12 *SDG13, climate action: health systems as stakeholders and implementors in climate policy change*

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12.1 Introduction

In August 2021 and March 2023, the Intergovernmental Panel on Climate Change (IPCC) starkly outlined humanity's inflection point with climate change: we must act now or face severe and irreversible consequences resulting from global warming driven by human emissions. Climate events directly threaten human health across a broad spectrum of issues – communicable diseases, heat events and natural disasters – which all present acute and chronic threats to human morbidity and mortality. Climate Action is one of the United Nation's Sustainable Development Goals. Yet despite calls for action, global governments have broadly not taken consequential change to reduce carbon outputs and mitigate warming. Our chapter argues that a primary cause of this inaction is political conflict and policy capacity. Without strong economic incentives and facing constrained resources, governments may opt to proceed with the status quo. Here, health systems present a critical resource to engage nations in climate action. Health systems produce political leverage as major political stakeholders across nations, globally, for *engaging* in broader climate policy and a wealth of resources inherent to health systems – expertise, funding – to directly *implement* climate policy.

The case study of the city of Toronto in Canada offers lessons for directly involving health systems in subnational climate action as policy stakeholders and implementors, and the co-benefits health system engagement brings to promote climate action intersectorally. Toronto provides an important case for high-latitude countries that will soon be facing climate hazards tropical nations have been grappling with for centuries. Engaging health systems in climate action policy processes may improve the likelihood of success for strengthening resilience and adaptivity to climate-related hazards.

12.2 What is SDG13 and how can health policy contribute?

Planetary health is inextricably related to human health. Anthropogenic climate change has been measurable since approximately 1900 CE (Crowley, 2000). The measurable effects of climate change increased substantially over the past two decades and will continue to accelerate in the future. We see these changes visibly in the increased frequency of natural and co-occurring natural and human-made disasters, adverse weather events including heat waves, sea level rise, and possibly the most salient, communicable disease transmission. The increase in individual events and their overlap necessitate immediate action to protect the health of the planet *and* the health of humans. This chapter outlines the unique position of health systems as 1) primary economic and political stakeholders in climate change policymaking and 2) essential actors in mitigating the adverse effects of climate change on human health. In both ways, health systems are vital actors in "strengthening resilience and adaptivity to climate related hazards and natural disasters" (SDG13 UN) related to anthropogenic climate change.

Health systems are primary parts of the economy and the political arena across all nations. In OECD nations, health accounts for a large part of government spending (OECD, 2019). While this amount varies across countries, health care systems across OECD countries account for a substantial proportion of social spending (OECD, 2019, 11). In some nations, health accounts for the greatest proportion of government spending on social programmes (for example, the United States). Spending on health systems in OECD nations will very likely increase in coming decades as population growth slows and citizens *age* substantially, necessitating increased health spending (OECD, 2021). Low-income countries will see increased need for spending on health systems as health risks increase with climate change (UNFCC, 2018).

While spending does not always translate directly to political engagement, health care sectors are major political stakeholders in OECD nations. High degrees of political leverage were engendered from long histories of policy engagement due to the professionalism of medicine and science (Best, 2019; Starr, 1982; Strach, 2015). Sustained political leverage for health systems also arises from the ways in which social policy systems have most often been structured around *health care*, as opposed to welfare, in OECD nations (Lynch & Perera, 2017; Starr, 1982; Tuohy, 2018). This centring of health care as opposed to social policy persists across OECD nations, even among lower-income OECD nations, where health systems may have sustained political leverage, even if publicly funded bureaucratic counterparts do not.

Health systems are also major contributors to climate change. For example, emissions from the US health care sector are among the highest (in absolute and per capita terms) of any health care system in the world, accounting for 8.5% of total greenhouse gas emissions nationwide in 2018 (Karliner et al., 2019; Medical Society Consortium on Climate and Health, 2021, 9; Pichler et al., 2019). Health care systems also exert substantial influence as consumers in general and are primary consumers for a number of specific industries. Examples include pharmaceutical manufacturing, which accounts for up to 10% of total greenhouse gas emissions in the United States (Belkhir & Elmeligi, 2019), and medical disposables (Campion et al., 2015), which can produce more carbon by up to a factor of ten than non-disposable alternatives (McGain et al., 2010; McPherson et al., 2019; Sherman et al., 2018). Per unit carbon emissions vary across pharmaceutical manufacturers (Belkhir & Elmeligi, 2019), implying that consumer choice by health care systems, or broad regulatory reforms, can lead to industry-wide improvements in emissions. In addition to consumption practices, simple, low-cost modifications to standard operating procedures can lead to significant energy and carbon savings. Surgical procedures in particular can be carbon intensive (MacNeill, Lillywhite & Brown, 2017). Much like pharmaceutical manufacturing, the carbon impact of different surgical approaches varies, implying potential for industry-wide improvement (Sherman et al., 2012).

Health systems can engage as leaders in reducing their outputs to mitigate climate change and have a direct interest in doing so to *reduce the adverse health effects of climate change*. Health systems around the globe will be a first line of defence for humans against the short- and long-term adverse health outcomes arising from climate change. Engaging health systems as key stakeholders in climate action policy processes upstream and downstream may improve the likelihood of success for strengthening resilience and adaptivity to climate-related hazards and natural disasters.

12.3 Causal pathways between health systems, climate change health action and co-benefits

Climate change is inextricably related to health outcomes. Health systems, as *upstream key stakeholders* in the political arena of most countries and *downstream responders*, or implementors to short- and long-term adverse health effects of climate change, are essential actors in achieving SDG13 climate change goals (see Fig. 12.1). The actions health systems take will likely produce co-benefits to other sectors through policy diffusion to produce intersectoral action in climate policy across other sectors, or direct climate mitigation benefits through internal health system changes.

12.3.1 Responding to upstream climate change: health systems as critical economic and political stakeholders in driving support for climate change policy

By virtue of the large proportion of political debates across OECD nations centred around health care and the economic prowess of health systems *themselves*, health systems are critical climate policy actors with the ability to shape agenda setting, influence political decisionmaking, and implement policies on the ground. Health systems can lead in climate policy debates and initiate policy change in other sectors and communities. Too long have health care and public health remained siloed from environmental health and climate concerns. Health systems are in a unique position to shift this notion and adopt a One-Health approach to climate action.

Many countries around the world are taking action to mitigate and prepare for climate change. Yet many more countries remain held back by various political factors contingent upon perceived benefits of engaging in climate change policy and institutional arrangements that may make policy action more or less viable. Agenda setting refers to whether or not topics become available to be considered for policy action (Kingdon, 1990; Schneider & Ingram, 1993; Stone, 1989). In countries where climate change is highly controversial, at the national or subnational level, *engaging health systems as critical political players* or stakeholders may improve the likelihood that climate policy is considered as a part of the political agenda in a jurisdiction (Stokes, 2020).

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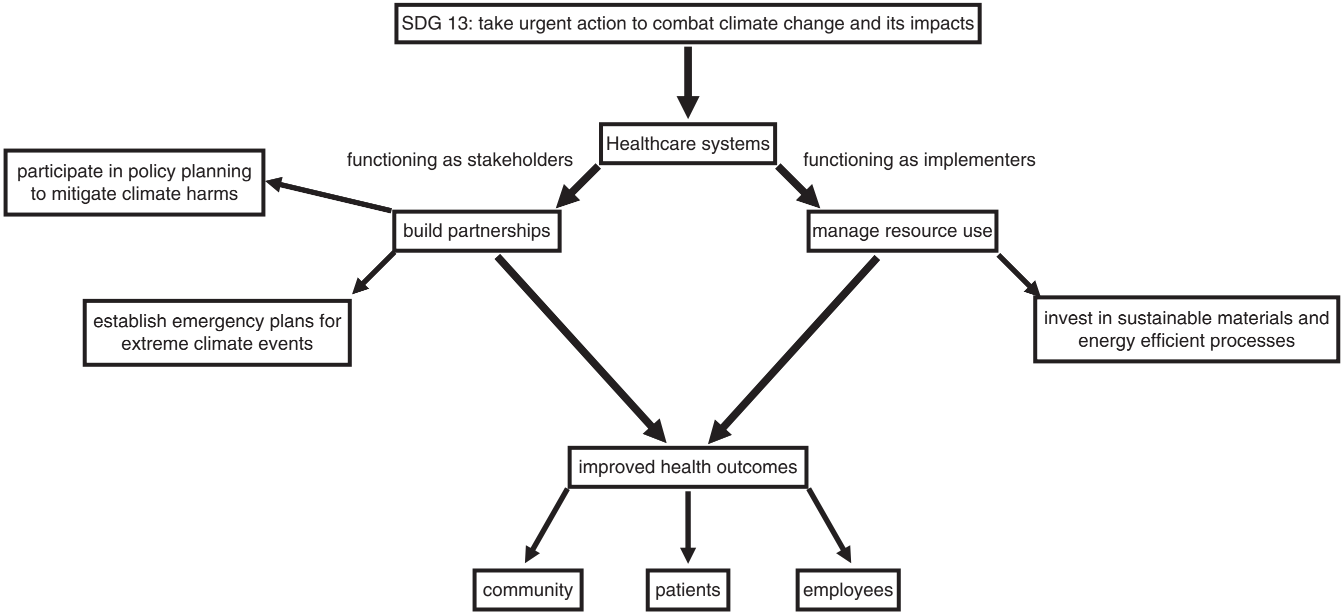

Fig. 12.1 Co-benefits for climate change through health system actions

Policy decisionmaking refers to the process by which political decisions are made that influence what policy outcomes, or formal or informal governmental actions on a specific topic, are generated or not. Policy decisionmaking is also influenced by a variety of complex factors. One critically important factor is the role of stakeholder groups. Stakeholder groups with stronger economic positions and coalitions of actors – large groups of well organized actors, such as professional organizations – wield more influence in political decisionmaking (Eaton & Weir, 2015). Health care systems across OECD nations persist as strong stakeholder coalitions because of their firm foothold in governmental spending valuing health care over other types of social policy, and economic power in privatized health systems (Beland & Waddan, 2012; Fox, 2016; Hacker et al., 2004; Kingdon, 1990; Starr, 1982; Tuohy, 2018). Once climate policy is on the agenda, organized mobilization by health systems may positively influence the likelihood of tipping national and subnational governments in favour of climate action, producing climate action co-benefits across jurisdictions.

Finally, health systems have crucial roles to play in policy implementation. Health system engagement in climate policy implementation may not only help speed implementation once policy has been generated but also help *initiate* policy action through diffusion. Policy diffusion is defined as occurring when one government's decision about whether to adopt a policy innovation is influenced by the choices made by other governments (Graham, Shipan & Volden, 2013, 675). Health systems, as key public or private stakeholders heavily involved in political decisionmaking across nations, have the ability to influence policy diffusion by acting as early adopters in climate change policy, while continuing to advocate for societal transition to renewable energy (Karliner et al., 2019, 36). Extensive co-benefits are produced when health systems engage in climate policy implementation across sectors, strengthening overall resilience and adaptivity (United Nations, 2021). Examples of climate policy implementation actions are outlined in the next section.

Policy diffusion is especially important in federated systems, where subnational governments may have varying degrees of adoption or movement towards climate policy. Yet policy diffusion can also happen intersectorally and internationally. Here, climate policy adaptation by health systems as primary components of a state may increase the likelihood of adoption of climate mitigation strategies by other state sectors (infrastructure, housing, education) or by other peer-countries (Bernauer, 2013, 437). There is much evidence to support policy diffusion as a mechanism for innovative or evidence-based health policies (Adolph et al., 2020; Grogan, Jones & Pacheco, 2017; Shipan & Volden, 2008; Tarr, 2001), and a growing body of evidence to support policy diffusion as a mechanism for environmental policies (Bromley-Trujillo et al., 2016). Health systems may help bridge the gap to facilitate policy diffusion across sectors. Health systems engaging in housing policy investments in the United States or lobbying for social spending in European nations (Lynch, 2019), are notable examples.

12.3.2 Responding to downstream climate effects on health: health systems as essential actors in responding to and mitigating adverse effects of climate change in the short and long term

The IPCC identifies major greenhouse gas emitting sectors as transport, buildings, industry, electricity, and land use practices, including agriculture and forestry. According to the COP21 glossary, decarbonization refers to the goal of energy-consuming processes producing no net (uncaptured) CO_2. As major consumers of energy and custodians of large building complexes, health care systems may be most directly positioned to influence those sectors toward decarbonization through the policy channels outlined above. In addition to upstream policy activities aimed at major and more formalized regulatory or legislative climate policy interventions, health care systems can act as policy implementors by taking immediate action within their own systems. Within-system changes may be particularly valuable in high-conflict contexts, which will be discussed shortly.

Downstream, direct actions taken by health care systems directly address a variety of climate-related health effects, while producing many intersectoral co-benefits. For example, health care systems can influence industry by setting low-carbon standards for their consumables, which account for 71% of the sector's emissions (Karliner et al., 2019, 5). Specific steps that health care systems could advocate for include investing in greener building materials for new construction or retrofitting old buildings to reduce carbon consumption for indoor climate control (Karliner et al., 2019). Additional benefits can be realized through investment in carbon-capturing green infrastructure, including living roofs and walls (Coutts & Hahn, 2015). Green buildings and open spaces provide important co-benefits particularly in the urban context, increasing the effectiveness and value of local ecosystem services such as runoff management (He et al., 2019) and capturing airborne particulate matter (Coutts & Hahn, 2015). Health outcomes and the importance of health care systems have historically been absent from the policy discussion around ecosystems services (Ford, Graham & White, 2015; Sandifer, Sutton-Grier & Ward, 2015). Health systems engaging in this area of policy could expand and improve the economic valuation of the quantifiable benefits (ecosystem services) provided by natural systems for human health as well as climate mitigation (de Groot et al., 2010; van Riper et al., 2017).

In addition to longer-term decarbonization investment, climate change is driving acute but unpredictable adverse events that are placing, and will continue to place, strong demands on health care systems. Health care systems are ideally situated to initiate or support policies designed to mitigate and manage the impacts of these events. Heat waves and emerging infectious diseases are classic examples of acute climate-driven hazards with unpredictable onset times that require management through policy. Natural disasters, such as hurricanes and wildfires, are described in more detail in the supplemental case study (Appendix 1). We describe the health threats posed by each category of event (heat waves and infectious diseases); discuss mitigation and planning strategies that would benefit from health system involvement; and demonstrate potential co-benefits emerging from action on these threats.

12.3.3 Heat waves

Climate change is predicted to drive longer, more intense, and more frequent heat waves, particularly in temperate regions that are not equipped to manage extreme heat (Arnell, Lowe & Challinor, 2019; Meehl & Tebaldi, 2004). Heat waves are defined as "a period of abnormally hot weather lasting longer than two days" by the United States National Weather Service. Heat waves increase morbidity and mortality, particularly in young children and the elderly (Haines et al., 2006; Herrmann & Sauerborn, 2018; Knowlton et al., 2009; O'Neill & Ebi, 2009). Exposure to chronic heat stress can lead to cardiovascular illness, chronic kidney disease, and mental health impacts (Kjellstrom et al., 2009; O'Neill & Ebi, 2009; Xiang et al., 2014). Manual labourers, including those who work outdoors such as farmers and construction workers, and those who may work with process-generated heat, such as factory workers and food service workers, are particularly at risk of negative impacts due to occupational exposure (Venugopal et al., 2020; Xiang et al., 2014).

12.3.4 Heat waves: the role of health systems and evidence-based actions

Health systems can work to mitigate the health impacts of heat waves in several specific ways. First, building green buildings and modifying open spaces to include tree cover can help mitigate the impacts of heat waves in buildings and in neighbouring areas, respectively (Aflaki et al., 2017; Onishi et al., 2010). In addition to saving cooling costs and the carbon emissions that come with air conditioning (Wong et al., 2003), these steps can help to buffer patients from indoor temperature swings, and will minimize impacts on particularly at-risk groups of employees such as food service workers and construction workers employed by health systems (Xiang et al., 2014). Higher vegetation cover at the neighbourhood scale (between 300m and 1km) can be correlated with improved health outcomes across a variety of measures, when neighbourhood and personal socioeconomic status are controlled for (Becker et al., 2019; Jenerette et al., 2016; Maas et al., 2009), indicating that investment in tree cover around health care facilities could benefit the surrounding neighbourhood as well as the specific buildings. Health systems can also participate in planning for heat waves. Many municipalities lack heat-wave response plans (Bernard & McGeehin, 2004). Health systems are well placed to raise awareness of the health impacts of heat waves, which may be less visible than those of other weather-related disasters. In addition, health systems have the expertise to help local governments develop plans for heat-wave response.

12.3.5 Emerging and migrating communicable diseases

Climate change is predicted to cause shifts in the ranges of many diseases currently restricted to warmer areas (Ciota & Keyel, 2019; Tesla et al., 2018) and to alter the relative prevalence and severity of pathogens throughout their ranges (Mordecai et al., 2020). High-latitude nations currently focused on chronic disease treatment will need to adapt their models of care to address emerging communicable diseases and should learn lessons from warm climate nations (Kavanagh & Singh, 2020).

Due to increasing temperatures, mosquito vectors of infectious disease are expanding their ranges toward the poles (Bartlow et al., 2019; Carvalho et al., 2015), as are parasites (York et al., 2015) and pathogens (Gonzalez et al., 2010; Maroli et al., 2008). From the perspective of any given location, the climate-driven shift in disease prevalence is unlikely to be predictable or orderly (Ciota & Keyel, 2019). At local levels, small differences in temperature microclimate can drive large differences in disease risk, particularly in vector-borne pathogens such as malaria, dengue or zika virus (Wimberly et al., 2020). Health systems will naturally be at the forefront of coping with emerging or migrating infectious diseases as they occur, but they can also play a role in preparing governments to cope with future threats.

12.3.6 Emerging and migrating communicable diseases: the role of health systems and evidence-based actions

Health systems can prepare for unpredictable and novel disease surges by planning for emerging epidemic diseases following procedures used to prepare for natural disasters. In addition to preparing for novel diseases, using green infrastructure in hospital grounds will reduce the local temperature and therefore the likelihood of an on-grounds disease outbreak. Incidence of viral diseases can track local temperature microclimates at the spatial scale of city blocks, with hotter neighbourhoods experiencing higher disease incidence (Wimberly et al., 2020), although socioeconomic status can be confounded with high local temperatures (Santos et al., 2020; Telle et al., 2021). Reducing local heat island effects could therefore mitigate the risk of a local outbreak.

Urban greening can also produce benefits for infectious disease management through a variety of mechanisms beyond reduction in local temperature. Vegetation increases surface permeability across cities, thereby slowing down runoff (He et al., 2019; Li et al., 2018; Mentens, Raes & Hermy, 2006). Slowing or reducing runoff volumes decreases the risk of runoff being contaminated with untreated sewage and other potentially dangerous substances (Zhang et al., 2015). Urban runoff often contains high concentrations of human-associated pathogens (Colford et al., 2012; Mallin & McIver, 2012), as well as pharmaceuticals, including antibiotics (Almakki et al., 2019). This combination can lead to the evolution of antibiotic resistance in potentially pathogenic bacteria strains (Almakki et al., 2019). Urban runoff can impact humans through direct contact and by contaminating agricultural systems and impacting food chains (Gillis, 2012). Health care buildings concentrate both pharmaceuticals and potential pathogens, making runoff management a high priority for the built environment of health care facilities (Devarajan et al., 2016; Kilunga et al., 2016; Laffite et al., 2016).

12.4 Governance and politics: conceptual issues

As discussed above, health systems bring an enormous amount of value to the table in their 1) upstream ability to promote climate change policy investments and 2) downstream, direct involvement in climate change mitigation through health and climate co-benefits, both short term and long term. Yet, while health systems have such substantial potential, the essential question persists: how do we attain these benefits? To answer this question, we must ask: 1) how do we actually *engage* health systems in climate change policy processes and 2) once health systems are on board, how do we mitigate conflict and constraints from other actors and systems to successfully promote climate change policy? To answer both questions, it is useful to think about: the degrees of conflict involved in climate policy discourse across governance systems; institutional constraints; and investments in health care systems.

Despite overwhelming and indisputable evidence of the reality of anthropogenic climate change from around the world, climate change is a policy space that still evokes high levels of *conflict* (see Table 12.1).

Table 12.1 *Health systems' potential to promote climate change policy*

		Conflict	
		High	**Low**
Political importance	High	Health systems engage in bureaucratic decisionmaking, implementors in low-conflict jurisdictions	Health systems agenda setting, decisionmaking and implementation for policy diffusion
	Low	Health systems implementors in low-conflict jurisdictions	Health systems agenda setting, engage as implementors for policy diffusion

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High levels of conflict arise in this policy space as a result of the threat (real and perceived) to existing economies and entrenched systems (Stokes, 2020; Stone, 1989). Thus, even when nations may place high degrees of political importance on addressing climate change, it may be met with substantial policy conflict arising from entrenched actors or coalitions, political parties, and the public (see Table 12.1) (Ansolabehere & Konisky, 2014; Peluso, Kearney & Lester, 2020). Coalitions and political parties centring opposition to climate policy starkly oppose climate interventions to protect status quo political economies they rely on (for example, fossil fuel industries and political parties with primary coalitions tied to these industries).

Institutional constraints interact with policy conflict. Institutional constraints refer to governance arrangements that make policy action more, or less, difficult at different levels (subnational vs. national) by placing different restrictions or checks on actors across multiple levels. Institutional constraints act as important accountability mechanisms and checks on power but may also inadvertently create barriers to policy action through fragmented systems and by gatekeeping political participation (see Tables 12.1 and 12.2). For example, highly fragmented and decentralized governance systems, such as in the United States, may necessitate more subnational action across policy mechanisms (agenda setting, decisionmaking and implementation) even in cases of high political importance and low policy conflict. Country context is very important in discerning institutional constraints that may impede or promote policy action and potential co-benefits (see Tables 12.1 and 12.2).

Table 12.2 *Potential to engage health systems in climate change policy*

		Stakeholder capacity	
		High	**Low**
Bureaucratic capacity	High	Health systems agenda setting, decisionmaking and implementation for policy diffusion	Health systems implementation for policy diffusion; localized or subnational decisionmaking
	Low	Health systems agenda setting	Health system engagement challenging

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When seeking to engage health systems in climate change policy, the capacity of health systems and their capabilities or visibility as prominent stakeholders in a country context need to be considered (Gailmard & Patty, 2007). While health systems may be aware of the intractable relationships between climate change and health, both their bureaucratic and stakeholder capacity will likely determine health systems' ability to engage in policymaking and the potential for that engagement to be successful (see Table 12.2). Health systems' capacity or bureaucratic capacity refers to resource investments in health systems such as knowledge or expertise and resources to carry out expert recommendations (funding and staffing). For example, do health systems in a nation or jurisdiction have sufficient funding to make investments in decarbonization, ecosystem services, or disaster planning and mitigation?

Do health systems in a nation or jurisdiction have the expertise (internal and/or scientific and public health expertise through intersectoral co-benefits) to make systems investments through policy implementation or advocate on behalf of climate change policy through agenda setting and decisionmaking? Stakeholder capacity is related to bureaucratic capacity but refers to the degree to which health systems are considered prominent political actors or stakeholders in a country context. OECD nations, which invest substantial amounts of GDP in health systems, are likely to perceive health systems as high-capacity stakeholders, even if there is variation in subnational bureaucratic capacity of health systems (see Table 12.2). Low-income countries may see different arrangements regarding health system engagement in climate change policy dependent on policy context (see Table 12.2). For example, while having lower traditional measures of bureaucratic capacity for health systems in terms of spending and expertise, many low-income countries have very high levels of *bureaucratic expertise* in health systems specific to *infectious diseases*. Here, intersectoral action produces co-benefits between health systems' engagement with public health to generate high levels of policy mobilization in agenda setting and decisionmaking regarding communicable diseases and climate change, as seen in the COVID-19 pandemic (Kavanagh & Singh, 2020). Higher levels of bureaucratic capacity broadly or in specific policy spaces related to climate change, paired with higher levels of stakeholder capacity, may make health systems more likely to be engaged or become engaged in upstream climate change policy processes.

12.5 Case study: Toronto heat islands

12.5.1 Toronto as a case of health system solutions to climate-exacerbated heat islands

The case of solutions to climate-exacerbated urban heat islands (UHI) in the city of Toronto, Canada, acts as an exemplar case study of how health systems may act as policy implementors, driving action for policy diffusion in governmental climate debates. Toronto is a case of health systems policy engagement upstream *and* in policy implementation, producing co-benefits across sectors in climate change policy development.

Toronto is an ideal case for many reasons that may make it generalizable to other subnational and municipal governments around the globe. Toronto is a major, international city, comparable to other major metropolitan cities in OECD nations (City of Toronto, 2021). Major, global municipalities not only are primary *sites* of adverse effects of climate change including flooding and urban heat effects but also are experiencing increasing waves of growth and immigration. As major international city centres expand, municipalities like Toronto face domestic and international pressure to address these adverse effects, while also often having the ideology, wealth and intergovernmental transfers to do so (Sellers, 2002). Canada, like many OECD nations, is a Westminster system, with strong federated governance promulgating discretion in many policy spaces to subnational, here provincial, governments. In Canada, this federated arrangement plays a key role in the nation's national health system where the primary payer is the federal government, yet provinces have high degrees of autonomy on health care system delivery (Tuohy, 2018).

Heat islands are an ideal substantive policy case to examine the role of co-benefits because of their overlap in processes and outcomes related to health care systems, public health, ecosystems and disaster response. A set of mitigation strategies for Toronto's UHIs have now been in place for a decade or more, allowing comparisons between them and comparisons to the previous status quo. Modelling studies show that Toronto's ongoing mitigation strategies, including reflective pavement and building materials, green roofs and urban tree planting, can reduce mean temperatures in some areas by up to a degree during summer (Wang, Berardi & Akbari, 2016). This contribution improves human wellbeing directly and reduces energy demand on indoor climate control (Wang, Berardi & Akbari, 2016). These interventions reduce spending on energy, saving consumers up to $11 million CAD per year (Akbari & Konopacki, 2004). Such interventions are particularly critical, and particularly high-payoff, in areas zoned for commercial and industrial use (Rinner & Hussain, 2011; Wang, Berardi & Akbari, 2016). Heat waves in Toronto drive an approximate 10% increase in emergency services use over the baseline expectation, particularly in industrial areas (Dolney & Sheridan, 2006).

Increasing urban tree cover is correlated to measurable health benefits, significantly reducing the need for emergency care for heat-related morbidity during heat waves (Graham et al., 2016). Tree cover over 5% of ground surface was found to have a statistically significant association with heat-related health impacts in this study. By engaging in strategies such as urban greening and green roofs that both mitigate local health effects caused by the Toronto heat islands and capture carbon from the atmosphere, the Toronto approach furthers SDG13. Both the city's current efforts and the framework for future planning allow a proactive approach to reducing climate change and mitigating its ongoing impact. We investigate the development of UHIs to understand the role of health systems in upstream and downstream climate change policy processes, and the development of co-benefits produced from direct or indirect intersectoral engagement in these policy processes.

12.5.2 How SDG13 in Toronto produces co-benefits for other SDGs

Reducing climate change and mitigating its impact will further many of the UN's SDGs.[1] The case study of climate-related heat stress solutions in Toronto is an excellent example of these intersections. Climate

[1] By encouraging investment in greener technologies through their purchasing power, health systems can spur innovation and encourage scaling in clean energy, thereby forwarding SDG7. SDG8, decent work and economic growth, can be forwarded by the materials, labour and innovation necessary to retrofit health care infrastructure to reduce fuel waste or build new green infrastructure. Investment by such a large sector of the economy will provide jobs in the short term and build local skills for similar work throughout the economy. In addition, improving the physical environment within buildings will increase wellbeing among employees. Both through direct investment in sustainable buildings and through using their purchasing power to convince upstream industries to adopt greener manufacturing processes, health systems can impact SDG9, industry, innovation and infrastructure. Improvements in physical infrastructure and manufacturing processes driven by health system investment will spread to other, non-health-related, sectors of the economy. By more effectively managing their waste and investing in responsible waste-management

change-related droughts resulting from and exacerbated by heat effects are already limiting the availability of food and water to many vulnerable groups worldwide. SDG1, no poverty, and SDG2, zero hunger, are therefore made more challenging by climate change. SDG3, good health and wellbeing, is furthered by reducing heat stress within health system infrastructure and in surrounding areas. Evidence shows that reducing UHI effects and providing green spaces have broad impacts on health and wellbeing within local communities.

Many of the local climate mitigation strategies that health systems can engage in to reduce UHI, such as green infrastructure and urban greening, also reduce runoff and provide filtered urban water systems, contributing to SDG6, clean water and sanitation. Since health systems are major landowners within many cities, a pivot towards greener infrastructure can further SDG11, sustainable cities and communities. Health systems can participate in the political process of developing local or regional plans to mitigate and manage climate change, and can underline the urgency of such planning by providing evidence of ongoing climate-change-driven health impacts.

12.5.3 Policy timeline

Toronto was an early actor in North America and worldwide in preparedness for climate-exacerbated heat effects and in efforts to reduce and mitigate climate change. A series of policies enacted in Toronto, starting in 1999 (Clean Air Partnership, 2008), aimed at reducing climate change and mitigating adverse effects of climate change. For this case study we are focusing on *policies targeting UHIs* within the city, though there are many other climate policies in place. These policies targeting UHIs include: the Heat Health Alert System, a Green Roof Bylaw, the Toronto Green Standard, an Eco-Roof Incentive Programme, Doubling the Tree Canopy Initiative, and "Greening" Surface Parking Lot guidelines (Pacheco & Gower, 2016). Many of these policies relevant to UHI reductions have broader benefits to other categories of adverse climate

infrastructure, health systems can further SDG12, responsible consumption and production. Because of the necessity of single-use, sterile items in health care, health care systems generate large volumes of waste. Using their purchasing power to encourage sustainable and equitable waste management systems will reduce both the carbon footprint of health care and make waste management infrastructure available to other sectors.

events mitigation and preventing adverse health effects associated with climate change. We are focusing on the catalysing events for intersectoral policy action during the turn of the twenty-first century and will make comparisons across the past two decades to examine how Toronto has sustained these climate mitigation strategies to reduce UHIs.

12.5.4 Policy stakeholders

A key part of Toronto's success in early and sustained climate action is participation across a wide array of stakeholders relevant to heat stress mitigation. This stakeholder network includes actors involved in climate change mitigation strategies *and* those involved in responding to the downstream, adverse events arising from UHIs such as increased morbidity and mortality, adverse weather events, and infectious diseases (as outlined in Section 12.2). A key component of this process is that health systems were perceived to be both mitigators and responders to UHI climate events (Karliner et al., 2019). Health systems have also been involved as key stakeholders in these upstream and downstream roles in the policy process since 1999 and continue to be active today in climate policy agenda setting, decisionmaking and implementation. Toronto Public Health has also taken a direct role in all these policy activities since 1999, often leading policy decisionmaking and working to coordinate with health systems in their mitigation and response efforts (Acting Medical Officer of Health, 2016; Clean Air Partnership, 2008).

12.5.5 Co-benefits as an argument

In the policy discourse, co-benefits emerged in policy deliberations and rationale later on in the time period, appearing closer to 2020 (City of Toronto and Sustainability Solutions Group, 2019a). Co-benefits for climate resilience are now being adapted for measurable outcomes in the city of Toronto (City of Toronto and Sustainability Solutions Group, 2019b). While 'co-benefits' have not been consistently used until recently, Toronto's advocacy for intersectoral action and partnership across relevant actors in mitigation and response persisted across the two-decade time-period. Rationale for these intersectoral partnerships were based on the *benefits* to different actors and the necessity for partnerships to generate comprehensive and effective policy responses (Acting Medical Officer of Health, 2016; Health Canada, 2020). The recent emergence of co-benefits may be a product of the proliferation of this language by the UN, IPCC and other international climate change organizations.

12.5.6 Factors related to Toronto's success

Toronto's ability to lead as an early actor in various policies targeting UHIs is likely related to multiple political and governance factors. These factors are related to a *high level of intergovernmental and intersectoral collaboration*, and *high levels of policy capacity* to further these collaborations (see Table 12.3). High policy capacity in Toronto's case specifically included high capacity within the health system and the Toronto Department of Public Health to link health effects and target health outcomes to ecosystems services utilized to mitigate heat effects. Most important in many ways is the low level of political conflict and the high level of political support across levels and sectors of government (see Table 12.4). In these

Table 12.3 *Intersectoral governance structures in Toronto urban heat islands policies*

			Possible governance actions with these tools								
			Goals and targets	Evidence support	Policy guidance	Implementation and management	Coordination	Advocacy	Monitoring and evaluation	Financial support	Legal mandate
Tools	Plan	**Plan**	X	X	X	X	X	X	X	X	X
	Indicators and targets	**Indicators**		X	X		X			X	
		Targets		X	X		X			X	
	Budgeting	**Pooled budget**									
		Shared objectives									
		Coordinated budgeting[2]		X						X	

[2] Ontario Provincial Government (Acting Medical Officer of Health, 2016, 6).

Table 12.3 *(Cont.)*

			Possible governance actions with these tools							
Tools	Organization	Ministerial linkages[3]	X	X	X	X	X		X	X
		Specific ministers								
		Organization	X	X	X		X		X	
		Legislative committees								
		Interdepartmental committees/units	X	X	X		X		X	
		Departmental mergers								
		Civic engagement[4]	X	X	X	X	X	X	X	
	Accountability	Transparent data								
		Regular reporting								
		Independent agency/ evaluators[5]	X	X	X	X	X		X	X
		Support for civil society[6]	X	X						
		Legal rights								

Table 12.4 *Political importance and conflict: the context of policymaking and implementation of Toronto urban heat islands policies*

		Conflict	
		Low	High
Political importance	High	x	
	Low		

[3] Toronto Environmental and Energy Departments (City of Toronto and Sustainability Solutions Group, 2019a, 26–28; Penney, 2012).
[4] Health Systems (Acting Medical Officer of Health, 2016).
[5] Canadian Federal Government (Health Canada, 2020; Toronto Medical Officer of Health, 2018).
[6] United Nations SDGs (Acting Medical Officer of Health, 2016, 10).

ways, Toronto's success may be relevant to other major metropolitan areas around the world. Major metropolitan areas, globally, tend to be more liberal and more progressive in climate policy action. In country contexts where either intersectoral or intergovernmental collaboration is missing or hindered, resulting from capacity or political conflict, health systems as major stakeholders may still be able to engage in action as implementors or spur action as agenda setters at the metropolitan level.

12.6 Discussion and conclusion

As key political stakeholders, health systems have the potential to promote substantial climate policy reforms. Health systems can take climate policy action to support SDG13 through upstream agenda-setting, and as directly implementing policy within their systems. We describe three categories of climate-driven, acute adverse events that are particularly amenable to mitigation through health system involvement: climate-driven natural disasters (discussed in the supplemental case study (Appendix 1)), communicable disease outbreaks, and heat waves. We conduct a case study analysis of the influence of health systems in climate policy development for responses to urban health islands (UHI) in Toronto, Canada. In Toronto, health system actors provided crucial policy capacity and stakeholder mobilization advocating for policy agenda-setting, policy design and implementation, while simultaneously producing policy co-benefits to other sectors through UHI mitigation.

Successful climate mitigation strategies will need to address governance challenges associated with political conflict and resource capacity, both upstream and downstream in policy design and implementation. Engaging health systems as primary economic stakeholders in national political economies may enhance the likelihood of climate policy success by generating upstream advocacy for climate policies and downstream capacity to implement policies on the ground. Toronto demonstrates this potential through intergovernmental health systems mobilization in response to UHIs. Even in cases where political conflict is high and capacity is low, health system climate policy action will produce cross-sectoral co-benefits arising from health systems as high-capacity implementors.

Health systems not only have capacity for policy change, but also have notable skin in the game as first-line responders to the adverse effects of climate change. Based on our findings from the analysis of co-benefits, governance challenges and Toronto as a case study, health systems as implementors may take immediate steps through both: 1) participating in local planning for adverse weather events, and 2) making direct infrastructure investments in sustainable buildings and materials. These actions will promote immediate progress for SDG13 and mitigate the health impacts of natural disasters, heat waves and emerging disease outbreaks.

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