proportion of "dismissives" has shrunk, such that alarmed individuals are now double the number of dismissives (see Figure S4; Yale Program on Climate Change Communication, 2016).
- Green technology is an economic growth area. Economies based on wisely used, sustainable, and renewable sources of energy appear ready to thrive. Fossil fuel availability will peak then decline, creating potential market gaps for prepared leaders and nations

to lead the green energy transition, enhancing the resiliency of cities, and making food and water systems sustainable. Embracing a planetary health mindset can challenge, renew, and unite us.

- Pay attention to what narratives and stories we tell ourselves: “If we don’t transition quickly to a sustainable way of life, humanity is doomed!” or rather, “We are transitioning to a more sustainable and resilient way of life that will offer tremendous benefits to humanity” (Frumkin, 2017; Hunter, Frumkin, & Jha, 2017).

Nurses are essential to every solution that will improve the health of the planet, with implications for the development and use of the global healthcare workforce, for research, and for practice. Nurses help plan and build resilient health systems, but in order to develop health beyond health care, nurses must move into expanded roles, working with other sectors and individuals, to support the development of resilient communities.

The science, techniques, and interventions useful in patient-level health promotion are uniquely understood by nurses and midwives. These selfsame tools can inspire and illuminate health promotion of the planet and the critical systems on which human existence depends. Safeguarding human health requires a healthy planet. The changes we make as individuals are useful, though as trusted clinicians, scholars, and leaders, those changes also can inspire and educate others (Whitmee et al., 2015). The magnitude of our jewel of a planet’s health crisis is enormous. But the timeliness, impact, and scale of the solutions that nurses and midwives will muster could evince the very best of our professional—and human—potential.

Clinical Resources

- Health Care Without Harm. <https://www.noharm.org/>
- Alliance of Nurses for Healthy Environments. <http://www.envirn.org>

References

Ahmed, N. (2015). *Scientific model supported by UK Government Taskforce flags risk of civilisation’s collapse by 2040. INSURGE intelligence*. Retrieved from <https://medium.com/insurge-intelligence/uk-government-backed-scientific-model-flags-risk-of-civilisation-s-collapse-by-2040-4d121e455997>

American Nurses Association. (2003). *Nursing’s social policy statement* (2nd ed.). Silver Spring, MD: Nursesbooks.org

American Nurses Association. (2007). *ANA’s Principles of Environmental Health for Nursing Practice with Implementation Strategies*. Retrieved from <http://www.nursingworld.org/MainMenuCategories/WorkplaceSafety/Healthy-Nurse/ANAsPrinciplesof-EnvironmentalHealthforNursingPractice.pdf>

Bank, T. W. (2010). *Cities and climate change: An urgent agenda*. Retrieved from <http://siteresources.worldbank.org/INTUWM/Resources/340232-1205330656272/CitiesandClimateChange.pdf>

Blake, E. S., Kimberlain, T. B., Berg, R. J., Cangialosi, J. P., & Beven, J. L. (2012). *Tropical cyclone report Hurricane Sandy*. Retrieved from http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf

Brown, T. M., Cueto, M., & Fee, E. (2006). The World Health Organization and the transition from “international” to “global” public health. *American Journal of Public Health, 96*(1), 62–72.

Canoui-Poitrine, F., Cadot, E., Spira, A., & Groupe Régional Canicule. (2006). Excess deaths during the August 2003 heat wave in Paris, France. *Revue d’Epidemiologie et de Sante Publique, 54*(2), 127–135.

Case, A., & Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proceedings of the National Academy of Sciences, 112*(49), 15078–15083.

Chan, M. (2015). *WHO Director-General addresses ministerial meeting on universal health coverage. Keynote address at the Ministerial Meeting on UHC: the Post-2015 challenge*. Retrieved from <http://www.who.int/dg/speeches/2015/singapore-uhc/en/>

Chetty, R., Stepner, M., Abraham, S., Shelby, L., Scuderi, B., Turner, N., . . . Cutler, D. (2016). The association between income and life expectancy in the United States, 2001–2014. *Journal of the American Medical Association, 315*(16), 1750–1766.

Choiniere, D. (2011). The greening of a major medical center. Interviewed by Barbara Sattler. *American Journal of Nursing, 111*(4), 60–62.

Cooper, R. (2012). *Resilience training*. Retrieved from <http://www.robertsoncooper.com/how-we-do-it/our-solutions/resilience-training-overview/resilience-training>

Crimmins, A., Balbus, J., Gamble, J. L., Beard, C. B., Bell, J. E., Dodgen, D., . . . Ziska, L. (Eds.). (2016). *The impacts of climate change on human health in the United States: A scientific assessment*. Washington, DC: U.S. Global Change Research Program. <https://doi.org/10.7930/J0R49NQX>

Crutzen, P. J. (2006). The “Anthropocene.” In E. Ehlers & T. Krafft (Eds.), *Earth system science in the Anthropocene* (pp. 13–18). Berlin, Germany: Springer.

Dabla-Norris, E., Kochhar, K., Suphaphiphat, N., Ricka, F., & Tsounta, E. (2015). *Causes and consequences of income inequality: A global perspective*. Washington, DC: International Monetary Fund. Retrieved from <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1513.pdf>

- Forsythe, M. (2017, January 2). *China aims to spend at least \$360 billion on renewable energy by 2020*. Retrieved from <https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html>
- Frumkin, H. (2017). *What is planetary health and why now*. Presented at the Annual Meeting on Planetary Health and GeoHealth, April 28–30, 2017, Boston, MA. Retrieved from <https://planetaryhealthannualmeeting.files.wordpress.com/2017/04/frumkinplanetary-health-overview-boston-04-2017.pdf>
- Global Consortium on Climate and Health Education. (n.d.). *Consortium on climate and health education: Mission*. Retrieved from <https://www.mailman.columbia.edu/research/global-consortium-climate-and-health-education/mission>
- Green, F. (2015). *Nationally self-interested climate change mitigation: A unified conceptual framework*. Centre for Climate Change Economics and Policy Working Paper No. 224; Grantham Research Institute on Climate Change and the Environment Working Paper No. 199. Retrieved from http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/07/F_Green_Nationally_Self_Interested_Climate_Change_Mitigation.pdf
- Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, P. S., Steffen, W., . . . Noble, I. (2013). Policy: Sustainable development goals for people and planet. *Nature*, 495(7441), 305–307.
- Hsiang, S. M., Burke, M., & Miguel, E. (2013). Quantifying the influence of climate on human conflict. *Science*, 341(6151), 1235367.
- Hunter, D. J., Frumkin, H., & Jha, A. (2017). Preventive medicine for the planet and its peoples. *New England Journal of Medicine*, 376(17), 1605–1607.
- Intergovernmental Panel on Climate Change. (2007). Multi-model averages and assessed ranges for surface warming. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, & H. L. Miller (Eds.), *Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. New York, NY: Cambridge University Press.
- International Council of Nurses. (2016). *Nurses: A force for change: Improving health systems' resilience*. Retrieved from <http://www.icn.ch/publications/2016-nurses-a-force-for-change-improving-health-systems-resilience/>
- Jost, J. T. (2015). Resistance to change: A social psychological perspective. *Social Research*, 82(3), 607–636.
- Kelley, C. P., Mohtadi, S., Cane, M. A., Seager, R., & Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. *Proceedings of the National Academy of Sciences*, 112(11), 3241–3246.
- Koplan, J. P., Bond, T. C., Merson, M. H., Reddy, K. S., Rodriguez, M. H., Sewankambo, N. K., . . . Consortium of Universities for Global Health Executive Board. (2009). Towards a common definition of global health. *Lancet*, 373(9679), 1993–1995.
- Kruk, M. E., Myers, M., Varpilah, S. T., & Dahn, B. T. (2015). What is a resilient health system? Lessons from Ebola. *Lancet*, 385(9980), 1910–1912.
- Motesharreia, S., Rivasb, J., & Kalnayc, E. (2014). Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies. *Ecological Economics*, 101, 90–102.
- Murray, C. J., & Lopez, A. D. (2013). Measuring the global burden of disease. *New England Journal of Medicine*, 369(5), 448–457.
- National Aeronautics and Space Administration. (2017). *Scientific consensus: Earth's climate is warming*. Retrieved from <https://climate.nasa.gov/scientific-consensus/>
- National Centers for Environmental Information. (2017). *Assessing the global climate in May 2017*. Retrieved from <https://www.ncei.noaa.gov/news/global-climate-201705>
- Office of the High Commissioner for Human Rights. (n.d.). *Human rights and the 2030 agenda for sustainable development*. Retrieved from <http://www.ohchr.org/EN/Issues/MDG/Pages/The2030Agenda.aspx>
- One Health Initiative. (n.d.). *About One Health*. Retrieved from <http://onehealthinitiative.com>
- Ortiz, I., & Cummins, M. (2011). *Global inequality: Beyond the bottom line. A rapid review of income distribution in 141 countries*. UNICEF Social and Economic Policy Working Paper. Retrieved from https://www.unicef.org/socialpolicy/files/Global_Inequality.pdf
- Reid, P. C., & Beaugrand, G. (2012). Global synchrony of an accelerating rise in sea surface temperature. *Journal of the Marine Biological Association of the United Kingdom*, 92(07), 1435–1450.
- Sayre, L., Rhazi, N., Carpenter, H., & Hughes, N. L. (2010). Climate change and human health: The role of nurses in confronting the issue. *Nursing Administration Quarterly*, 34(4), 334–342.
- Science and Security Board. (2017). It is two and a half minutes to midnight: 2017 doomsday clock statement. *Bulletin of the Atomic Scientists*. Retrieved from <http://thebulletin.org/sites/default/files/Final%202017%20Clock%20Statement.pdf>
- Toro, R. (2012, March 13). Half of US population lives in coastal areas (Infographic). *Live Science*. Retrieved from <https://www.livescience.com/18997-population-coastal-areas-infographic.html>
- United Nations. (2014). *World urbanization prospects*. Retrieved from <https://esa.un.org/Unpd/Wup/Publications/Files/WUP2014-Report.pdf>
- United Nations. (n.d.). *Goal 3: Ensure healthy lives and promote well-being for all at all ages*. Retrieved from <http://www.un.org/sustainabledevelopment/health/>
- United Nations Framework Convention on Climate Change. (n.d.). *The Paris agreement*. Retrieved from <http://unfccc.int/2860.php>

- United Nations Human Settlements Programme. (n.d.). *Slum almanac 2015/2016. Tracking improvement in the lives of slum dwellers*. Retrieved from <https://unhabitat.org/slum-almanac-2015-2016/>
- University of British Columbia. (2016, February 12). Poor air quality kills 5.5 million worldwide annually. *UBCNews*. Retrieved from <https://news.ubc.ca/2016/02/12/poor-air-quality-kills-5-5-millionworldwide-annually/>
- van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the public against misinformation about climate change. *Global Challenges, 1*, 1600008. <https://doi.org/10.1002/gch2.201600008>
- van der Linden, S., Maibach, E., & Leiserowitz, A. (2015). Improving public engagement with climate change: Five “best practice” insights from psychological science. *Perspectives on Psychological Science, 10*(6), 758–763.
- Vlahov, D., Freudenberg, N., Proietti, F., Ompad, D., Quinn, A., Nandi, V., & Galea, S. (2007). Urban as a determinant of health. *Journal of Urban Health, 84*(Suppl. 1), 16–26.
- Wei, T., Dong, W., Yan, Q., Chou, J., Yang, Z., & Tian, D. (2016). Developed and developing world contributions to climate system change based on carbon dioxide, methane and nitrous oxide emissions. *Advances in Atmospheric Sciences, 33*(5), 632–643.
- Whitmee, S., Haines, A., Beyrer, C., Boltz, F., Capon, A. G., De Sousa Dias, B. F., . . . Yach, D. (2015). Safeguarding human health in the Anthropocene epoch: Report of the Rockefeller Foundation-Lancet Commission on planetary health. *Lancet, 386*(10007), 1973–2028.
- Wong, P. P., Losada, I. J., Gattuso, J. P., Hinkel, J., Khattabi, A., McInnes, K. L., Saito, Y., & Sallenger, A. (2014). Coastal systems and low-lying areas. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, & M. D. Mastrandrea (Eds.), *Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 361–409). Cambridge, UK: Cambridge University Press.
- World Health Organization. (2005). *Ecosystems and human well-being: Health synthesis. A Report of the Millennium Ecosystem Assessment*. Retrieved from <http://www.millennium-assessment.org/documents/document.357.aspx.pdf>
- World Health Organization. (2015). *UN Sustainable Development Summit 2015*. Retrieved from <http://in.one.un.org/page/un-sustainable-development-summit-2015/>
- Yale Program on Climate Change Communication. (2016, November 30). *Global warming’s six Americas, November 2016*. Retrieved from <http://climatecommunication.yale.edu/visualizations-data/global-warmings-six-americas-november-2016/>
- Zalasiewicz, J., Williams, M., Steffen, W., & Crutzen, P. (2010). The new world of the Anthropocene. *Environmental Science & Technology, 44*(7), 2228–2231.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher’s web site:

Figure S1. Planetary health effects. Reproduced by permission of the WHO from Millennium Ecosystem Assessment (2005).

Figure S2. Climate change and how health systems might respond (adapted from Crimmins et al., 2016).

Figure S3. Communicating about planetary health (adapted from van der Linden, Maibach, Leiserowitz, 2015).

Figure S4. Survey data, Yale program on climate change communication, 2016.

Table S1. Policy Statements on Environment, Resilience

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