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PUBLIC HEALTH, GOVERNANCE, AND THE ANTHROPOCENE

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INTRODUCTION

Anthropogenic climate change is more than another challenge to the public health infrastructure; it signals a new reality for human life on earth. Failing to embrace the implications of this new reality, the public health infrastructure will be unable to face the challenges of anthropogenic climate change. Rather than accepting climate change as a transformative event for human health, the current public health infrastructure views it as one of many problems to be considered. This view will make the health impacts from climate change worse. To truly prepare for the health effect of climate change, the public health infrastructure[1] must adopt the values of the Anthropocene.[2]

The public health infrastructure has started to address the issue of climate change with techniques of adaptive management and of emergency preparedness. These approaches, however, are not sufficient to address the fundamental shift represented by climate change. While these models show great promise and are important tools, there are two larger systemic barriers to adopting such approaches. First, the public health infrastructure relies on a set of governance values and assumptions about health that make it impossible to tackle the challengwes presented by climate change. Second, the current approach to funding and the provision of clinical services make efforts to develop a comprehensive adaptation plan impossible.

The Anthropocene provides a rich conceptual framework and path to build a public health infrastructure for the challenges ahead. This short review will highlight key conceptual and structural barriers in the field of public health that limit necessary steps to grapple with

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[1] Following Wiley, I will use the term "health care infrastructure" to describe "the resources we deploy to treat and prevent injury and illness at the level of individual interactions with patients" and will use term public health infrastructure to describe "services aimed at promoting health and preventing disease and injury at the population level." Lindsay F. Wiley, *Moving Global Health Law Upstream: A Critical Appraisal of Global Health Law as a Tool for Health Adaptation to Climate Change*, 22 GEO. INT'L ENVTL. L. REV. 439, 455 (2010). I will use the term health infrastructure to describe both. Broadly, the public health infrastructure focuses on population health issues and operates at the local, state and federal levels. I also use the term infrastructure instead of system to more strongly emphasize the distinction of a view of public health from the perspective of the Anthropocene which includes but is broader than the term *system* and emphasizes the human dimension of health.

[2] *See* discussion *infra* Part IIV.

climate change. This review will not provide a detailed analysis of the expansive literature on the Anthropocene or climate adaptation. Rather, the goal of this review is to suggest a path of inquiry to conceptualize the challenges that climate change will produce. In Part II, I provide an overview of the health impacts of climate change. In Part III, I provide an overview of the current public health infrastructure, its funding, early steps taken to meet the health challenges of climate change, and current problems unrelated to climate change. In Part IV, I discuss the health effects of climate change and explore why current approaches in public health policy will not be effective. In Part V, I provide an overview of the Anthropocene and how it can support a change in values and highlight next steps for creating a climate-resilient health infrastructure.

I. CLIMATE CHANGE AND HUMAN HEALTH

Anthropogenic climate change is affecting human health now and is projected to do so far into the future. Human activity is affecting the climate—the temperature of the surface of the planet continues to rise;[3] the acidification of the oceans continues;[4] and the frequency and intensity of extreme weather event increases.[5] These extreme weather events will increase the number of floods and fires. This warming is a given, the magnitude is the only variable and is dependent only on what scenario Greenhouse Gases (GHG) emissions is considered.[6] Even with radical mitigation of greenhouse gas emissions, the planet is locked into a long-term period of climate change.[7] In addition to

[3] INTERGOVEMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REP. 2 (Core Writing Team et al. eds., 2014).

[4] *Id.* at 4.

[5] *Id.* at 10.

[6] *See id.* at 57 (using scenarios to understand future impacts of greenhouse gas emissions, pollution, land use and other factors based on the discussion of four Representative Concentration Pathways (RCP). These RCPs provide projections based on various scenarios of mitigation and adaptation.).

[7] *See id.*

these effects, climate models project a rise in sea levels.[8] The rising seas will put many coastal areas and urban centers in jeopardy. The effects of our activity on the planet's systems will continue to ripple through the environment for centuries even under the best scenarios for greenhouse gas emission reduction.

Anthropogenic climate change affects health in two ways. First, disruptions to the climate and earth systems will intensify existing health problems. This intensification effect is usually not mentioned as much as the other effect of climate change, the creation of new health problems, e.g. the increase in vector-borne diseases, the change in vector habitats, malnutrition from decreased nutritional value in foods, etc. All these changes in climate will affect health directly and indirectly through changes in the environment and social systems that human health is dependent upon.[9] These impacts on human and natural systems that impact health are profound. The health-related implications include an increase in temperature-related deaths from increased heat and frequency of heat waves; an increase in health burden related to poor air quality from wildfires, ozone, and worse asthma and allergy conditions;[10] increasing exposure to extreme weather events such rain and hurricanes, coastal flooding, and related infrastructure disruption;[11]and an increase in vector-borne illnesses.[12] The effects on food security, availability of water, and human migration will have serious implications for human health as well.[13] In addition to the these direct health effects of climate change, there are qualities to climate change that are challenging for public health infrastructure. Two concepts are particularly worth highlighting: the problem of thresholds and the problem predictability or uncertainty.

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[8] R. S. Nerem et al., *Climate-Change–Driven Accelerated Sea-Level Rise Detected in the Altimeter Era,* PROC. OF THE NAT'L ACAD. OF SCI. 1, 1.

[9] Nick Watts et al., *The Lancet Countdown On Health and Climate Change: From 25 Years of Inaction to a Global Transformation for Public Health*, 391 LANCET 581, 594 (2018).

[10] U.S. GLOBAL CHANGE RES. PROGRAM, THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES: A SCIENTIFIC ASSESSMENT 70 (2016).

[11] *See* INTERGOVEMENTAL PANEL ON CLIMATE CHANGE, *supra* note 3, at 11.

[12] *See id.* at 69.

[13] *Id.* at 13, 16.

Thresholds or tipping points are particular points beyond which the change is irreversible, and the natural system enters a new state not to return to the old. These thresholds are on the horizon, "as human pressures on the Earth system accelerate, critical thresholds at various scales are quickly being approached or, in some cases, have already been exceeded."[14] A threshold is a point beyond which a system changes from one state to another state. [15] These changes of state are irreversible and, for many systems, the threshold point is unknown.[16] This behavior of complex earth systems contrasts the dominant view that natural systems operate within an envelope of variability.[17] Traditional public health practice assumes some variability, but also that there is some baseline of population health to which a population will return.[18] For example, the term *epidemic*, commonly used in public health practice, defines an outbreak of a disease over a period of time that has an endpoint with a return to pre-epidemic disease levels. [19] Anthropogenic climate change suggests, instead, increasing levels of infectious disease with no return to a pre-epidemic state.

It is also critical to understand that these tipping points or boundaries are not necessarily predictable, "both ecologists and the Intergovernmental Panel on Climate Change (IPCC) have made it clear that predictability and reversibility will be coming increasingly unlikely in our climate change century."[20] Current public health practice relies on some level of predictability in the causes, distributions, and management of health problems. In our world it may not be possible to distinguish an epidemic and a new state of endemic disease.

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[14] MELINDA HARM BENSON & ROBIN KUNDIS CRAIG, THE END OF SUSTAINABILITY: RESILIENCE AND THE FUTURE OF GOVERNANCE IN THE ANTHROPOCENE 34 (Kimberly K. Smith ed., 2017).

[15] Timothy M. Lenton et al., *Tipping Elements in the Earth'S Climate System*. PROC. OF THE NAT'L ACAD. OF SCI. 105, no. 6 (2008): 1786.

[16] *Id.*

[17] *See* BENSON & CRAIG, *supra* note 14, at 34.

[18] *See generally* THEODORE H. TULCHINSKY ET AL., THE NEW PUBLIC HEALTH (3d ed. 2014).

[19] *Id.*

[20] BENSON & CRAIG, *supra* note 14 at 31.

II. THE CURRENT PUBLIC HEALTH INFRASTRUCTURE

To be prepared to respond to the challenges of climate change, the public health infrastructure must, "mak[e] resilience a goal."[21] A resilient health system is "one that is capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate."[22] A resilient health infrastructure is distinct from one focused on climate adaptation. Adaptation seeks to minimize and lessen the harm of impacts from climate change and is an integral part of a resilience strategy but alone is insufficient; a resilience approach to climate change seeks to maintain a functioning health infrastructure in the face of climate change.[23]

The public health infrastructure in the United States is dynamic and decentralized, capable of supporting an approach to climate resilience that supports the overarching themes of community-engagement, and adaptive management. However, the current leadership and governance values of the public health infrastructure limit the ability of the system to take advantage of its dynamic structure and coordinate policy to address the demands of climate. Instead, the public health infrastructure is focused on a climate adaptation strategy alone. While the World Health Organization (WHO) does not prioritize any of ten components of a climate-resilient health system, I argue that current values and structures in the public health infrastructure in the areas of leadership and governance and of climate and health financing limit the ability of the system to make climate-resilience a choice.[24] Public health efforts must emphasize these two components.

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[21] *See* WORLD HEALTH ORG., OPERATIONAL FRAMEWORK FOR BUILDING CLIMATE RESILIENT HEALTH SYSTEMS 8 (2015).

[22] *Id*.

[23] *Id*. at 7.

[24] Those components are: leadership and governance; health workforce; vulnerability, capacity and adaptation assessment; integrated risk monitoring and early warning; health and climate research; climate resilient and sustainable technologies and infrastructure; management of environmental determinants of health; climate-informed health programs; emergency preparedness and management; and climate and health financing. For a full discussion of each, *see* WORLD HEALTH ORG., *supra* note 14. See discussion *infra*.

A. Leadership and Governance

The leadership and governance component emphasizes "the strategic consideration and management of the scope and magnitude of climate related stress and shocks to health systems now and in the future."[25] In the United States, the public health infrastructure is organized primarily at the state level with a federal public health infrastructure working in collaboration with state and local agencies. At the state level, there is variance as to how each state organizes its health system. The majority of state public health agencies are independent.[26] Those that are part of a larger organization are umbrellaed under a parent organization that focuses on medical service, public assistance, or mental health services.[27] The governance structure of the public health system within a state is highly variable. Some states have a highly-centralized structure with a state agency managing and staffing local health departments; other states have a decentralized structure with a state agency and highly independent local health departments.[28] The American Association of State and Territorial Health Officials (ASTHO) developed a model for classifying these different organizational structures and found that the majority of states have a decentralized governance structure, the larger minority a centralized structure, and the smallest minority as a mixed structure.[29] This variety of structures embraced by the states indicates a diverse and heterogeneous public health governance system. While the majority of local health departments are small, they serve less of the total US population.[30] The minority of local health departments are large but serve the majority of the US population.[31] There is resource sharing among state

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[25] *Id*. at 14.

[26] ASS'N OF STATE AND TERRITORIAL HEALTH OFFICIALS, ASTHO PROFILE OF STATE AND TERRITORIAL PUBLIC HEALTH, VOLUME FOUR IX 17 (2017).

[27] *Id*. at IX.

[28] *Id.* at 20-21.

[29] *Id.* at 22.

[30] NAT'L ASS'N OF COUNTY AND CITY HEALTH OFFICIALS, NAT'L PROFILE OF LOCAL HEALTH DEPARTMENTS 24 (2016).

[31] *Id.* at 24.

and local health departments, but this resource sharing primarily occurs in the area of all-hazards response and surveillance.[32]

The current federal public health system has been built on top and in partnership with this state system. The federal public health system operates primarily through the authority of the federal government to tax and spend and regulate interstate commerce.[33] Under the authority to tax and spend, the federal government funds and manages a number of programs to provide health services, such as Medicaid, the Women, Infants, and Children (WIC) program, and other federally-funded public health programs.[34] Under its authority to regulate commerce, the federal government regulates drugs and medical devices for safety, mandates national food labeling, and regulates other interstate commerce activities that affect public health.[35] Public health at the national level also relies on custom and agreement. For example, parts of the surveillance system rely on agreements rather than specific mandates.[36] The percentage of local health departments with formal partnerships and collaborations with other agencies dropped across all domains from 2008 – 2016.[37] This drop in collaboration may signal difficulties is federal-state collaboration and future coordination.

In this diverse system, the definition of public health, the fundamental values of public health, and the orientations of practitioners define the field and the approach to leadership and governance. The most commonly-held and dominant framework that defines public health practice is one based on an extended metaphor. This metaphor relies on the notion of upstream and downstream causes of disease and injury.[38] As used commonly, downstream (or proximal) causes are those

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[32] *Id.* at 25.

[33] LAWRENCE O. GOSTIN & LINDSAY F. WILEY, PUBLIC HEALTH LAW: POWER, DUTY, RESTRAINT 93 (3d ed. 2016).

[34] *Id*. at 35-38.

[35] *Id*. at 40-41.

[36] Jason Smith & Chandrakala Ganesh, *Public Health Surveillance, in Climate Change, Public Health, and the Law* (forthcoming).

[37] NAT'L ASS'N OF COUNTY AND CITY HEALTH OFFICIALS, *supra* note 30, at 33.

[38] *See* Nancy Krieger, *Proximal, Distal, and The Politics of Causation: What's Level Got To Do With It?*, 98 AM. J. PUBLIC HEALTH (2008); *see also* Howard Waitzkin, *John D. Stoeckle and the Upstream*

that are closer to the individual, e.g. having unprotected sex, living in an area with vector-borne disease and not having access to mosquito netting, driving while intoxicated, etc.[39] These behaviors are directly linked to causes of ill-health. Upstream (or distal) causes on the other hand are those that are more systemic and widespread, e.g. poverty, racism, education, etc. These are causes that present a less than clear one-to-one causal link with a particular individual's health. Public health practitioners use this metaphor to describe not only the causes of ill-health but also to discuss where the most effective intervention point may be, i.e. should public health focus on buying mosquito netting for everyone in an area or should public health focus on clearing irrigation systems to reduce stagnating water? This concept of proximal and distal, downstream and upstream established itself firmly in public health analysis in the mid-20th century and has been the primary conceptual framework for the field.[40] The definition and elaboration of this framework predates the development and drafting of the most commonly used definition of public health by the Institute of Medicine in 1988.[41]

The most commonly accepted definition of the function of public health in the United States is the definition created by the Institutes of Medicine, "[public health is] what we as a society do collectively to assure the conditions in which people can be healthy."[42] This definition focuses on causes that are not only the most proximate to the individual but also includes more distal social causes linking upstream conditions to society and social choices. The definition emphasizes social conditions that shape the health of an individual. It does not emphasize or even consider environmental conditions or factors that affect health nor the interactions between humans and their physical environment. This definition focuses on downstream and midstream social conditions. An older definition of public health \ focuses more on

Vision of Social Determinants in Public Health, 106 AM. J. PUBLIC HEALTH (2016).

[39] Krieger, *supra* note 38, at 223.

[40] *Id.* at 98.

[41] *See generally id.* (discussing the history of this framework from the 19th century to the current period.)

[42] INST. OF MED., THE FUTURE OF PUBLIC HEALTH 1(1988).

downstream and midstream causes of health with a concentration on communicable disease and includes environmental conditions:

Public health is the Science and Art of (1) preventing disease, (2) prolonging life, and (3) promoting health and efficiency through organized community effort for (a) the sanitation of the environment, (b) the control of communicable infections, (c) the education of the individual, (d) the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and (e) the development of social machinery to ensure everyone a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to enjoy his birthright of health and longevity.[43]

While this definition includes the environment as a key part of public health, the environment is described as something to be acted upon rather than to be understood as interacting with public health.

Focusing almost exclusively on the upstream or social conditions that drive health, theorists like Michael Marmot and the WHO Commission on Social Determinants emphasize poverty reduction as the appropriate area of emphasis for public health efforts.[44] Definitions and work by Marmot focus on the upstream conditions of health, to the near exclusion of other areas of focus. As Nancy Krieger discusses in her work, these frameworks of proximal and distal are artificial ones that collapse many complex concepts into an unsophisticated archetype that is based on proximity to the individual.[45] This value system emphasizes a relatively-unexamined view of human health built on the isolated individual as the starting point. Disputes in the field often focus on the intervention point to achieve health, not on the fundamental value of health or the utility of the framework.

In the field of public health law,[46] practitioners and theorists have also struggled with definition—some emphasize a greater focus on

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[43] *Id*.

[44] *See generally* Michael Marmot et al., *Closing the gap in a generation: health equity through action on the social determinants of health*, 372 LANCET 1661 (2008).

[45] Nancy Krieger, *supra* note 38, at 98.

[46] Public health law focuses primarily on issues involving state authority to achieve public health goals. This work traditionally has focused on analysis of the police power and its limits as well as federal authority for public health work. For a detailed introduction to this field,

downstream concepts and some more intensely on more upstream conceptions of public health. Micah Berman outlines these definitional issues in the field of public health law in his work.[47] His analysis starts with the work of Larry Gostin and his definition of the field in 2000.[48] In that 2000 definition, Gostin defined public health law rather narrowly, focusing on the population perspective of public health, a shared legal context, and demarcating the primary value question as one between public health and individual rights, a more downstream-focused denotation.[49] In 2008, Gostin updated his definition and included a normative component that "the prime objective of public health law is to pursue the highest possible level of physical and mental health in the population, consistent with the values of social justice."[50] This definition took into account increasing understandings of the roles of social determinants and socioeconomic conditions on individual health.[51] The 2008 definition moved the conversation to upstream factors and social conditions and occurred at the same time as shifts in emphasis in public health. The evolution of these definitions represent different emphases along the spectrum of prevention from the more narrow definition in 2000 with a focus on the more downstream interventions and the broader 2008 definition with an emphasis on a broader range of prevention that includes upstream determinants. The debates in public health law and debates in public health have focused primarily on the scope of public health interventions and where on the spectrum they might land.

Krieger suggests that this focus on upstream and downstream is an historic artifact of the evolution of public health following the

see GOSTIN & WILEY, *supra* note 33.

[47] Micah L. Berman, *Defining the Field of Public Health Law*, 15 DEPAUL J. HEALTH CARE L. 45 (2013).

[48] *Id.* at 66.

[49] *Id.*

[50] *Id.*

[51] A third edition was published in 2016 and the definition remains practically the same. LAWRENCE O. GOSTIN & LINDSAY F. WILEY, PUBLIC HEALTH LAW: POWER, DUTY, RESTRAINT (2016).

control of infectious disease.[52] The Institute of Medicine conducted a similar analysis that also emphasized competition and distinction of public health and medical care.[53] The effect of these historical events and this history has created a value in the field that frames health around an individual and struggles only in terms of scope and level intervention. Definitions of public health and public health law are not based only on this upstream and downstream metaphor—Health can also be conceptualized as a dimension of governance.[54]

Berman highlights the work of Wendy Parmet and her emphasis on the population-perspective. Berman argues that Parmet brings a perspective to the field that emphasizes instead of the scope of government action problem, the role of health as a value in governance.[55] In reviewing the evolution of these definitions, a theme emerges that emphasizes the conditions for individual health as the focus of concern with the dispute being only in the scope of authority in public health. Parmet and Berman's own definition brings an alternate view that emphasizes the health of populations as populations.[56]

B. Climate and Health Financing

Health financing is a key component in developing a public health infrastructure.[57] The history and legal structure of the public health system creates public health systems at the state and local level that operate programmatically in silos with narrow and discrete funding streams. These funding streams shape the priority areas for these agencies.[58] Funding for public health tends to focus on particular programmatic issues and areas in public health rather than taking a broader

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[52] Krieger, *supra* note 38, at 221.

[53] INST. OF MED., *supra* note 42, at 3-5.

[54] See *infra* for this discussion.

[55] Berman, *supra* note 47, at 76.

[56] *Id*. at 76, 79.

[57] WORLD HEALTH ORG., *supra* note 21, at 34-35.

[58] Solange Gould & Linda Rudolph, *Challenges and Opportunities for Advancing Work on Climate Change and Public Health*, 12 INT'L J. ENVTL. RES. AND PUBLIC HEALTH 15649, 15654 (2015).

systems-based approach.[59] Funding for public health systems focuses on a particular disease or issue rather than on cross-cutting issues.

The majority of funding for state health agencies comes from the federal government[60] with the majority of state health agency expenditures spent on clinical services and WIC.[61] These funding streams in turn affect the priorities of state health agencies that are currently, chronic disease, clinical services, quality improvement, and health data/health information technology (HIT).[62] Public health funding tends to be discretionary with half of funds provided to state and local health departments by the federal government and one quarter imparted by state governments.[63] Since 2008, funding for public health at all levels has been decreasing.[64]

This funding model makes it difficult for the public health system to absorb shocks. This programmatic approach to funding means that revenues for health departments in states and localities vary with economics and with pressures on the reimbursable health care services. It also produces state and local health department staffing that focus on narrow areas of programmatic focus instead of broader areas of general practice. Given the increasing costs associated with the increase in severe weather events and other climate-related disruptions, jurisdictions may soon find that responding to emergencies will be the new status quo and will consume precious resources that could have been better spent.[65] There is a need to focus on the health effects of climate change and to understand that resources do not match demand.[66] This is due to two factors. First, while the health effects of climate change

[59] *Id.*

[60] ASS'N OF STATE AND TERRITORIAL HEALTH OFFICIALS , *supra* note 26, at 107.

[61] *Id.* at 112.

[62] *Id.* at 31.

[63] TRUST FOR AMERICA'S HEALTH, A FUNDING CRISIS FOR PUBLIC HEALTH AND SAFETY: STATE-BY STATE PUBLIC HEALTH FUNDING AND KEY HEALTH FACTS, HEALTHYAMERICANS.ORG (2018).

[64] *Id.*

[65] *See, e.g.*, Solomon Hsiang et al., *Estimating economic damage from climate change in the United States*, 356 SCI. (2017); Cunrui Huang et al., *Constraints and Barriers to Public Health Adaptation to Climate Change: A Review of the Literature*, 40 AM. J. PREVENTIVE MED. 183 (2011).

[66] Gould & Rudolph, *supra* note 58, at 15650.

are real and likely to affect many, those impacts lack the immediacy of other health issues and problems. This "lack of tangibility or immediacy to the issue" is another barrier to action.[67]

C. Current Public Health Problems

The severity of emergent public health problems coupled with the perceived lack of immediacy of climate change can make it difficult for climate change adaptation to get traction, "even in settings with a well-developed infrastructure, climate change adaptation competes, often unsuccessfully, with other urgent public health concerns."[68] The focus of debate in public health on upstream and downstream causes of ill health makes the public health infrastructure susceptible to external shocks and often subsequently shifts in focus to the newest and most severe public health problem rather than long-term planning. As the debate in public health is over where to intervene, there is no filter for or consideration of what health issue should and could be addressed in the public health infrastructure. This is not a new phenomenon but is a major barrier in addressing climate change.[69]

The opioid epidemic is an example of an emergent problem that threatens to push out concerns about the climate. The costs and burdens associated with addressing the opioid epidemic are extraordinary. From 2000 to 2014, the number of deaths associated with opioid overdose increased by 137%.[70] That increase has continued.[71] This epidemic is associated with increasing burdens on the health system with increased emergency room visits, stress on clinical providers and

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[67] *Id.* at 15652.

[68] Jeremy J. Hess et al., *Integrating Climate Change Adaptation Into Public Health Practice: Using Adaptive Management to Increase Adaptive Capacity and Build Resilience*, 120 ENVTL. HEALTH PERSP. 171, 172 (2012).

[69] *Cf.* Wendy K. Mariner, *Law and Public Health: Beyond Emergency Preparedness*, 38 J. HEALTH L. 247, 254 (2005).

[70] R. A. Rudd et al., *Increases in Drug and Opioid Overdose Deaths--United States, 2000-2014*, 64 MMWR MORB MORTAL WKLY REP 1369, 1378 (2016).

[71] *See Overdose Death Rates*, NAT'L INST. OF DRUG ABUSE (Sept. 2017), https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates (presenting updated statistics and current estimates).

increases in morbidity and mortality.[72] The costs associated with the epidemic both in excess clinical care costs and in losses to businesses are over $70 billion.[73] However, the interventions that are under consideration for mitigating the opioid epidemic are troubling from the perspective of climate change adaptation. Medication-Assisted Treatment (MAT) for opioid addiction, which uses drugs like methadone, buprenorphone, and naltrexone to assist treatment and recovery, requires clinical experience and is deployed in a healthcare setting.[74] This intervention is associated with better treatment outcomes and is a successful way to address opioid dependence. However, resources expended here do not necessarily contribute to creating a more resilient health system. There has been an increase in the number of infants born addicted to opioids.[75] These children require expensive treatment and hospital stays. Some jurisdictions are building more NICUs and incurring additional health care costs. These interventions are not ones that build climate resiliency in the population or in the health care system. In fact, the opioid epidemic is degrading the ability of communities to respond to other critical health issues and draining the finite resources otherwise available.[76] This is not to say that communities shouldn't focus on these emergent issues. Rather, that if the public health system does not develop a dedicated funding model to support climate adaption, then these burgeoning problems will drain available resources and political and policy attention.

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[72] Matthew V. Ronan & Shoshana J. Herzig, *Hospitalizations Related To Opioid Abuse/Dependence And Associated Serious Infections Increased Sharply, 2002–12*, HEALTH AFF. (PROJECT HOPE) (2017); Z. Song, *Mortality Quadrupled Among Opioid-Driven Hospitalizations, Notably Within Lower-Income And Disabled White Populations*, 36 HEALTH AFF. (MILLWOOD) (2017).

[73] C.S. Florence et al., *The Economic Burden of Prescription Opioid Overdose, Abuse, and Dependence in the United States, 2013.*, 54 Med. Care 901, 906 (2016); Roxanne Meyer et al., *Prescription Opioid Abuse: A Literature Review of the Clinical and Economic Burden in the United States*, 17 POPULATION HEALTH MGMT. 372, 372 (2014).

[74] *See* F. R. Levin et al., *A review of a national training initiative to increase provider use of MAT to address the opioid epidemic*, 25 AM. J. ADDICTION 603, 603-04 (2016).

[75] Catherine Saint Louis, *A Tide of Opioid-Dependent Newborns Forces Doctors to Rethink Treatment* (Jul. 2017), https://nyti.ms/2ufN2Wh.

[76] *See generally*, Devesh Vashishtha et al., *The North American Opioid Epidemic: Current Challenges and a Call for Treatment as Prevention*, 14 HARM REDUCTION J. (2017); Meyer et al., *supra* note 72.

D. Current Approaches to Climate and Health

The public health infrastructure has made efforts in some areas to build a resilient health system. These efforts have focused on emergency preparedness and management and on the application of adaptive management to develop climate-informed health programs. The preparedness approach developed in earnest following the attacks of September 11, 2001 and prompted the development of *legal preparedness* as a related concept in public health law and policy.[77] The initial description of legal preparedness was expansive, linking the concept to the 1988 IOM report on public health and the broad definition of public health in *The Future of Public Health, .* Moulton et al. defined legal preparedness at that time as "a subset of public health preparedness […] defined as attainment by a public health system […] of legal benchmarks essential to the preparedness of the public health system."[78] The preparedness of the system was defined it terms of the IOM report and the ability of the system ensure that people can be healthy.[79] This rather circular definition did not stay in place. Over time, this definition of preparedness and legal preparedness changed to focus on emergencies.

By 2008, the term *emergency* had been added to concepts of preparedness and eventually the definition became focused on emergencies entirely, "the capability of the public health and health care systems, communities, and individuals, to prevent, protect against, quickly respond to, and to recover from health emergencies, especially those whose scale, timing or unpredictability threatens to overwhelm routine capabilities."[80] Public health legal preparedness followed suit and also began to focus on emergencies.[81] This legal focus on emergencies

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[77] G. C. Benjamin & A. D. Moulton, *Public health legal preparedness: a framework for action*, 36 J. L. MED. ETHICS 13, 13 (2008).

[78] A. D. Moulton et al., *What is public health legal preparedness?*, 31 J. L. MED. ETHICS 672, 674 (2003).

[79] *Id.*

[80] Benjamin & Moulton, *supra* note 77, at 14 (quoting Christopher Nelson et al., *Conceptualizing and Defining Public Health Emergency Preparedness*, 97 AM. J. PUBLIC HEALTH S9 (2007)).

[81] *See* J. A. Bernstein, *Beyond public health emergency legal preparedness: rethinking best practices*, 41

emphasizes infectious disease outbreaks and the role of the federal government in public health emergency preparedness.[82] Public health emergency preparedness urges an increase in surveillance capacities, training, and coordination to prepare public health systems for emergencies. Given the focus on events that "overwhelm routine capabilities" the emphasis of public health emergency planning is on infectious disease and other hazards that will overwhelm a system in a certain period of time.[83] Considering the likely increase in the number and frequency of extreme weather events and other disasters related to climate change, a focus on preparedness is a key part of adaptation planning.

The other step the public health infrastructure is taking is to apply adaptive management principles to service delivery. Adaptive management emphasizes modeling and information, iteration and the broad engagement of stakeholders and participants. It is reactive and dynamic.[84] In public health, the Building Resilience Against Climate Effects (BRACE) framework, has been proposed as a model for adapting the public health system to the health effects of climate change.[85]

SUPPL 1 J. L. MED. ETHICS 13 (2013). *See also* James G. Hodge, *The evolution of law in biopreparedness*, 10 BIOSECURITY AND BIOTERRORISM: BIODEFENSE STRATEGY, PRACTICE, AND SCI. (2012)(discussing history of law and preparedness with emphasis on Model State Emergency Health Powers Act.)

[82] Benjamin E. Berkman et al., *Assessing the Impact of Federal Law on Public Health Preparedness*, 4 ST. LOUIS U.J. HEALTH L. & POL'Y 155, 155-57 (2010).

[83] *Cf.* Christopher Nelson et al., *Conceptualizing and Defining Public Health Emergency Preparedness*, 97 AM. J. PUBLIC HEALTH 59 (2007) (discussing of the elements of public health emergency preparedness including infectious diseases, radiologic and chemical threats, rapid response, and mass health care).

[84] For a general discussion of adaptive management and public health *See generally* Kristie Ebi, *Climate Change and Health Risks: Assessing and Responding to Them through Adaptive Management*, 30 HEALTH AFF. 924 (2011) (discussing adaptive management generally); Hess et al., *supra* note 68 (reviewing key features of adaptive management literature in public health); J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems - with Applications to Climate Change Adaptation*, 89 N.C. L. REV. 1373, 1374 (2011) (discussing adaptive management and resilience in legal systems); Robin Kundis Craig & J.B. Ruhl, *Designing Administrative Law for Adaptive Management*, 67 VAND. L. REV. 1 (2014) (featuring an overview of adaptive management and administrative law).

[85] Gino Marinucci et al., *Building Resilience against Climate Effects—A Novel Framework to Facilitate Climate Readiness in Public Health Agencies*, 11 INT'L J. ENVTL. RES. AND PUB. HEALTH 6433,

The BRACE framework is built on principles of adaptive management that "explicitly acknowledges that complex systems are incompletely understood, that management interventions can affect system behavior in unexpected ways, and that management strategies need to be regularly updated as system managers and stakeholder learn through interactions with the system and each other."[86] The BRACE model proposes five sequential steps: (1) anticipate climate impacts; (2) project disease burden; (3) assess interventions; (4) develop a plan; and (5) evaluate impact.[87] This model is the basis of the Center for Disease Control and Prevention's Climate-Ready States & Cities Initiative (CRSCI) with eighteen states and cities funded through the CRSCI program.[88] These programs vary in area of focus from heat exposure, storms, sea level rise, infectious diseases, to general capacity building.

III. CURRENT GOVERNANCE FRAMEWORKS CANNOT ADDRESS CLIMATE CHANGE

While the current public health system is based on a governance model that is decentralized and adaptive, its fundamental values prevent meaningful transformative action in public health. Without a clear framework for setting priorities nor an embrace of the unpredictability of climate change and its intensifier effects, the public health system will not be able to adapt to the realities of climate change. In order to think about how the public health infrastructure might be better adapted to climate change and the requisite changes in law and policy implications that would accompany that choice, it is useful to have a framework to analyze the current system. In an influential piece on adapting the legal system to climate change, JD Ruhl argues that in order to adapt to the demands that climate change will place on our societies and environments the law must develop a greater capacity to

6433-34 (2014).

[86] *Id.* at 6435.

[87] *Id.* at 6436.

[88] *Climate-Ready States & Cities Initiative Grantees*, CENTERS FOR DISEASE CONTROL AND PREVENTION (Dec. 7, 2017), https://www.cdc.gov/climateandhealth/crsci_grantees.htm.

be both resilient and adaptive.[89] Ruhl proposes four characteristics of an adaptive and resilient legal system.[90] First, the system must be designed so that it does not emphasize or operate on principles of predictability and stationarity.[91] Second, the system must be based on principles of decentralized and collaborative governance instead of command-and-control models.[92] Third, the system must be based on principles of dynamic federalism which emphasizes overlapping jurisdictions and shared authority.[93] Finally, the system must be built to facilitate the flow of information across government, these trans governmental networks "emphasiz[e] the nonhierarchical horizontal and vertical networks that are built among the officials … to exchange information, identify best practices, harmonize approaches, and enforce the overall policy program."[94] In many ways, the public health infrastructure meets most of the qualities of an adaptive system. The area where it falls short is its reliance on principles of stationarity and predictability. The public health system must overcome this significant barrier to be resilient. There are two ways that this reliance on stationarity and predictability manifest—in setting priorities and in ignoring the intensifier effect of climate disruption.

A. Setting Priorities

The current infrastructure has no mechanism to set priorities for resource allocation. The public health infrastructure is funded primarily through programs and contract funding from federal agencies. This model drives the priorities that these agencies focus on. Emphasizing climate change and its health effects as a problem that demands our attention will not work in this environment. It fits too neatly into a common model of public health practice of reacting to the newest or next severe public health threat. Keeping the same traditional

[89] Ruhl, *supra* note 84, at 1373-74.

[90] *See id.* at 1394-99.

[91] *Id.* at 1396.

[92] *Id.*

[93] *Id.* at 1398.

[94] *Id.* at 1399.

approach will only create an impetus to create another silo of funding and separate program area. If the public health system does not prioritize climate change issues and act boldly, it will be overwhelmed slowly by the intensification of the problem and its effects. The 2017 hurricane season, the California wildfires and Dengue Fever all demonstrate this point.[95]

The reliance on the dominant metaphor of the stream is also problem because it assumes and relies on an individual view of what constitutes health. It ignores the broader context in which public health operates. If the public health infrastructure relies on this metaphor that only focuses on intervention point, it cannot set priorities based on the condition being addressed. The upstream and downstream argument is one of scope of intervention. It details where and how one should intervene to address or obtain specific health outcomes in a population. It gives no analytic tool to understand or grapple with a general intensification of a health burden, and it relies on processes that don't demonstrate boundary conditions or thresholds, i.e. complex systems. The routine use of the definition of health by WHO will also prove difficult for setting priorities as the definition suggests a demand for health resources that is as varied and extensive as there are individuals in the population, "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."[96]

Widely used and based on adaptive management, the BRACE framework provides a system for management in addressing climate change but itself provides no clear guidance on how to set priorities. Yet, it argues that "BRACE enables systematic prioritization of adaptions for resource challenged public health agencies … Step 2 enables further narrowing of scope by providing future disease burden estimates that may help a public health agency choose what issues are of the highest priority for taking action."[97] Step 2 requires that the public

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[95] NAT'L OCEANIC AND ATMOSPHERIC ADMIN., NAT'L CENTERS FOR ENVTL. INFO., U.S. BILLION-DOLLAR WEATHER AND CLIMATE DISASTERS (2018), https://www.ncdc.noaa.gov/billions/.

[96] *See* WORLD HEALTH ORG., CONSTITUION OF WHO: PRINCIPLES.

[97] Marinucci et al., *supra* note 85 at 6437.

health agency project the disease burden.[98] The authors of BRACE focus almost entirely on the issue of data and modeling. While modeling is critical, it is also essential to establish a frame to interpret the results. The authors suggest stakeholder engagement and an analysis in Step 3 to assess the appropriate public health priority and intervention based on the social, political, cultural, and logistics environment serve as the frame.[99] Yet, the discussion focuses entirely on steps to adapt that preserve the same level of health for the population, i.e. there is no discussion of an altered and irreversible environment or the need to readjust health expectations. The authors do indicate that priority setting is a key issue in implement BRACE but provide no guidance to provide the truly transformational change that is required.[100]

B. The intensifier effect and relying on predictability

The BRACE adaptive planning model fails to address the underlying structure of the public health system and provides instead a proposal based on the current system. In their discussion of priority setting, the authors develop a model that focuses entirely on the direct effects of climate change, e.g. heat waves and sea level rise. The authors do not focus on the intensifier effects of climate change and the increasing burden of current health issues. Instead, the BRACE framework focuses on the development of adaptation plans that "aim to coordinate, highlight, and potentially instigate a series of activities aimed at preventing, or at least reducing, the anticipated impacts of climate change in the area."[101] This is the very definition of predictability and stationarity. The impacts are not preventable. Adaptation efforts must not focus on maintaining the status quo in the face of a changing environment.

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[98] *Id.*

[99] *Id.* at 6446.

[100] *Id.* at 6450.

[101] *Id.* at 6433-58.

IV. PUBLIC HEALTH AND THE ANTHROPOCENE

The Anthropocene provides a set of values and a framework to empower the public health infrastructure to live up to its potential in adapting to the demands of climate change. The current conceptual approach in public health emphasizes the individual and focuses on improving population health as an object of study. This approach, while it does include social and cultural factors, considers them as objects of study from the perspective of the social sciences. The scientific and conceptual framework of the Anthropocene can give public health a conceptual tool to see health linked more closely with climate change and to properly adapt to the changes in climate being caused by human activity. The Anthropocene can provide similar clarity for the health system. Embracing the concept of the Anthropocene is a means to address these issues and to embrace a value system that will enable the public health system to prepare for and adapt to the changes associated with climate change, both intensifier effects and new health challenges.

A. Anthropocene Defined

In 2000, two scientists, Paul Crutzen and Eugene Stoermer, suggested that we are living in a new geological period characterized by the transformations of the planet from human activity, which they deemed the Anthropocene.[102] While the concept has not been formally accepted the scientific community as an official geologic period, there is great pressure to recognize it as such.[103] In its most basic formulation, "the Anthropocene hypothesis suggests that the Earth is moving out of its current geological epoch and that human activity is largely responsible for this exit. Humankind has thus become a global geological

[102] P. Crutzen & E. Stoermer, *The Anthropocene*, 41 GLOBAL CHANGE NEWSL. 17–18 (2000). For a detailed discussion of the concept Anthropocene and its history,
See Will Steffen et al., *The Anthropocene: Conceptual and Historical Perspectives*
PHILOSOPHICAL TRANSACTIONS: MATHEMATICAL, PHYSICAL & ENGINEERING SCI. 369 842-67 (2011).

[103] MANUEL ARIAS-MALDANO, ENVIRONMENT AND SOCIETY: SOCIONATURAL RELATIONS IN THE ANTHROPOCENE (2015).

force in its own right."[104] There is significant evidence to support this reclassification and climate change is perhaps the most important implication of the Anthropocene. While the concept continues to be debated in geology and earth sciences, the debate has focused primarily on when the epoch should be classified as starting. The acknowledgement that human activity has the ability to change the planet has been important.

In the Anthropocene, social systems, and the environment are entangled.[105] Actions in one affect the other. These human-nature entangled systems exhibit several qualities. First, complex feedback loops are created in these systems.[106] A number of factors including governance structures have an effect on these feedback loops.[107] Human-environment interactions have been explored with flooding,[108] the economy,[109] and other systems. Second, these relationships are non-linear and exhibit thresholds, spatial and temporal.[110] This characteristic means that entangled social-environmental systems shift from one state to another state once a threshold is crossed. These shifts in states are not reversible, instead the system enters another state. These thresholds and shifts in state occur over time and over space. Third, these entanglements can lead to outcomes that surprise humans. Liu et al. give the example of a panda habitat in Wolong.[111] The habitat degraded faster after it was turned into a protected reserve and local residents were asked to help monitor illegal harvesting of the wood pandas eat.[112] Unexpectedly, the local residents had split their

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[104] *Id.*

[105] *Id.*

[106] Jianguo Liu et al., *Complexity of coupled human and natural systems*, 317 SCI. 1513 (2007).

[107] *Id.* at 1514.

[108] Giuliano Di Baldassarre et al., *Human-flood interactions in Rome over the past 150 years*, 9 ADVANCES IN GEOSCIENCES 44 (2017).

[109] Owen Kellie-Smith & Peter M. Cox, *Emergent dynamics of the climate–economy system in the Anthropocene,* 868 (Phil. Trans. R. Soc. A. 2011).

[110] *Id*. at 869-73.

[111] *See generally* Liu et al., *supra* note 106.

[112] *Id.* at 1514-15.

households into smaller units to take advantage of government subsidies for the program.[113] This increase in households led to an increase in harvesting of wood for fuel and accelerated the very degradation that it was meant to prevent.[114] Fourth, these entangled systems tend to demonstrate time lags between human activity and the result.[115] These delays can be decades to centuries. Fifth, the resilience of a system matters, and human intervention is key to maintaining it.[116] Finally, these entanglements are heterogeneous, "[h]uman-nature couplings vary across space, time, and organizational units."[117] What works in one time, location or space may work differently or not at all in another. This entanglement of human and natural systems; the social and the environmental has implications for public health and its foundational values. Specifically, human health cannot be considered separately from the environment. We must consider how choices about human health impact the environment; and how the environment impacts and shapes human health.

A current example of this entanglement can be found in South Africa. A drought since 2015 has drastically reduced the water supply for Cape Town. [118] The city, population 4,000,000,[119] is noted for its green policies and adaptation to climate change and has in place effective policies and tools to reduce water consumption.[120] Even in the face of growing population, the city was able to keep water demand flat.[121] This success may have contributed to the problem by giving the city a

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[113] *Id.* at 1515.

[114] *Id.* at 1516.

[115] *Id.*

[116] *Id.*

[117] *Id.*

[118] Aryn Baker, *What It's Like To Live Through Cape Town's Massive Water Crisis* TIME, http://time.com/cape-town-south-africa-water-crisis/.

[119] *Id.*

[120] Norimitsu Onishi & Somini Sengupta, *Dangerously Low on Water, Cape Town Now Faces 'Day Zero'* N.Y. TIMES (Jan. 30, 2018), https://www.nytimes.com/2018/01/30/world/africa/cape-town-day-zero.html?hp&action=click&pgtype=Homepage&clickSource=story-heading&module=second-column-region&region=top-news&WT.nav=top-news.

[121] *Id.*

false sense of security where no action was taken to find additional water or restrict growth in the city. Now the city is approaching "Zero Day" when then water supply to the city will be shut off and residents will be required to obtain their water from collection points around the city.[122] This solution itself will raise additional issues as it is estimated that up to 5,000 persons per day would congregate at water distribution points even if only a quarter of residents each family sent one representative.[123] Individuals are being allocated 25L of water per day requiring that a family of four transport 100L of water from a distribution point. [124] This process raises serious logistical concerns, law and order concerns, and sanitation concerns as water for sewer systems and toilets is restricted. Here, we see the entanglement as a consequence of social and governance choices, of not restricting growth or moving rapidly to find additional water sources. This coupled with an incremental strategy of adaption, might lead to exacerbations of health conditions.

Aside from its scientific implications, the Anthropocene has several conceptual implications that are critical for understanding the world we are in. These implications have been explored by scholars in philosophy, ethics, history, and political science. This acknowledgement that humans are a geological force has implications that will affect the way we think of ourselves and of human health. Climate change is not a problem that is going to be solved or fixed, "The Anthropocene may be said to constitute the geological translation of the idea that nature has, in a particular yet significant sense, ended."[125] It is a fundamental shift in our beliefs about what it means to be human. This is a fundamental shift in our thinking, not one problem among many that needs to be solved.

B. Values in the Anthropocene

These qualities of the Anthropocene also have moral and value implications. These implications for human life and systems come

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[122] *Id.*

[123] Baker, *supra* note 118.

[124] *Id.* (inferring the total amount allocated per family based on amount allotted to individuals).

[125] *Id.*

from some of the unique characteristics of living in the Anthropocene. These characteristics—geo-power, difficult regulations, complex moral questions, and stewardship—have implications for how humans will continue to define what it means to be healthy. *Geo-power* refers to the ability of individual actors to have impacts on the functioning of the earth's systems.[126] Di Paola compares building a well and collecting water to turning on a light switch, "in the first case only proximate resources are used, while in the second a while infrastructure of provision (that presides over the global procurement and distribution of energy) is activated."[127] In a world where this geo-power is common, each person's individual actions are translated through a complex system into real impacts on the earth's systems. The concept of geo-power also suggests that human activity and human political activity must be seen as embedded in, formed by, and responsive to the earth's systems in which they are embedded.[128] This level of geo-power and the complexity of our systems make the Anthropocene difficult to govern and to manage.[129] It also means that governance must include the geophysical. Sovereign states no longer have complete control over the impacts in their jurisdictions as actions in one area of the globe can be felt in another. This complex and highly diffuse system of interactions challenges our current systems of governance and management.

This distributed system also makes understanding our moral lives more complex. Ethical theories that rely on fixed and predictable consequences (consequentialism) and theories that rely on stability and strong theories of autonomy (deontology) are less up to the task to understand this new global environment that entangles human agency in larger systems with less predictability.[130] Finally, the Anthropocene presents us with the "homeopathic curse" that "the alleviation of the

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[126] Marcello Di Paola, *Virtues for the Anthropocene*, 24 ENVTL. VALUES 187 (2015).

[127] *Id.* at 187.

[128] Nigel Clark & Kathryn Yusoff, *Geosocial Formations and the Anthropocene*, 5 THEORY, CULTURE & SOC'Y 34 (2017).

[129] See *id.* at 5 ; BENSON & CRAIG, *supra* note 14, at 137.

[130] Di Paola, *supra* note 126, at 187; Jeremy J. Schmidt et al., *Ethics in the Anthropocene: A research agenda*, 3 ANTHROPOCENE REV. (2016).

global ecological quandaries that characterize the Anthropocene depends on us; at the same time, these quandaries are largely brought about by us."[131]

The complexity of the Anthropocene and its implications for understanding human-environment entanglement raises significant questions for ethics, politics, and law that are just now being explored. Dipesh Chakrabarty argues that human history and natural history are no longer distinguished;[132] the collapse of the distinction between human and geologic timescales threatens the human project of increasing freedom and globalization;[133] globalization must now grapple with its effect on the human species;[134] and the Anthropocene threatens our ability to apply historic understanding to imagine our future.[135] Benson and Craig, working in environmental law, provide another set of principles for governance that can support human flourishing in this period and address fundamental questions of equity. Those principles include a focus on resilience;[136] constant monitoring and study;[137] the reduction on non-climate change stresses;[138] long-term planning;[139] weight public rights and values in planning;[140] and embracing a principled flexibility in resource management.[141] They also point to a normative goal for this new era, "To build adaptive capacity within ecosystems and societies in order to adapt to climate change and associated stressors with the aim of promoting biodiversity and ecological function and, where necessary, of guiding chosen trajectories

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[131] Di Paola, *supra* note 126, at 197.

[132] Dipesh Chakrabarty, *The Climate of History: Four Theses*, 35 CRITICAL INQUIRY 201 (2009).

[133] *Id.* at 207-12.

[134] *Id.* at 213.

[135] *Id.* at 220.

[136] BENSON & CRAIG, *supra* note 14, at 137.

[137] *Id.*

[138] *Id.*

[139] *Id.*

[140] *Id.*

[141] *Id.* at 180

for [social-ecological system] transformation."[142] Arias-Maldonado, summarizing work in this area suggests there are four possible values implied by the Anthropocene: frugality, restraint, enlightenment, and boldness.[143] The value of frugality argues that in the face of unsustainable growth and the disruption of the environment so that it no longer supports human life humans must change their values around consumption.[144] The likelihood of thresholds, irreversibility, and lags between actions and results urge restraint as a value. If humans are both the cause and solution to the quandary of the Anthropocene, then there must be a call for a new "Anthropogenic Enlightenment" for humans to explore new ways of living in the world.[145] Those who take the perspective of boldness, argue that the Anthropocene, rather than suggesting frugality or restraint calls for bold technological and scientific action to "make liberal society and the Anthropocene technically compatible."[146] Schmidt et al. propose a research agenda for the Anthropocene that examines normative claims "posed by calls for substantially enhanced planetary stewardship"; identifies ethical issues raised by the Anthropocene; and reevaluates traditional areas of ethics such as environmental ethics.[147]

C. Reexamining Human Health

The projected impacts of climate change on human societies make it clear that the health needs of populations will rapidly outstrip resources if action is not taken to adapt the system. These projections also suggest that not all levels of health as currently understood can be preserved; adapting to preserve the current level of public healthy may be expensive; and these adaptations may themselves have negative effects on long-term public health. Current definitions of health employed by public health focus on definitions of health from the

[142] *Id.* at 168.

[143] ARIAS-MALDANO, *supra* note 103, at 87-88.

[144] *Id.* at 86.

[145] *Id.* at 87.

[146] *Id.* at 88.

[147] Schmidt et al., *supra* note 130, at 190.

perspective of the individual. Whether it is the WHO definition or the IOM definition, each is built around the concept of individual health. What makes an individual healthy and the concepts of health and disease are contested.[148] The problem in the United States is that these definitions, rooted in the perspective of the individual, are easily compatible with the dominant paradigm in the United States, justice. This paradigm rooted in a liberal vision of the world with an emphasis on individual autonomy and freedom will be incompatible with life in the Anthropocene. Whether we assume the definition of health to be that of the WHO, fulfilling the totality of an individual's desire, or a more limited *minimum* version. In the case of life in the Anthropocene, both the minimum and maximum definitions of health are unsustainable in the face of the predicted intensification of health burdens and increased frequency of extreme events. This increasing burden will raise the cost of obtaining health regardless of the definition of health. Further, if the disruptions related to climate increase health burden, the minimum and maximum will also continue to increase in order to compensate for the overall degradation of health. Also unexplored in current definitions of health are the contributions of health to climate change. In the United States, emissions from the health care sector represent almost 10% of total emissions in the United States.[149] These health impacts of providing care are not limited to GHG emission but also include smog, ocean acidification, and the release of toxic chemicals in the environment.[150] How can the health infrastructure think about health when the provision of health services may worsen the environment. What is needed is an exploration of human health that can respond to adapt for the Anthropocene. There are two approaches in public health and public health law that might provide a pathway for a solution. The first is public health as a form of governance. Second, and related, is the ethical concept of *solidarity.*

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[148] *E.g.,* M. Lemoine, *Defining disease beyond conceptual analysis: an analysis of conceptual analysis in philosophy of medicine* 34 THEORY (2018).

[149] M. J. Eckelman & J. Sherman, *Environmental Impacts of the U.S. Health Care System and Effects on Public Health*, 11 PLOS ONE 3 (2018).

[150] *Id.*

D. Governance

The Anthropocene if anything brings to the fore the impact of human systems and human action on biophysical systems. These impacts working in both ways can be mediated. That mediation occurs through governance.[151] Governance is a key factor for managing the relationships between human activity and the environment. Benson and Kundis Craig have made this argument powerfully and demonstrated how the Anthropocene can be a framework for environmental governance in their recent book *The End of Sustainability*. Health as a concept can be viewed as a function of effective governance rather than particularly an attribute of an individual. Health as governance also supports a democratic polity that provides a framework to debate and to understand the implications of the Anthropocene and our role in it.[152]

Embracing the Anthropocene and its implications can support a transformation in public health governance, one that is rooted in the traditions and theoretical foundations of the public health and that can focus on important issues of health equity. As Craig and Benson have suggested, "The Anthropocene now demands that we think in terms of how to preserve and enhance social equity in the midst of significant change, rather than by shifting priorities and resources within a position of significant stability."[153] Benson and Craig argue that this normative shift can be accomplished by a turning to communitarian philosophy that reminds us that "individuals can thrive only within broader community structures and networks."[154] Remarkably, this does not require a lot of new theoretical work. It simply requires that public health and public health law and policy explore other theoretical foundations and emphasize health as a dimension of governance, not services. In the field of public health, Nancy Krieger has been a powerful critic of the upstream and downstream framework that

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[151] Matthew J. Kotchen & Oran R. Young, *Meeting the challenges of the anthropocene: Towards a science of coupled human–biophysical systems*, 17 GLOBAL ENVTL. CHANGE-HUMAN AND POL'Y DIMENSIONS 150 (2007).

[152] BENSON & CRAIG, *supra* note 14, at 71.

[153] *Id.* at 76.

[154] *Id.* at 237.

dominates today. She has proposed an approach that takes a larger conceptual view of public health and the place of the person as embodied in a social and political system.[155] Dorothy Porter, a scholar in the history of public health has focused on the history of public health as a function of governance and state power.[156] In the field of public health law, Wendy Parmet has argued forcefully for the foundation of public health law and justification of public health in concepts of democratic governance.[157] She refers to this as the population perspective.

This is none other than the statement for the justification of public health action as good government.[158] This is a foundational argument and justification for state action that has a long history in US law.[159] Benson and Craig argue that this doctrine may often be at odds with the individualistic focus of the US legal system.[160] There are strong examples though where this is not the case and the needs of population health have been balanced against the rights of individuals.[161] Returning to this population perspective of health as a dimension of governance over and individual one will enable the public health system to meet the challenges of climate change.

Defining health as a function of governance also requires further elaboration to understand what the implications of such a definition might be for the individual. While we should not and cannot base concepts of health on individual desires alone, those desires and beliefs form part of the value system that animates the health infrastructure. The Anthropocene calls for us to interrogate our values[162] and to consider new values for the human community moving forward. In terms

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[155] Krieger, *supra* note 38.

[156] DOROTHY PORTER, HEALTH, CIVILIZATION, AND THE STATE : A HISTORY OF PUBLIC HEALTH FROM ANCIENT TO MODERN TIMES (1999).

[157] WENDY E. PARMET, POPULATIONS, PUBLIC HEALTH, AND THE LAW (2009).

[158] *See generally id. See* also GOSTIN & WILEY, *supra* note 33 (discussing public health and the population perspective).

[159] Wendy E. Parmet & Jason Smith, *Free Speech and Public Health: Unraveling the Commercial-Professional Speech Paradox*, 78 OHIO L. REV. 4, 887-915, 906 (2017).

[160] BENSON & CRAIG, *supra* note 14, at 138.

[161] *See generally* Parmet & Smith, supra note 159.

[162] *See* discussion *supra.*

of the distribution and allocation of resources and burdens around health care, recent work on solidarity can provide a unique path forward.

E. Solidarity

Solidarity as an ethical principle has been the subject of renewed interest in bioethics and also of interest in confronting the implications of the Anthropocene. Solidarity as a principle emphasizes mutual obligations and relationships among individuals and some level of social cohesion. Prainsack and Buyx provide a basic definition of solidarity that can apply to most uses of the concept,

In our understanding, and in its most bare-bone form, solidarity signifies *shared practices reflecting a collective commitment to carry 'costs' (financial, social, emotional, or otherwise) to assist others.* It is important to note that solidarity is understood here as a *practice* and not as an inner sentiment or an abstract value. As such, it requires actions – motivations, feelings such as empathy etc. are not sufficient to satisfy this understanding of solidarity, unless they manifest themselves in acts. The term 'costs', here, is understood to mean a wide range of contributions in terms of time, effort and emotional investments, or money, that groups or individuals make to assist others.[163]

As a concept it can be applied both to individual relationships and desires and is usually formulated as *reflexive solidarity* that emphasizes the relationships between individuals and the development of personal values and identity.[164] Solidarity can also be applied to analyze issues of justice.[165] Given that it focuses on relationships and cohesion and can be applied across multiple levels of social interaction, it is particularly suited to begin a conversation about the proper definition of human health and its implications to for individuals, communities, and for governance.[166]

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[163] BARBARA PRAINSACK ET AL., *SOLIDARITY IN CONTEMPORARY BIOETHICS– TOWARDS A NEW APPROACH*, 26 BIOETHICS 346 (2018).

[164] R. ter Meulen, *Solidarity*, *in* ENCYCLOPEDIA OF THE ANTHROPOCENE 113 (2018).

[165] *Id.* at 114.

[166] *Cf.* PRAINSACK ET AL., *supra* note 163 at 346 (discussing the levels and types of solidarity by application).

Focusing on redefining health and our values associated with health through principles of solidarity will allow us to move toward a definition of public health that focuses on health in its dimensions as a part of effective governance. This reframing will give policy makers, practitioner, and theorists in public health the tools to link the geological and environmental implications of the Anthropocene to the practice of public health.

F. Geo-Determinants: The Stream is Flooded

The Anthropocene demands that we fund public health more generally and over the long term. I believe the focus of public health attention to the metaphor of the stream is myopic. It focuses attention only on the level of intervention and almost exclusively has been focused on upstream social determinants. Even this focus has been, for the most part, uni-directional, seeking to understand the impact of social systems on human health. As public health practitioners have debated issues of intervention, little attention has focused on how the public health infrastructure identifies the most important public health threats and problems to focus on. The model also fails to incorporate issues of geo-power into conceptions of health determinants. If we are in an era of entanglement between humans and the environment, then we must embrace the implications of that entanglement in our funding and governance models. This means we must have the patience to wait and to focus on restraint, to see where the demand will come and be prepared to prioritize our resources. If the public health infrastructure continues to focus only on the newest, most severe, or politically expedient threat to population health, it will fail to notice, relying on the metaphor of the stream, that the water has continued to rise and the stream has been replaced by a lake and then by a sea.

The public health system must also work on the problem of access to basic health care services and what those services are. Rather than a focus on health from the individual perspective, the public health system must focus more on a systems perspective and building a resilient health care system. The focus on individual health and communities as aggregations of individuals simply exacerbates in individualist approach to the problem and feeds the public health system's problem of

the "tyranny of the urgent."[167] If the public health system remains the business of providing clinical services, it will be in no position to address the rising pressures and demand on services.

Before the public health system can meaningfully adapt and prepare to face the challenges of climate change and its effects on human health, policy makers and public health practitioners must make meaningful choices and adopt a framework for public health law and policy that embraces the realities of the Anthropocene. This means that there must be a radical change in vision and values. This change in policy values must embrace the dynamism of the Anthropocene and abandon approaches rooted in predictability and stationarity.

Approaching climate change and adaptation without interrogating our deeply held values is a problem and risks maintaining the status quo.[168] The Anthropocene and its challenges call us to evaluate our values in public health and the values we hold in defining health itself. It may not be possible to address the challenges that face public health without scrutiny of our fundamental values. In our need to address the challenges of the Anthropocene, we must be willing to see the importance of not only preparing for climate-related disruptions but also to redefine our expectations and choices about human health. If we want to design or adapt the public health infrastructure for climate change, we must ask the questions: What kind of health is it trying to protect? What is the public health system trying to do?

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[167] Gould et al., *supra* note 58, at 15656.

[168] *See generally,* N. Castree et al., *Changing the intellectual climate*, 4 NATURE CLIMATE CHANGE 763 (2014).