

# **The International Flow of Risk: The Governance of Health in an Urbanizing World**

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*In 2008, the world's urban population exceeded its rural population for the first time. The United Nations estimates that about 15% of the world's population now lives in "megacities" of 10 million or more people, or in near-megacities of 5-10 million. Three-quarters of the megacities are in low- and middle-income nations, where rural-to-urban migration will drive rapid urbanization through 2050. Services and infrastructure rarely keep pace with population growth. Even in well-resourced cities, municipal leaders struggle with urban sprawl, unmet housing and transportation needs, environmental degradation, and disaster vulnerabilities. In the absence of adequate resources and regulation, informal settlements and markets evolve fluidly, creating shelter and livelihoods but also exposing inhabitants to environmental risks that exacerbate health inequities. These problems might once have been considered local challenges. Now, these "international cities" are often cross-roads for the movement of people, animals, and goods (and the health risks that they carry), as well as drivers of national or regional economic development. New strategies are needed to govern the flow of health risks within and among these densely populated urban centers. The breathtaking scope of the challenges that urbanization poses for development and security can only be understood by looking at long wave events that cross sectors, disciplines, and borders. Tools such as the Framework Convention on Tobacco Control and the International Health Regulations (2005) can affect the flow of health risks between regions, but cannot substitute for strong planning, policy, and management functions at the municipal level – exactly where governance capacities tend to be weakest.*

## **INTRODUCTION**

In the last two decades, accelerated globalization and urbanization helped promote unprecedented economic growth, allowing millions in the developing world to climb out of poverty. Globalization and urbanization also profoundly influenced the determinants of health for these millions and more.

Just as resources can be envisioned as flows from one country to another, so can risks. Since the modern reduction of endemic disease burdens by the world's industrial powers, most models of health risks and benefits assume directionality. Knowledge, technologies and resources predictably flow from the developed to the developing world in this paradigm, benefits that ultimately improve the quality and length of lives, while infectious disease risks flow back "uphill" with goods and people. This view underestimates the complexity of health risk flows. Many common behavioral risk factors that underlie the steep worldwide increase in chronic diseases – unhealthy diets, physical inactivity, and tobacco use – originated in highly developed regions, spreading worldwide. Populations in developing regions are increasingly susceptible to a dual burden of the diseases of poverty and wealth. At the same time, those populations are

increasingly concentrated in built environments where new behaviors, conditions, and microbes may mix dangerously to generate new health threats. These could easily flow with trade and travel to every corner of the world, starting with the urban centers where disease multipliers might propagate risks still further.

Instruments such as the International Health Regulations (2005) and the Framework Convention on Tobacco Control are intended to stem the international flow of risk, from the existential threat of emerging infections to an underlying determinant of chronic disease. Implementing these instruments and other global governance tools presents new challenges in an urbanizing world, where leaders at the municipal level hold immediate responsibility for the health and welfare of populations that may number in the tens of millions, among cities directly connected by travel and trade routes.

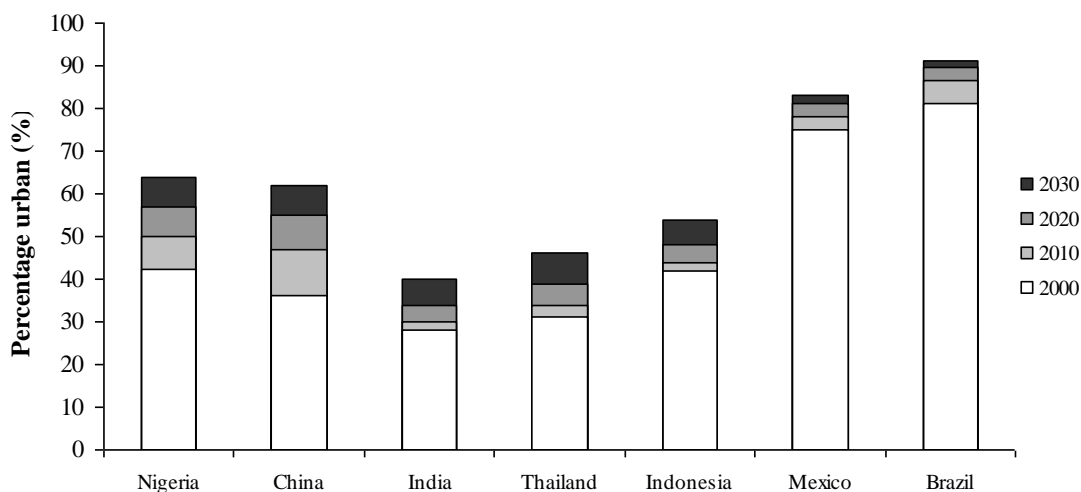
In this paper we describe trends in urbanization, review urban health risks in an increasingly complex built environment, and discuss the implications of globalization for the international flow of such risks. We then present some of the tools that are available to manage the flow of risk, and discuss the importance of building policy and planning capabilities at the municipal level.

## **URBANIZATION TRENDS**

By mid-2009, the world's urban population exceeded its rural population. In coming decades, worldwide rural population growth is projected to slow and then decline as the global urban population swells to almost 5 billion by 2030.<sup>1</sup> While the number of urban centers of more than one million people continues to increase precipitously, most projected urban population growth through 2030 will take place in cities of less than 500,000 people. These smaller cities frequently lack strong policy and planning mechanisms and face the worst combined challenges of the urban and rural worlds, struggling to match basic services to needs, and competing for skilled workers attracted by larger cities.<sup>2</sup>

Only about 15% of the world's population lives in what the United Nations Department of Economic and Social Affairs defines as "megacities" of 10 million or more people, or "megacities-in-waiting" of 5-10 million. However, more than 80% of these massive urban centers are in low- and middle-income nations; their cumulative populations are projected to exceed 600 million people by 2025.<sup>1</sup> Their sheer size and complexity amplify public health challenges, particularly in the developing nations of Asia and Africa, where public services and infrastructure often lag behind population growth.

Figure 1: Urban population as a percentage of total population in select nations



The urban population is predicted to increase among the emerging economies of East, South, and Southeast Asia through 2030, and to climb slightly within the already highly urbanized nations of Latin America. (Source data: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision* and *World Urbanization Prospects: The 2009 Revision*.)

Population growth will most likely outstrip public health and safety infrastructure in many of the megacities projected to absorb the largest population increases, including Kinshasa, Dhaka, Lahore, Karachi, Lagos, Delhi, and Mumbai. The already highly urbanized emerging economies of Latin America will see relatively slow growth of urban populations through 2030. In contrast, widespread rural-urban migration by those seeking educational and employment opportunities will propel Africa and Asia to annual rates of urban population growth in excess of two percent. China and India alone are expected to account for one-third of the projected increase in the worldwide urban population through 2050.<sup>1</sup>

These cities serve as engines of growth for national economies, often accounting for an outsized share of gross domestic product, and providing gateways to globalized private sector networks.<sup>3</sup> At the same time, rapid urban growth exacerbates the management and planning challenges that already overwhelm some municipal authorities. Much of the internal migration in developing countries will be driven by the rural poor moving to cities where poverty (relative and absolute), social inequalities, and health inequities are already high. Estimates suggest that 40-50% of the urban populations of developing nations such as Burundi, El Salvador, the Gambia, Kenya, the Kyrgyz Republic, Moldova, and Zimbabwe live below the poverty line. This percentage climbs to more than half in Angola, Armenia, Azerbaijan, Bolivia, Chad, Colombia, Georgia, Guatemala, Haiti, Madagascar, Malawi, Mozambique, Niger, Sierra Leone and Zambia.<sup>4</sup>

As the poor migrate from rural to urban environments, kinship networks and necessity often steer them toward informal settlements characterized by crowding, lack

of access to clean water and adequate sanitation, and air pollution (both outdoor and indoor from the burning of solid fuels).<sup>5</sup> In 2006, nearly one billion people worldwide – about one-third of the world’s urban population – lived in these slums, more than 90% of them in developing countries. Their numbers are projected to double in coming decades.<sup>6</sup> Informal or illegal slums often consist of low-quality housing on marginal lands not in demand for other uses. Housing structures are prone to collapse during natural disasters, from major catastrophes to more common (and costly) events such as flooding. Even though residents may find employment in the formal or informal sectors, the majority lack access to basic workplace protections and benefits including health insurance.<sup>7</sup>

Urban population and slum population growth rates vary considerably among cities and across regions. For example, in Southeast Asia, the proportion of the urban population living in slums is declining with economic development and maturing migration patterns. In South Asia and sub-Saharan Africa, slum populations are growing at the same rate as the total urban population. Although urbanization in sub-Saharan Africa has lagged, its cities have the highest percentage of slum dwellers, at more than 70%. Projections suggest that the number of slum dwellers in the region will double to nearly 400 million by 2020, just edging out South Asia as the region with the most slum occupants.<sup>7</sup>

Urban sprawl can affect cities at every level of economic development in the absence of strong regional planning. Low-density housing developments spring up beyond existing administrative boundaries in response to two different types of demand: relatively affluent households seeking a higher quality of life, and poor households seeking affordable housing, often through informal or illegal settlements – a functional extension of slums into peri-urban areas. Suburbanization can carry penalties in terms of long commutes, traffic congestion, and stresses on basic public services.<sup>8</sup> However, the expansion of high-value residential and commercial developments also creates a foundation for urban corridors, city-regions, and mega-regions, such as the Hong Kong-Shenzhen-Guangzhou region of China or São Paulo and Rio de Janeiro in Brazil, where city populations of tens or even hundreds of millions converge, spurring dynamic economic activity and innovation.<sup>9</sup>

## HEALTH RISKS AND THE URBAN ENVIRONMENT

On the other side of the equation, the pace of urbanization and industrialization often outstrips the concomitant development of basic public health services and infrastructure. As a consequence, occupational and community exposures to environmental health risks strongly affect the underlying determinants of health.

In its *Global Report on Human Settlements 2003*, the United Nations Human Settlements Programme (UN-HABITAT) first established an operational definition of slums. In the context of the Millennium Development Goals, slums consist of urban households that lack one or more of the following: improved water, improved sanitation, sufficient living area, durable housing, and secure tenure.<sup>10</sup> These conditions expose slum households to physical, biological, and chemical health risks. Exposures to outdoor air pollution, indoor air pollution from burning solid fuels, unsafe drinking water, and toxic metals and chemicals may underlie nearly 25% of the global disease

burden. Urban crowding amid inadequate infrastructure also increases the toll of unintentional injuries such as the road traffic accidents that claim an increasing number of lives each year in low- and middle-income countries.<sup>11</sup> The risks are not confined to dense urban cores. Urban sprawl contributes to changing land use including deforestation and encroachment into new ecosystems. Disruption of ecosystems changes the habitats of local wildlife species and insect vectors, increasing the risks that vulnerable human populations will be exposed to the diseases they carry, either directly or through a “bridge” domestic animal species.<sup>12</sup>

Public services in these urban areas may fall far short of population needs, especially where municipal leaders may hesitate to legitimize illegal settlements by investing in public health infrastructure.<sup>6</sup> The lack of sanitation and waste removal services creates breeding grounds for pathogens and vectors of disease, including insect and animal vermin, perpetuating a cycle of exposures to microbiological hazards. Poor water management also creates conditions hospitable to parasites and insect vectors. For example, *Aedes aegypti*, the mosquito vector of yellow fever, dengue, and chikungunya viruses thrives in the minute amounts of stagnant water rife in urban areas, from water barrels and flower pots to toilet tanks. In every major city in the world, populations of thousands or even millions living in slums or slum-like conditions are vulnerable to infectious disease outbreaks and the consequences of disasters.<sup>13,14</sup>

The incidence and prevalence of infectious diseases in urban communities depends on population mobility and crowding and social determinants including access to basic resources such as clean water and air and adequate quantities of safe and nutritious food. Unsafe water, inadequate sanitation, and insufficient hygiene perpetuate cyclical outbreaks estimated to cause 1.5 million deaths worldwide from diarrheal diseases each year. Ninety percent of these deaths occur in children under five years of age. Repeated bouts of waterborne diarrheal diseases and parasitic infections also lead to malnutrition. This increases stunting and susceptibility to other infectious diseases, adding another 860,000 estimated child deaths each year.<sup>15</sup> Inadequate access to safe water can prevent hygiene practices such as hand-washing that prevent fecal-oral disease transmission.<sup>16</sup> Access to improved drinking water and sanitation tends to be significantly higher in urban than in rural areas. This still leaves nearly 800 million urban dwellers worldwide without access to improved sanitation (including more than 40% of the urban populations of South Asia and more than half in sub-Saharan Africa), and about 140 million without access to improved water.<sup>17</sup> Measurements of access alone can also be deceptive: sewerage systems can be fragmented and poorly maintained, eventually discharging wastes directly into the open urban environment. Municipal leaders often cope with excess demand on water treatment and supply capacities by deliberately interrupting water services, resulting in profound inequities in water distribution. Households in areas of concentrated poverty may receive only intermittent services, with municipal water flowing cumulatively for a few hours each day. Prolonged periods of low or no water pressure not only reduce access to and use of drinking water, but result in high levels of contamination in treated water. Urbanization can exaggerate water stress as crowding reduces per capita water availability – a problem that is only going to worsen with climate change and increasing demands on finite groundwater sources.<sup>18</sup>

Undernutrition can hamper intellectual and physical development in children and compromise immune function. Maternal and child undernutrition may underlie more than one-third of the global disease burden in children under five years of age, and at least 20% of maternal mortality.<sup>19</sup> The availability of adequate and nutritious food supplies depends on interlinked economic, political, and environmental factors. Poor urban households may lack not only the financial resources to buffer changes in food costs, but also any benefits that subsistence farming offers to poor rural communities. Households made vulnerable by food insecurity or socioeconomic isolation – as well as migrant laborers separated from family support networks – appear more likely to engage in behaviors, such as transactional sex, that increase the risk of HIV transmission.<sup>20</sup>

Tuberculosis spreads most easily among densely crowded populations affected by chronic undernutrition and environmental health threats such as indoor and outdoor air pollution. Co-infection with HIV significantly increases the risk of active TB disease even in the absence of AIDS-defining conditions and regardless of antiretroviral therapy. All of these risk factors are concentrated in the growing urban areas of low and low-middle income countries, creating perfect conditions for the transmission of TB including drug-resistant strains arising from incomplete or inadequate treatment.<sup>21</sup>

Overcrowding in slums throughout the world (with as many as 13 people cooking, eating, and sleeping in a space of less than 450 square meters) can also accelerate the spread of other communicable diseases including the acute respiratory infections that remain the leading infectious cause of death worldwide.<sup>22,23</sup> Air pollution from the indoor burning of solid fuels, industrial sources, and traffic emissions increases susceptibility to acute respiratory infections and non-communicable cardiovascular and respiratory conditions.<sup>24</sup>

Many urban centers now carry a dual disease burden: morbidity and mortality associated with infectious diseases and complications of pregnancy remain relatively high, while the prevalence of chronic diseases such as coronary artery disease, ischemic stroke, diabetes, and some cancers climb sharply among working-age adults.<sup>25</sup> The spread of these chronic diseases is the result of a complex interplay of social, economic and behavioral factors. In the last decade, behavioral risks or “lifestyle choices” that increase the odds of developing chronic diseases have increased dramatically among cities in developing regions.<sup>26</sup> For example, in both sub-Saharan Africa and South Asia, tobacco use tends to be highest among urban men of lower socioeconomic and educational status, and is particularly prevalent among slum dwellers.<sup>27,28</sup> Not all unhealthy behaviors represent voluntary preferences. Despite assumptions about the “failure of rationality” in lifestyle choices, the unintended consequences of deliberate policies (such as domestic protections for sugar producers, which may make sweets much less expensive than fruit) and marketing also play significant roles. Secondhand smoke and the marketing of unhealthy foods and sugared drinks to children are instances where personal choice is limited.<sup>29</sup>

The urban poor face economic and time pressures to purchase energy-dense, nutrient-deficient foods, and are less likely to have access to adequate healthcare or nutrition information. Urban dwellers often find less physically demanding work than their rural counterparts, with the likelihood of recreational exercise largely determined by education and income levels. In sprawling urban agglomerates, many non-working hours may be spent sitting in buses or cars mired in traffic congestion. Housing costs

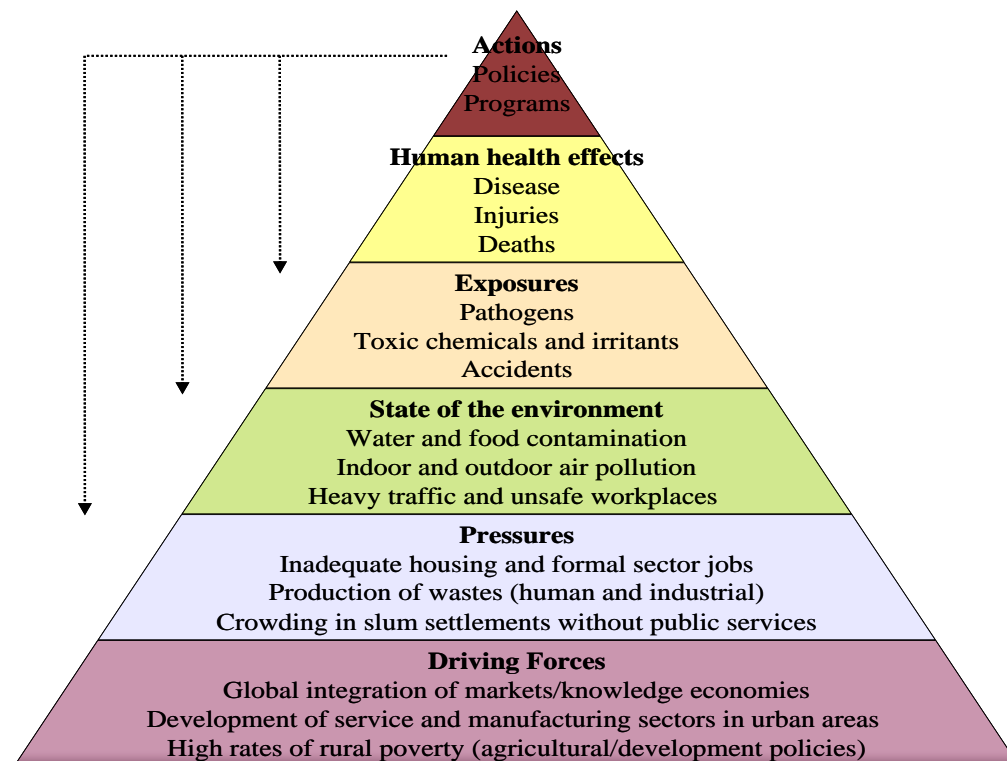
often drive the poor to outlying peri-urban areas in search of housing that is both safe and affordable. For example, the poorest socioeconomic groups in Rio de Janeiro spend an average of three hours daily commuting from peripheral neighborhoods into the urban core and back. Although deliberate urban planning can encourage physical activity, this has not been a priority in low- and middle-income countries, and the urban poor appear to be on a trend toward increasingly sedentary lifestyles.<sup>30</sup>

Unsurprisingly, groups from the lowest socioeconomic levels are significantly more likely than their neighbors to suffer from one or more non-communicable chronic diseases (NCD). Chronic diseases tend to take a higher toll at a younger age in low- and middle-income countries.<sup>31</sup> Urban centers typically offer a wider array of public and private healthcare options than rural areas, but the resulting patchwork of varying affordable and accessible treatment options does not encourage the type of integrated healthcare programs that can delay the onset and severity of NCD symptoms. Disabilities from NCD can limit labor market participation and curb household consumption and savings. In the worst case, catastrophic spending on health and long-term care can lead to household impoverishment, exacerbating inequities.<sup>32</sup>

The stratification of health status among populations can also exacerbate perceptions of relative deprivation, increasing socioeconomic, political, and cultural frictions. Rates of intentional violence across the Latin America and Caribbean region, where profound income inequality remains the norm, are double the world average. Violent crime and homicide rates in Mexico City, Rio de Janeiro and São Paulo significantly exceed their national averages (more than two-fold in the case of Rio), with implications for life expectancies and mental health in affected communities.<sup>33,34,35</sup> The urban centers of South Africa are similarly notorious for violent crime. In both regions, higher socioeconomic status offers partial insulation against exposures to such violence, as the wealthier classes sequester themselves in enclaves protected by private security measures.<sup>36</sup>

Although the proximate causes of these health effects vary, they are often rooted in the same “upstream” societal forces. One of the major challenges in analyzing health risks associated with development and environmental changes lies in understanding all of the causal pathways that converge to influence any given health indicator, such as the incidence of acute respiratory infections in a slum population. Figure 2 depicts a framework for analyzing how global socioeconomic and governance trends ultimately influence urban health effects, using the “Driving Forces–Pressures–State–Exposure–Effects–Action” model to consider the health effects of exposures to physical, chemical, and biological hazards in the context of broader market forces and population growth.<sup>37</sup>

Figure 2. Globalization and urbanization drive changes in human behavior that affect the quality of the environment, exposures to health risks, and, ultimately, population health



This schematic depicts how the “Driving Forces–Pressures–State–Exposure–Effects–Action” framework can be used to understand the relationships between global and national economic drivers and health indicators at the community or city level. Arrows indicate opportunities for policy and programmatic interventions to ameliorate any negative public health consequences. (After Corvalan, Briggs, and Kjellstrom, 1996.)

## GLOBAL INTERCONNECTEDNESS

Urban health once fell solely into the province of local decision makers. However, the increased interdependence of markets and interconnectedness of cultures creates substantial global risk in parallel with economic opportunities. The annual international movement of millions of travelers from countries with considerable burdens of malaria, dengue fever, tuberculosis, and other endemic diseases to low prevalence countries attracts the attention of the public health community for obvious reasons. The diffusion of behavioral risk factors for chronic diseases from mature market economies to low- and middle-income nations is also of considerable concern, but until recently attracted less public attention.

### *Travel and Trade*

Many megacities and near-megacities serve as regional hubs for travel and trade. As demonstrated by the 2009 H1N1 influenza outbreak and the spread of SARS in 2003, the volume of international air transit allows emerging infections to spread between air hubs too rapidly to be contained with current disease detection and response

capabilities. Intra-regional and domestic migration facilitate the circulation of diseases between vulnerable urban and rural populations – such as the cycling of malaria and polio strains between rural Indian states and Mumbai – allowing the resurgence of disease threats despite public health interventions.<sup>38,39</sup> Workers in developing regions frequently travel between urban and peri-urban workplaces and their rural home provinces. In some countries, national household registration policies that limit the portability of health coverage or other government services reinforce this cycle. These trips help outbreaks cycle between rural areas, where the risk of infectious disease exposures may be much higher and disease surveillance and treatment capacities much lower, and cities densely populated with susceptible local and foreign populations.

For example, in 2007 and 2008, health authorities in Paraguay, Brazil, and Argentina reported clusters of yellow fever in urban areas for the first time in decades.<sup>40</sup> Brazil suspended exports of its domestically produced yellow fever vaccine and requested an additional four million doses of vaccine from the global emergency stockpile managed by the International Coordinating Group on Vaccine Provision for Yellow Fever Control for an emergency vaccination campaign targeting seven million people.<sup>41</sup> Three major factors most likely fostered resurgence of the disease: the circulation of workers between densely populated urban centers and rural or peri-urban areas, where deforestation has increased exposures to the *Aedes aegypti* mosquito vector; poor management of fresh water and wastes in deprived urban areas, providing the mosquito vector with breeding habitats; and lack of a long-term political commitment to a sustained mosquito control program that crosses national borders.

Thailand offers another example of health risks among highly mobile, intersecting populations. Employment opportunities for unskilled laborers in the greater Bangkok metropolitan region attract legal and illegal migrants from less-developed neighboring countries, as well as from the Thai countryside.<sup>42</sup> Migrants often turn to crowded slum housing with poor protection from the mosquitoes that transmit various infectious diseases.<sup>43</sup> Thailand (like Brazil) has recently experienced a high incidence of dengue fever, another illness borne by the *Aedes aegypti* mosquito. Epidemics of dengue hemorrhagic fever, the most serious form of the disease, have radiated outward from Bangkok in a traveling wave, eventually affecting every province.<sup>44</sup> Despite Thailand's highly integrated disease detection and response infrastructure, dengue epidemics can spread across the entire country in the space of months.<sup>45</sup> The influx of international migrants over the last decade has also coincided with an increase in reported malaria cases, from 51,271 cases in 2004 to 63,272 in 2006 (50% of cases? in the migrant population).<sup>46</sup> Thailand's tourism and business sectors draw large numbers of temporary migrants from beyond the region; Bangkok's airport is among the top 20 busiest in the world, hosting over 38.6 million travelers in 2008.<sup>47</sup>

### *Food*

Shifts in technologies and trade promote the “nutrition transition,” a shift from diets based on traditional grains, fruits, and vegetables to increased consumption of animal products and high-calorie foods.<sup>48</sup> As worldwide consumption patterns and preferences become more homogenous, food marketing and delivery trends continue to converge across middle- and high-income nations.<sup>49</sup> Trade liberalizations have fostered

the multinational proliferation of supermarkets, convenience store, and fast food outlets which market low-cost, calorie-dense, nutrient-deficient foods. Studies suggest that income elasticity is high for foods such as prepared sweets and soft drinks, so that snacking tends to increase rapidly as incomes rise in low- and middle-income countries.<sup>50</sup> Easy access to low-cost processed foods contributes to rapid increases in overweight and obesity. As a consequence, deaths from diabetes in low- and middle-income countries are projected to nearly double between 2008 and 2030.<sup>51</sup> At the same time, children of the urban poor are at increased risk for undernutrition. This can lead to side-by-side obese and malnourished populations in cities undergoing socioeconomic transitions, sometimes within households.<sup>52</sup>

### *Animal/Human Interface*

To support the nutritional demands of urban populations, the agriculture industry often creates complex food supply and delivery networks that stretch into rural and peri-urban areas. Concentrated livestock populations on the margins of large urban areas expand the opportunities for pathogens to move among species at the human-domestic animal-wildlife interface. The increased demand for animal protein and the popularity of urban “wet markets” for selling live or freshly butchered animals multiplies the odds of human exposures to zoonotic diseases. These often occur in settings where crowding and poor underlying health status increase susceptibility to infectious diseases.<sup>53</sup> The SARS virus provided a case study of how a novel pathogen might cross from a wild animal vector (bat) into a cultivated animal (civet), and then into urban populations through marketing, handling, or food preparation. The emergence of West Nile virus in New York City in 1999 (when mosquitoes presumably imported as a byproduct of trade transmitted an infection previously unknown in the U.S. to humans, zoo animals, and the wild birds that serve as a disease reservoir) pointed to the continuing gaps in knowledge and resources of the ecology of urban green spaces.<sup>54</sup>

### **GOVERNING THE FLOW OF HEALTH RISKS**

In one sense, urbanization improves the odds of fulfilling one of the traditional roles of public health: ensuring access to safe water and adequate sanitation. Urban water and sanitation systems can reach many more people, more cost-effectively, than small-scale water improvement projects scattered through rural villages. Effectively managed basic public services can ameliorate many of the physical, chemical, and biological hazards associated with industrialization and increasing population density. Large urban centers also tend to attract skilled health workers and foster community mobilization, producing a higher concentration of health and social services than in surrounding rural areas. These can create an urban advantage in terms of child survival and other indicators of population health. However, proximity does not guarantee access to such interventions. In areas of concentrated disadvantage, including slums, poor and migrant households may still incur urban health penalties – in some cases not only considerably worse off than their more affluent near-neighbors, but than their rural counterparts.<sup>55</sup>

No case illustrates the intersection of governance and the underlying determinants of health more clearly than the provision of safe water and sanitation services. Developing nations may devote as much as 5% of gross domestic product (GDP) to providing urban water and sanitation services. However, spending is not synonymous with success, as illustrated by the example of Lagos. Investments in Lagos steadily increased the capacity to deliver household water between the 1970s and early 2000s, but not quickly enough to keep pace with demand. Reforms passed in 2004 laid the groundwork for increased privatization of the state water utility and also launched a major overhaul and expansion of existing municipal water treatment and delivery systems. The strategy ultimately attracted World Bank support, but political and economic risks discouraged foreign investors.<sup>56</sup>

By the end of 2008, vigorous efforts by the state water authority achieved a water delivery capacity of 200 million gallons per day (mgd) against a demand of 600 mgd, a gap of about 66%. Plans to rehabilitate and expand waterworks should boost the water supply to about 241 mgd by 2015 – still far short of current needs.<sup>57</sup> Periodic electrical failures prevent existing treatment plants from operating at their design capacity. The Lagos Water Corporation (which spans 20 independently administered local government areas in the conurbation) rarely collects adequate revenues for the water it does deliver, eroding capital and maintenance budgets.<sup>58</sup> Households lacking piped water in the home or from community taps turn to private wells or street vendors to meet drinking water needs, creating a thriving market for “sachet water,” commercially purified water packaged in polyethylene pouches. Sampling studies have shown that, despite popular perceptions of purity, sachet water frequently exposes consumers to bacterial and heavy metal contamination exceeding local regulatory standards.<sup>59, 60</sup> The plastic packages themselves create a solid waste hazard that chokes waterways and drainage systems. Perceptions of water safety and purification at the point of use echo findings elsewhere: households tend to be more concerned with the appearance and taste of water than the invisible load of microorganisms. The number of cases of waterborne diseases such as cholera and dysentery reported annually in Lagos has increased over the past two decades.<sup>61</sup>

This is by no means atypical: when public services fail, poor households often turn to private vendors who inflate prices for the poorest customers, charging from 50% to more than 1200% in excess of typical local rates.<sup>62</sup> Households that cannot afford these services are likely to turn to unsafe bore wells, untreated open water sources, or illegal taps, increasing community exposures to water-borne illnesses and contaminants. Population growth concentrated in developing regions will plunge more countries into water stress by 2030, increasing demands on water by all sectors.<sup>63</sup>

The risks of such municipal governance failures can be significant for spread of diseases between and beyond urban communities. For example, hyper-inflation in Zimbabwe compounded serious challenges in managing water and sanitation services in the capital of Harare in the late 2000s. Services became increasingly intermittent, ceasing altogether in outlying suburbs for prolonged periods by July 2008.<sup>64</sup> In August 2008, an outbreak of cholera began just south of Harare. The complete failure of Harare’s piped water and sewage systems facilitated rapid spread among crowded urban

populations, just as the public health system collapsed.<sup>65</sup> People leaving the dysfunctional capital for holiday travel or to seek care at rural health outposts spread the outbreak to every province in the country. Migrant workers and medical refugees seeking health services spread the disease to Botswana, Mozambique, South Africa and Zambia. In December 2008, Zimbabwe's government declared the cholera outbreak a national emergency and called for international assistance.<sup>66</sup>

The industrializing cities of nineteenth century Europe and the United States illuminated the "urban health penalty" more than a century ago: the crowding of people and environmental health risks amidst socioeconomic upheaval can leave poor households even more vulnerable to disease.<sup>67</sup> The same patterns are now being repeated among emerging and developing economies. At every level of development, the middle and upper classes insulate themselves against many environmental hazards with resources and technologies. Vaccines and antibiotics interrupt the transmission of diseases common among those at the lowest socioeconomic levels. Options for circumventing weak public health and safety systems range from bottled water to private security forces. Many simply take refuge behind high walls where external hazards can be more easily avoided. This effectively exaggerates existing health inequities, and reduces incentives for the growing professional classes to demand better urban governance – a key factor in spurring the historical sanitary reforms that helped offset the urban health penalty in industrialized settings.<sup>68</sup>

## URBAN GOVERNANCE

Given the myriad health risks, more research is needed to examine the options available to govern the flow of health risks within and between urban areas, and assess best practices for effective governance. At the global level, three separate agreements create relevant frameworks for international actions: the Millennium Development Goals (MDG), the Framework Convention on Tobacco Control (FCTC), and the revised International Health Regulations [IHR (2005)]. UN Member States and international development institutions adopted the Millennium Development Goals (MDGs) in 2000, establishing donor consensus on measurable steps toward reducing global poverty by 2015. Three of the MDGs address health issues directly (reducing child mortality, improving maternal health, and combating HIV/AIDS, malaria, and other infectious diseases). Other relevant MDGs set targets for improving conditions for slum dwellers and increasing access to sanitation, nutrition, clean water, and affordable pharmaceuticals.<sup>69</sup> The MDGs helped focus international attention on the role of governance in the delivery of basic services, with an emphasis on strategies to "reinvent government," primarily through decentralization of authorities to the local level.<sup>70</sup>

The FCTC governs the international flow of a specific health risk: the globalization of the tobacco industry, and the public health implications of increasing tobacco use in developing regions. Concerns about the future burden of tobacco-related chronic diseases helped spur an unprecedented level of cooperation between state and civil society actors during negotiation of an "evidence-based treaty" through the World Health Organization (WHO), aimed at curtailing the tobacco industry's transnational marketing influence by harmonizing national and local tobacco control policies.<sup>71</sup> Finally, the IHR (2005) require all 194 States Parties to develop the core capacities to

detect, assess, report, and respond to public health emergencies when and where they occur, and to report such incidents promptly and transparently if they pose a risk for international spread.<sup>72</sup> The IHR (2005) conceptually value mutual protection from transnational disease threats over sovereignty, providing an operational framework for reciprocal responsibility.

All three of these global agreements share a core trait: they depend on national, provincial or state, and local stakeholders for effective implementation. The past two decades have seen widespread adoption of reforms that stress decentralization of planning and program authorities to the local level, both within health systems and across governments. Decentralization strategies generally replace top-down vertical management with more flexible decision-making instruments, placing responsibility into the hands of stakeholders who are familiar with local conditions and most directly affected by services. In practice, results can be decidedly mixed for reasons that range from lack of local public administration capacities to capture of programs by local elites. However, new governance strategies that deliberately encourage participation by non-governmental organizations and community actors have proved successful in areas such as community water management and public sanitation projects. Public health leaders have begun to identify best practices in community participation, and in building the capacities for local governance of services and health programs. This will require a new approach to sustainable development in the context of urbanization, with new demands on leadership between the immediate community and national levels. As described succinctly by Burris et al., “Local governments typically are short not just on cash but on properly trained bureaucrats with the skills and incentives to use their power productively.”<sup>73</sup>

Maintaining public health surveillance and intervention programs to prevent outbreaks among vulnerable urban populations requires an unrelenting infusion of resources, political commitment, and technical competency. Increasing urbanization and decentralization of government functions means that municipal leaders are responsible for a larger share of national public health challenges, with tools that are often an unplanned, poorly integrated mix of public and private assets. The driving forces are generally beyond their control – and preventing the spread of health risks within and beyond the city may be a very low priority compared to more immediate socioeconomic concerns. A 2006 survey of public and private sector stakeholders in the management of the world’s largest cities found that although environmental sustainability, health, and security issues represented serious concerns, more than 80% of respondents cited economic competitiveness and employment as the primary drivers in urban decision-making. Despite the increasingly obvious toll of inadequate access to safe water and sanitation on economic growth and workforce productivity, only 3% of respondents ranked water and sanitation first among issues affecting economic competitiveness.<sup>74</sup>

The private sector plays an important role in service delivery within urban areas, from pharmaceutical distributors to privately run, highly sophisticated health clinics. This can increase access to services but may also exacerbate fragmentation of health systems at the national and sub-national level, with implications for public health surveillance, reporting, and response across populations. To implement the revised IHR and the FCTC successfully in an urbanizing world, the global health community must

seriously consider integration of the private sector—from NGOs to for-profit service providers – into public health planning and policy development.

Local decision makers and their national and international counterparts will require not only examples of best practices, but significantly more data to understand the roles of social networks and other emerging factors in containing or propagating the flow of health risks. Major gaps remain in identifying acute urban public health vulnerabilities – such as “hot reservoirs” and “hot settings” for disease emergence and spread – and in establishing the baselines that would allow officials to identify unusual events before they become health crises. The flow of health risks directly between major urban centers, as well as along the increasingly blurred rural-urban continuum, has been glimpsed only in fragments. Mapping such risks will require cross-sector engagement beyond the public health community, including expertise in urban planning, migration, and animal and environmental health.

Public health vulnerabilities with implications for the emergence of potential pandemics are clearly not unique to megacities and near-megacities, but these massive urban centers represent a special challenge for global health security. The fluid evolution of informal settlements and markets accommodates a dynamic workforce, but also creates conditions hospitable to new, re-emerging, and drug-resistant diseases in the midst of densely crowded communities. These “international cities” are often not only drivers of economic growth but trade and transit hubs for their countries – cross-roads for the movement of people, animals, and goods, and thus for disease vectors.

Neither the emergence of lethal new diseases nor the vulnerability of poor and marginalized populations to health catastrophes represents a new phenomenon. What has changed in recent decades is the extreme and routine mobility of international travelers and the interdependence of economies via financial markets and global inventory systems. In this context, emerging and re-emerging infections pose a direct threat to vital national, regional, and global interests and could represent a singular concern for the densely populated urban centers where disease multipliers can exacerbate the rapid spread of disease. The disease burden caused by environmental and behavioral health risks may also erode economic growth, with implications for stability and for societal resilience. Finally, the perception that government leaders have failed to meet public health and safety needs can reverberate politically. Successive community and household health crises may undermine public trust in the priorities, effectiveness, and ultimately the legitimacy of governments that fail to implement necessary reforms.

Such concerns have helped catapult global health issues, from capacity building for emerging infectious disease control to global health governance to development assistance for health, into foreign policy and security discourse worldwide. Future success in governing the flow of health risks in an increasingly urbanized world will require a better understanding of urbanization itself as a determinant of health, and the evolution of mechanisms to strengthen multi-stakeholder networks organized around health risks and capabilities rather than borders.

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