Chapter 5: Harness Urban Complexity for Health and Well-Being

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5.1 Introduction to Global Health Challenges

To improve global health and well-being for cities, three global realities must be considered: the demographic shift related to aging of the population, the epidemiologic shift from infectious to noncommunicable diseases as the major threats to health, and climate change – which is changing disease patterns and quality of life, as well as, for some cities, creating serious challenges to their physical infrastructure. All of these critical challenges to health around the world converge in cities and the rapid rate of urbanization worldwide make attention to urban health a critical component of sustainable development.

The number and size of cities is expanding in all regions of the world, with China positioned as the world's largest urban nation (see Chapter 1.1). Rapid urbanization is already presenting challenges to all countries, but its pace and scale are greatest in low- and middle-income countries, not only because of the rise of megacities (those with populations over 10 million), but primarily due to the rapid development of midsized cities of 250,000 to 500,000 inhabitants.

While the rapid rise in the world's population of people aged 60 years or older is a public health triumph, it adds an additional challenge to advancing the health of people in cities: in the next four decades, 21 percent of the population will be over 60 years old, though the rate of increase of this demographic will still be higher in developed countries than in developing ones. Creating urban environments that support active, healthy aging, and health-promoting conditions for all ages is critical to preventing unsustainable pressures on health and social service systems and to maintaining a healthy workforce and active, engaged citizens.

The epidemiologic shift towards noncommunicable diseases, or NCDs – including primarily cardiovascular disease, or CVD; diabetes; cancer; and pulmonary disease – has made NCDs the number one cause of death globally, with a disproportionate impact in low- and middle-income countries and their already fragile healthcare systems. Deaths from NCDs are projected to increase

77 percent between 1990 and 2020, growing from 28.1 million to 49.7 million deaths annually (Report of the Obesity Working Group 2013). The rise in NCDs is tied to globalization and urbanization, as well as the aging of the population.

The environmental impacts of urbanization – increasing energy use and related greenhouse gas emissions, soil degradation, biodiversity loss, and severe water stress – have also had tremendous health consequences: In 2012, approximately seven million people died prematurely as a result of exposure to air pollution (WHO 2014), making air pollution the world's single largest environmental health risk.

In order for cities to evolve as engines for national economic development and as hubs for technological innovation, social progress, and environmental sustainability, city leaders must respond to these challenges with evidence-based policies and programs that can promote the health of urban residents. For example, when plans for the built environment (including housing, land use, and transport) include consideration of their health impacts, cities can facilitate healthy choices in terms of food, exercise, and social engagement; address the physical and mental health issues linked to NCDs, infectious diseases, violence, road accidents, unemployment, poverty, and natural disasters; and maximize the resilience of its residents. In contrast, a failure to address the health of people living in cities can place urban residents at serious health, economic, and security risks. Since healthy people are critical to social and economic development, addressing the health impacts of urbanization must be central to national, regional, and local sustainable development agendas.

5.2 Determinants of Urban Health

Health experts now know that there are broader and more important determinants of health than the availability of medical care (Figure 5.1), which has often been the major focus of global and national health policy attention and investment (Dahlgren and Whitehead 1991; Woolf et al. 2007). Age, sex, and genetic makeup, as well as other "constitutional factors" such as ethnicity, influence people's health, as does access to quality health care. But other factors, including safe natural and built environments (housing, transportation, parks, and urban design), and the socioeconomic environment (the availability of education, jobs, and social support) can prevent or exacerbate risky health behaviors (such as diet, exercise, tobacco use, and unhealthy alcohol and drug use). In addition, the public policies and political environment that shape these environments, including the societal impact of racism, have far greater impacts on health than the environments alone. These can be modified to affect the health of entire populations.

Figure 5.1 Broad determinants of health. Urban health experts now know that the built, physical, social, and economic environments are crucial factors in maintaining and improve health. Source: Jerker Lokrabtz/Azote.

Because cities are the places with the highest human population densities and concentrations of physical, social, and economic infrastructure, they pose challenges to and yet provide opportunities for action on these variables to improve the health and well-being of the majority of the world's population. The multifactorial nature of these challenges calls for a multisectoral approach to governance and for an approach that is inclusive – involving multiple stakeholders and communities in identifying and solving priority problems themselves. A systems approach to such governance, along with a commitment to decisions that advance health and health equity, will be critical to urban health and, therefore, to global health.

5.3 A Conceptual Framework for a Systems Approach to Urban Health and Well-Being

Figure 5.2 aims to explain how urban health and well-being emerges and is further changed by urban systems functions. Because the city is an open system, it is also influenced by processes outside the urban system (see Chapter 1.2).

In identifying the various goods and services that urban systems provide, this framework also supports action based on the evidence that the key factors influencing urban health are primarily located outside the traditional healthcare system. Table 5.1 concentrates more deeply on the components of "urban
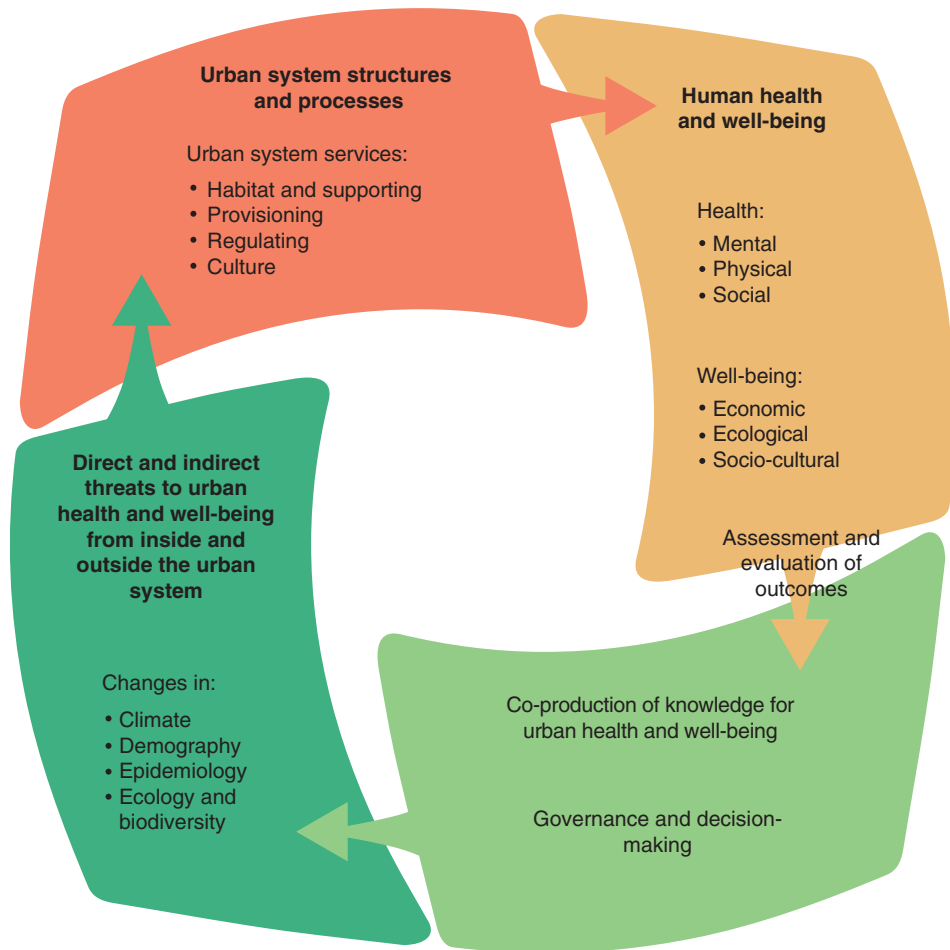

Figure 5.2 Urban health and well-being emerges as an outcome of urban system structure and processes and change factors from outside the system. Source: Jerker Lokrantz/Azote.

Table 5.1 Urban system goods and services and examples of health benefits and risks

Type of urban system service	Description of urban system services	Examples of health benefits and risks
Habitat and supporting	These are physical spaces and infrastructure for living and working in the city. Green (such as parks), blue (such as lakes), and gray (such as roads and buildings) environments are created to provide basic needs, including shelter, waste management, water treatment and sanitation, production of goods, and energy provision.	Housing-related health risks: • Allergies and asthma occur as a result of the accumulation of indoor pollutants and dampness • Infectious diseases spread • Increases or disruptions of immune system regulation by the microbiome of the built environment exaggerate or suppress inflammation • Respiratory and cardiovascular diseases arise from indoor air pollution • Risk of airborne infectious diseases rises because of inadequate ventilation • Illness arises, driven by temperature extremes • Risks of home injuries exist
	Habitat functions make the city a livable place by providing the hardware that enables material, energy, and data flows, thereby facilitating urban metabolisms.	Health benefits from urban green space: • Urban heat is reduced • Greenhouse gas emissions are offset • Storm water is attenuated • Urban residents are provided with spaces for physical activity and social interaction • Exposure to microbiota occurs, which educates the human immune system

Table 5.1 (cont)

Type of urban system service	Description of urban system services	Examples of health benefits and risks
Provisioning	These include goods and services provided by the urban system – some of which can be exchanged on markets, provided by the public, or coproduced. Goods include food, water, manufactured goods, medicines, computers, and books, among many others. Services include access to and use of roads, communication and other public infrastructure, security, waste management, health care and education systems, and disaster response and emergency systems. The provision and production of goods and services can be organized publicly, privately, or in public-private combinations.	• Obesity increases due to unhealthy urban food environments • Urban farmers markets increase healthier food choices • Pharmaceuticals and medicines are accessible • Public health facilities are accessible • Transport and communication infrastructure can improve social networks • Social determinants of health • Health insurance • Hospitals • Clean water • Sanitation facilities
Regulating	These are benefits derived from having a system of rules and regulations in place, by means of which the urban system is governed (in the social space) and managed (in the economic and technological space). Regulating services include institutional infrastructure, which determines social interactions and other urban metabolic outcomes, such as regulating access to public places and services, markets and businesses, traffic, the collection and use of data, the implementation of food safety protocols, and the application of environmental standards in the urban economy. Formal and informal rules, norms, and conventions are part of the urban institutional environment.	• Policing and public safety • Enforcement of traffic rules and road safety • Food safety standards and controls • Disease control regulations • Hygiene regulations/standards • Medical law • Public health law • Construction regulations • Standards in the control of hazardous substances • Environmental regulations

| Type of urban system service	Description of urban system services	Examples of health benefits and risks
Cultural	These are benefits created in urban sociocultural spaces; they include social spaces and liberties for economic and political innovation; exchange of ideas; creativity from exposure to cultural diversity and different forms of cultural expression; recreation and leisure; space for spiritual enrichment; and places to do art and undertake cognitive development. Examples include cultural events, religious places, "Heimat" (sense of belonging), exhibitions, libraries, cultural heritage values (such as historical places), and cultural diversity.	• Culture is a key component in health maintenance and promotion (Napier et al. 2014) • Cultural diversity in healthcare systems increases inclusion of minorities • Cultural competence can improve quality of health care; culturally adapted health care can improve patient understanding and health outcomes • Culture's dictation of female and male roles that limit women's mobility and ability to seek health care

system services," drawing on the processes described in Figure 5.2. Habitat and supporting services provide space and infrastructure to meet the basic needs of life. These are the preconditions for energy and information flows, such as houses, roads, marketplaces, water pipes, sanitation infrastructure, and telephone lines. Provisioning services provide products and energy for consumption and production. Regulation services generate benefits from governing interactions and exchange processes. Cultural services generate nonmaterial benefits for cognitive and knowledge development. Understanding the interconnections of these systems and aligning them to produce health is the challenge for a "Health in All Policies"[1] governance of a city and can be facilitated by a systems approach to identifying the problem and exploring solutions.

5.4 A Systems Approach to Some Common Urban Health Challenges

5.4.1 Transportation

The following examples reveal the breadth of interconnected urban health problems related to complex interrelations between transportation (Figure 5.3), food security (Figure 5.4), and public health as examples of a systems approach to common urban health problems.

Increased road use by private vehicles, for instance, takes advantage of and eventually wears down an intact road infrastructure. Urban planning that
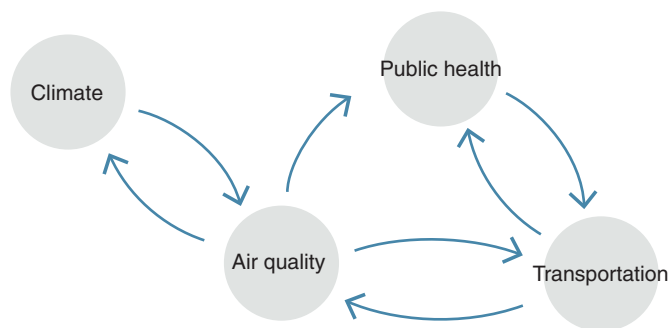
Figure 5.3 Simplified interconnections between urban transportation, air quality, climate change, and public health. Source: Jerker Lokrantz/Azote, modified after Lung (2014).

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[1] "'Health in All Policies' is an approach to public policies across sectors that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in order to improve population health and health equity." (The Helsinki Statement on Health in All Policies 2013, p.2)
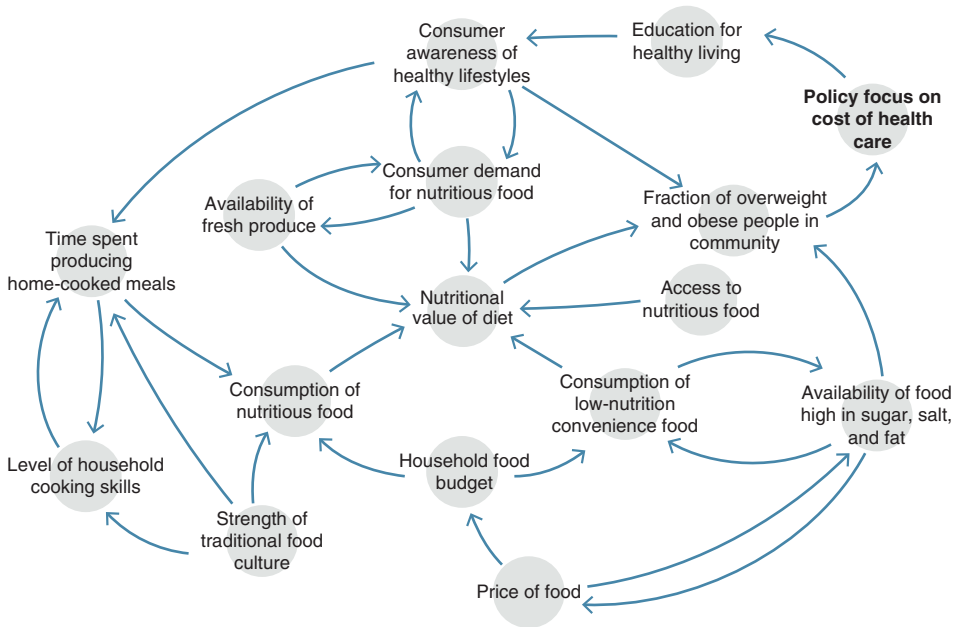
Figure 5.4 Dynamic relationships between variables for food security and the proportion of obese people in urban communities. Source: Jerker Lokrantz/Azote, modified after Proust and Newell (2016).

favors the use of cars can lead to increased air pollution and road traffic injuries, as well as contribute to a reduction in physical activity, with implications for public health and heath care costs from obesity, cardiovascular disease, chronic and acute pulmonary disease, and certain cancers. In contrast, positive health impacts can be expected from reducing the amount of private cars on roads and improving public transport infrastructure (Lung 2014).

5.4.2 Access to Affordable, Nutritional Foods

Today, the prevailing rates of weight- and diet-related chronic diseases, such as diabetes and hypertension, are increasing in every region, but especially in low- and middle-income countries. Population growth, rising incomes, urbanization, and globalization are some of the major drivers of changes in dietary patterns (Figure 5.4). Estimates suggest that by 2030, the number of overweight and obese people will have increased from 1.33 billion in 2005 to 3.28 billion, around one-third of the projected global population (GPAFS 2016).

Urban food security refers to the access to, availability of, and use of food. This includes production, distribution, safety, and quality of food, but it often ignores the nutritional value of diets and individual choices. The Food

and Agriculture Organization, or FAO, defines food security as a "situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2015). Food insecurity has substantial negative impacts on the physical and mental health of adults and children and is a major problem for many urban populations.

Food insecurity can also exist in communities where sufficient food is not available and/or where diets are not nutritious or safe. These low-quality diets contain insufficient calories, vitamins, and minerals or contain too many calories and too much saturated fat, salt, and sugar. The risk that poor diets pose to mortality and morbidity is now greater than the combined risks of unsafe sex and alcohol, drug, and tobacco use. To achieve healthier diets, food systems must focus on quality and on making the healthy and affordable food choice the easy choice.

To improve diets, healthy eating must be the easiest available choice; likewise, to reduce obesity, physical activity must be desirable and accessible. No single intervention can address the many factors (as identified in Figure 5.2) that contribute to obesity. Priorities for policy-makers include addressing drivers of caloric overconsumption within the food system; supporting access to healthy and affordable foods, especially in low-income communities; incentivizing production of fresh produce; establishing public procurement guidelines that support these producers; developing workplace/school setting interventions that promote healthy eating and physical activity; and providing nutrition education that is culturally appropriate (Libman et al. 2016).

An example of a successful intersectoral partnership for obesity control is the Ensemble Prévenons l'Obésité Des Enfants (Together Let's Prevent Childhood Obesity), or EPODE, an international network that aims to connect a network of stakeholders that takes a "whole community approach" to reducing obesity in a particular locale by coordinating action across school-based interventions, parent and community engagement, municipal support for environmental changes (such as new sports facilities), and media coverage (Report of the Obesity Working Group 2013).

A school meal initiative to improve child nutrition and school enrollment rates that incorporated procurement rules addressed multiple local needs – for fresh, high-quality food as well as a stable market for small local producers. Similarly, the UN World Food Programme's Home Grown School Feeding Program, as implemented in the municipality of Campinas in São Paulo, Brazil, transitioned the community from unpopular and low-quality processed foods to broadly approved, high-quality fresh vegetables, fruits, and meats when regulations were added that required 30 percent of the national school food

budget to be spent on food sourced directly from family farmers in the local region served by the school (Otsuki 2011).

As these examples illustrate, a systems approach offers an exciting framework for multisectoral definitions of problems and problem solving that incorporates evidence-based solutions for promoting health in urban planning, housing, transportation, food systems, education, and other sectors. Indeed, researchers have applied a systems science approach to other health issues such as obesity, and this technique is a growing area of interest for public health scholars.[2]

In addition to exploring the complex interconnectedness of system variables that determine urban health, the systems approach, as developed by the Urban Health and Wellbeing programme of the International Council for Science, integrates human health concerns into questions about urban system function. It also addresses knowledge creation in science and society in order to harness urban complexity by solving complicated, wicked types of problems, and the different types of knowledge needed to solve them (ICSU 2011; Gatzweiler et al. 2016).

Accordingly, for society, a systems approach to urban health and well-being means scientists coproducing knowledge for urban health in collaboration with affected communities, government agencies, and civil society organizations; recognizing how different urban system functions and modes of urban life are connected to particular health and well-being outcomes; raising awareness and educating the public and policy-makers on interrelated issues of health and well-being; creating demand and opportunities for entrepreneurship, business, and civil society engagement for health and well-being; and creating networks of like-minded system thinkers and agents of change for improving health and the quality of life in cities.

For science, a systems approach means:

1. The development of new conceptual models that incorporate dynamic relations of the processes leading to health in urban settings. These conceptual models must be specific to a given research problem or question; the development of these models may involve input from stakeholders as well as scientists, as appropriate to the research problem and context.

2. The use of systems tools and formal simulation models, such as agent-based models, systems dynamic models, or other systems modeling tools, to better understand the functioning of the integrated urban health system or to predict changes to health under various hypothetical interventions.

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[2] See, for example, The Columbia University Systems Science Program, a joint venture between the Mailman School of Public Health and the School of Engineering and Applied Sciences (SEAS), http://engineering.columbia.edu/breaking-down-complex-systems-public-health.

3.   The integration of various sources and types of data (including spatial, visual, quantitative, and qualitative data) in the conceptual models and/or the formal simulation models as well as the identification of important data gaps that need to be filled in order to advance understanding of how the system works.

5.5 Governance to Advance Urban Health and Well-Being

Effective, inclusive, and representative "government" – including the institutional means to ensure provision of infrastructure – requires goods and services to address urban health problems. Such a government must also be able to engage other stakeholders to achieve agreement on the nature of the problem, potential solutions, and how to measure success. Alignment on aspects of a given problem and its solution is often referred to as "governance." An extensive literature shows that effective government is part of good governance and both are important determinants of urban health; particularly important is a strong public health infrastructure that can work cooperatively to examine potential risks and benefits to health policies, programs, and investments across sectors.

   This need for broad-based action underlies a governance framework for health called a "Health in All Policies" approach, which reflects the importance of a public policy focus on the broader determinants of health, such as housing, transportation, built and natural environments, education, and economic development to create communities that actually support and permit healthier behaviors. The complexity of these determinants and their solutions further requires the input of a broad range of stakeholders beyond healthcare providers, such as community-based organizations, academia, business, and the media. The public health system can help to catalyze actions that bring the many stakeholders in urban health together to systematically consider the health implications of decisions, to seek synergies, and to avoid harmful health impacts to improve population health and health equity.[3]

   The World Health Organization's recent *Global Report on Urban Health: Equitable, Healthier Cities for Sustainable Development* devotes its third section to the need for a renewed focus on urban governance to achieve the Sustainable

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[3] WHO: Health in All Policies: Framework for Country Action http://apps.who.int/iris/bitstr eam/10665/112636/1/9789241506908_eng.pdf?ua=1.

Development Goals globally, as well as to achieve healthier cities in countries (WHO 2016). Since local governments may have responsibility for multiple functions that affect health (including land use, roads and transportation, and environmental protection), governance for healthy and sustainable cities requires an integrated approach across agencies and sectors that facilitates meaningful community participation. Empowering citizens with information is key to their involvement in decision-making on urban health initiatives, especially to ensure sustainable action on health inequities. Data sharing and transparency are also important for enabling civil society, government, and the private sector to work together effectively. With rapid urbanization constraining government capacity to provide quality services, the private sector serves an increasingly important role as a partner in meeting the needs of urban residents. Above all, the report emphasizes the importance of adopting a "Health in All" approach to policy and decision-making processes across city governments, with health equity as a core value.

An example of governance for health that addresses one of the important urban health challenges of aging is the Age-Friendly New York City Initiative. Using the WHO age-friendly framework[4] that promotes healthy aging using a life-course approach to help cities plan for the needs of older adults. The WHO identified eight domains of age-friendliness that, if addressed through improvements to policies, practices, and programs, can reverse or slow the disability trajectory.

One comprehensive example is the Age-Friendly New York City Initiative (hereinafter Age-Friendly NYC), a public-private initiative that brings key people from multiple sectors and government agencies together to improve the lives of older adults by changing their physical and social environments to promote the maintenance of independence and active engagement of older persons in the life of the city. Launched in 2007, Age-Friendly NYC is a partnership between a nongovernmental organization – the New York Academy of Medicine – and local government offices, including the Office of the Mayor of the City of New York and the New York City Council. Age-Friendly NYC attracted the support of local policy-makers during the global financial crisis because of several factors: the number of older persons in New York City was projected to grow by 40.7 percent within the next 20 years; this subpopulation would be one of the most diverse groups of older persons in the world; and older people live in all parts of the city and vote and shop locally, thus they are engines for community economic development. A mayor-appointed Age-Friendly Commission, with representatives from business, city government, NGOs, and the private sector, oversees the initiative, which includes input

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[4] www.who.int/ageing/projects/age_friendly_cities_programme/en/.

from older persons via public hearings held across the city. Mayor Michael Bloomberg also mobilized 22 city agencies around the initiative, asking them to examine the programs and capital investments already planned over the next five years to determine how they might be changed if the needs of older persons were taken into account. The result was a report with 59 city government commitments that continue to be tracked by the commission, which has also promoted complementary private sector activities.

One area in which Age-Friendly NYC has had a visible impact is in addressing transportation challenges faced by older adults that decrease their ability to leave their homes, to engage actively in their communities, and to exercise and access healthy food. Solutions are aimed at creating "Complete Streets"; these provide for safe and active movement for all users by improving the safety of seniors and other pedestrians, as well as all road users in New York City. Aspects of Complete Streets include bus shelters with seating and signage, paid for by advertising; school buses repurposed during the school day for grocery store trips; benches installed with older adult input; and improvements to streets and signage in neighborhoods with the most pedestrian accidents, including extending pedestrian crossing times, altering curbs and sidewalks, restricting vehicle turns, and narrowing roadways. When all of these improvements are implemented, officials expect an estimated 10 percent reduction in pedestrian fatalities among older people.

Lessons learned in creating and implementing cross-sectoral strategies for age-friendly cities are equally applicable to efforts to prevent NCDs, where there is increasing evidence that incidents over a lifetime seem to make individuals more vulnerable to premature morbidity and mortality. Approaches that change the environment will have a broader impact than efforts to change individual behavior and should be a priority for city action. Initiatives that can address more than one need are more likely to gain and sustain the support of political leaders. Low-cost and no-cost interventions can have a tremendous impact on health and may be easy to incorporate into existing plans and activities. Because the determinants of health are affected by all sectors, planning for health should leverage financial resources from within and outside the health sector; partnerships outside of government and public engagement are key to sustainability.

5.6 Conclusions

As we have gained information about and understanding of the multiple determinants of health, we have found that the systems approach to urban health and well-being permits individuals charged with and concerned about

improving the health of cities to better develop strategies that identify the multisectoral origins of the problem; encourages research for solutions that advance health; and engages effectively with multiple stakeholders to increase the likelihood of sustainable implementation of new initiatives.

We must remember to keep inequity at the forefront of any discussion of urban policies. Since cities are the locus of vast inequities of opportunity, compounded by poverty, race, ethnicity, gender, age, and migration status, urban dwellers bear the consequences of unplanned urbanization differently than nonurban residents, with adverse impacts falling disproportionately on the vulnerable and poor (see, for example, Marmot 2015). Moreover, in cities, concentrations of deprivation often exist at the neighborhood level. This phenomenon emphasizes the importance of identifying problems, creating appropriate solutions, and tracking progress in partnership with local communities, which are the experts on their neighborhood. The evidence clearly indicates that locally owned solutions are critical to achieving and sustaining a community's health (see Cummins et al. 2007; Kershaw et al. 2015).

Ultimately, the effective governance of cities in general – and, specifically, of cities seeking to achieve goals of health and well-being – depends on political will. As we move to engage political officials at the city level, we must first understand that they may not be familiar with the evidence for the multiple determinants of health, and may still see the solution to achieving health as primarily an issue of assuring access to health care and strengthening personal healthcare systems. Further, as national governments increasingly move to identify their own models for local government and the decentralization of authority, it is important to understand whether local government entities have the authority to address such problems and, even where such authority *does* exist, whether they have the basic information systems and infrastructure to solve them. A systems approach to these challenges can help to facilitate understanding and action to improve the health and well-being of people in cities, and to achieve the Sustainable Development Goals for improved health for all.

Acknowledgments

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