

# URBAN HEALTH: Evidence, Challenges, and Directions

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■ **Abstract** Urbanization is one of the most important demographic shifts worldwide during the past century and represents a substantial change from how most of the world's population has lived for the past several thousand years. The study of urban health considers how characteristics of the urban environment may affect population health. This paper reviews the empirical research assessing urban living's impact on population health and our rationale for considering the study of urban health as a distinct field of inquiry. The key factors affecting health in cities can be considered within three broad themes: the physical environment, the social environment, and access to health and social services. The methodologic and conceptual challenges facing the study of urban health, arising both from the limitations of the research to date and from the complexities inherent in assessing the relations among complex urban systems, disease causation, and health are discussed.

## INTRODUCTION

Urbanization is likely the single most important demographic shift worldwide during the past century and in the new century, and it represents a sentinel change from how most of the world's population has lived for the past several thousand years (83). Current estimates suggest that the trend toward an urbanizing world will continue well into the twenty-first century (15). At the beginning of the nineteenth century only 5% of the world's population was living in urban areas. By the end of the century, about 46% of the world's population was living in urban areas (15, 49). There are ~50,000 urban areas in the world today and almost 400 cities containing a population of one million people or more (110). Around 1940, the New York metropolitan area became the first urban area to become a megacity containing more than 10 million inhabitants. Today there are more than 15 megacities worldwide (109, 110). Overall global population growth in the next 30 years will be primarily in cities. Current projections suggest that more than half the world's population will be living in urban areas by 2007 and that nearly two

thirds of the world's population will live in urban areas within the next 30 years. By 2010, approximately 4000 million people will live in urban centers worldwide (49).

We might expect such a shift in how the majority of the world's population lives to have health implications. Indeed, researchers, both in the popular press and in the academic literature, have long been interested in cities and how they may affect the public's health. Writers from several eras in western European history considered cities as places that were detrimental to health, and in many ways, for much of history, cities were, in fact, characterized by features that were unquestionably linked to poor health. Charles Dickens's novels detail and offer insights into the difficulties of city life in the nineteenth century (22). As cities assumed a greater role in the life of European countries, population density, numbers of marginalized populations, pollution, and crime frequently increased, resulting, in many countries, in worse health in cities than outside of cities (76, 115). Multiple writers, commentators, and social theorists observed the problems endemic to these growing cities and suggested that the cities themselves had a role in shaping individual well-being (25, 26, 28, 80).

However, whereas writers in the eighteenth and nineteenth centuries overwhelmingly noted a connection between the urban context and poor health, the urban environment in many Western cities improved dramatically at the turn of the twentieth century, and coincident with this sanitary awakening, the health of urban populations improved. One historical analysis showed that, although for much of the nineteenth century infant mortality rates in Imperial Germany were higher in urban areas than they were in nonurban areas, there was a dramatic improvement in infant mortality rates in urban areas starting in the 1870s, which preceded a comparable decline in mortality in the rest of the country (126). This analysis suggested that improvements in the urban environment were responsible for this rapid improvement in infant health in Imperial Germany and that this pattern was typical of the pattern observed at around the same time in many European industrialized societies (112). Today, in many countries, including the United States, aggregate health, as measured by life expectancy, all-cause mortality, and many other health indicators, is actually better in many urban areas than it is in nonurban areas (102).

What then is urban health, and why should we concern ourselves with urban health as a specific subject of inquiry? As urban living becomes the predominant social context for most of the world's population, the very ubiquity of urban living promises both to shape health directly and indirectly to affect what we typically consider risk factors or determinants of population health. Therefore, despite the truism that the urban context inherently shapes population health in cities, not all public health is urban health. We consider urban health research to be the explicit investigation of the relation between the urban context and population distribution of health and disease. Urban health, then, concerns itself with the determinants of health and diseases in urban areas and with the urban context itself as the exposure of interest. As such, defining the evidence and research direction for urban health requires that researchers and public health professionals pay attention to theories

and mechanisms that may explain how the urban context may affect health and to methods that can better illustrate the relation between the urban context and health. To that end, in this review we first discuss what we mean when considering urban areas; then we address potential mechanisms that can explain the relation between the urban context and health. We discuss particular challenges in the study of urban health and conclude with directions for potential research and practice.

## CITIES AND THEIR ROLE IN THE WORLD

As we discuss urban health, we are implicitly assuming that readers share an image of cities and urban areas. However, our personal experiences likely have shaped what we think of when we discuss “cities” and “urban areas.” Saul Bellow, the novelist and Nobel Prize laureate, in discussing how Americans think of New York City, suggested, “That is perhaps like asking how Scotsmen feel about the Loch Ness monster. It is our legendary phenomenon, our great thing, our world-famous impossibility. . . . New York is stirring, insupportable, agitated, ungovernable, demonic. No single individual can judge it adequately” (11a). In academic discourse investigators have long disputed the definition of “urban” (45). Cities are not static, and the very density and diversity that characterize most cities make generalizations about defining cities difficult. We discuss below the implications of these definitional challenges for the empirical study of urban health. Meanwhile we can consider different types of cities using an example that all readers are likely familiar with.

Cities can be sprawling, diffuse, and automobile-dependent metropolitan areas. This has led to recent substantial academic discourse about urban sprawl (37). For example, in Atlanta, Georgia, the average person travels by car more than 34 miles each day, which is more than twice as many miles as people in Philadelphia, Pennsylvania, drive (121). Conversely cities can be small and compact, as are many old European cities like Venice. Cities can be unique, cosmopolitan places (e.g., Paris, Casablanca), but also they can look tremendously alike, as do any number of mid-sized North American cities (e.g., Kansas City, Denver). Cities frequently include both sophisticated and wealthy areas, featuring commercial and entertainment interests that are among the best in their country, as well as areas of extreme poverty and deprivation. For example, Rio de Janeiro has among the world’s most expensive tourist resorts abutting on extremely poor favelas; in New York City, the Upper East Side and Harlem are adjacent neighborhoods that are among the richest and poorest neighborhoods respectively in the United States. Cities are generally the centers of commerce and culture in their countries and geographic regions. However, proximity to other cities frequently defines the range of opportunities available in a particular city. For example, a regional capital in a large, sparsely populated area, such as Whitehorse in Canada’s Yukon territory, is likely to have more diverse cultural offerings and a greater range of health services available than would a comparable-sized city close to other, far

larger, urban areas. Therefore, cities can represent diverse conditions within which people live and can represent a range of human experiences. Throughout the rest of this review we discuss how these diverse places may affect health and how the systematic study of urban health may afford opportunities to improve population health.

## MECHANISMS OF DISEASE: WHY CITIES MAY SHAPE POPULATION HEALTH

How does the urban context affect health? In particular, what are the mechanisms by which cities can affect health? Before answering this question, a couple of considerations are in order. First, there is no one way in which the urban context may affect health. Although, for the sake of explication, we generally discuss mechanisms and health in general, frequently different mechanisms are important potential explanations for the relations between the urban context and different diseases. As we discuss potential mechanisms, we consider health as one construct but make reference to specific theoretical distinctions and empirical examples that suggest how various factors may be important in different ways for diverse conditions. Second, as we highlight in the preceding section, cities ultimately are geographic places. Although cities are not static, and in fact cities' dynamism is one of their defining features, considering health in cities is fundamentally the study of how a particular type of place may affect health. Explanations for these potential effects then rest primarily on how characteristics of places, in this case cities, may be important health determinants. Several characteristics of cities may be important health determinants, each having multiple implications for urban dwellers. Academic interest in urban health has waxed and waned over the past century; several authors at different time points have proposed frameworks for considering the relation between city living and health, and they have identified features of the urban context that may be particularly important for specific diseases (42, 73, 91, 124). Many of these frameworks build on work that discusses the social and economic determinants of better population health (31, 52, 61). We find it useful to think of three broad categories of theories and mechanisms that may explain how city living can affect health: the physical environment, the social environment, and the availability of and access to health and social services.

### The Urban Physical Environment

The urban physical environment includes the built environment: the air city dwellers breathe, the water they drink, the indoor and outdoor noise they hear, the park land inside and surrounding the city, and the geological and climate conditions of the site where the city is located. McNeill has suggested that primarily what distinguished the twentieth century from previous ones, and cities from nonurban areas, is the degree to which humans have become the primary influence on the physical

environment (84). Although the literature on the relation between features of the physical environment and health is vast, we consider here some of the primary evidence linking key features of the physical environment to health.

**THE BUILT ENVIRONMENT** The human built environment can influence both physical and mental health; empirical evidence about the relation between the built environment and health conditions includes, among others, asthma and other respiratory conditions, injuries, psychological distress, and child development (30, 71, 92). As an example, Weich and colleagues in 2002 (129) demonstrated higher levels of resident depression in areas that had less desirable built environments. In a study of New Orleans neighborhoods, Cohen (20) found that the prevalence of gonorrhea infection was higher in neighborhoods with deteriorating built environments. Different aspects of the built environment have been linked to specific health outcomes. For example, specific features of the built environment, including density of development, mixed land uses, scale of streets, aesthetic qualities of place, and connectivity of street networks, may affect physical activity (54). In turn, low levels of physical activity are a well-established risk factor for cardiovascular disease and all-cause mortality in urban areas (23, 97). A substantial literature addresses the relation between housing and health (68, 122). Recent work has begun to differentiate the roles of the external and the internal built environment in shaping health (56). Urban design may also affect health behaviors, crime, and violence rates (12, 89, 108), suggesting close interactions among urban physical and social environments.

**URBAN INFRASTRUCTURE, WATER, AND SANITATION** The urban infrastructure is a critical part of the physical environment and determines how a city provides water, disposes of garbage, and provides energy (85). Water scarcity and water pollution are serious urban problems, particularly in less-wealthy countries. Nearly 1.5 billion people lack safe drinking water, and at least 5 million deaths per year can be attributed to waterborne diseases (70). The relation between the urban infrastructure and health is shaped by different forces in established urban areas and in rapidly growing urban areas. In longstanding urban areas, the decline of an aging infrastructure, coupled with frequently declining municipal resources, may challenge cities' ability to continue to provide safe water and sanitation for urban residents. Breakdowns may increase, causing health problems related to water, sewage, or disposal of solid waste (44). In rapidly urbanizing areas, frequently in less wealthy countries, cities are often challenged to maintain an adequate fresh water supply to growing numbers of urban residents and to transport accumulating sewage and other waste. The World Health Organization (WHO) estimates that most urban populations in developing countries do not have access to proper sanitation (136). Inadequate provision for solid waste collection frequently results in contamination of water bodies, which, coupled with the population density inherent to cities, presents a substantial risk for spreading epidemics rapidly (6, 18, 109).

**POLLUTION** In the first half of the twentieth century, air pollution in the United States increased steadily as industrialization progressed, industries and homes used coal for power and heat, and cars proliferated. Cities had worse pollution than did nonurban areas (84). In the second half of the century, however, and especially in the past 25 years, many forms of pollution decreased as coal was phased out, manufacturing plants moved to the suburbs or abroad, lead was banned from gasoline, and the automobile industry was forced to build cleaner cars. However, cities still generate close to 80% of global carbon dioxide emissions and account for three quarters of industrial wood use worldwide (93). As late as the mid-1990s, investigators estimate that air pollution contributed to 30,000–60,000 deaths per year in the United States (24, 106). Indoor and outdoor air pollution are thought to contribute to 3 million deaths globally a year, with 90% of these deaths being in less wealthy countries (136). Worldwide, atmospheric pollution is thought to affect more than a billion people, mostly in cities (29, 104).

**ACCESS TO GREEN SPACE** Some of the earliest studies that considered the relation between the urban context and health emphasized the role of access to parks and green space, or lack thereof, in shaping the health of urban populations. Griscom's report about housing in New York City in 1845 suggested that a lifestyle filled with "animal and vegetable exhalations" in the countryside provided "prima facie proofs" of the superiority of living in the countryside (45, 46). Although it remains generally recognized that public green spaces make for a more pleasant living environment (73), the empirical literature evaluating the relation between green space and health remains limited. Recent work has shown that living in areas with walkable green spaces, as opposed to living in areas without walkable green spaces, was associated with greater likelihood of physical activity (14), higher functional status (50), lower cardiovascular disease risk (74), and longevity among the elderly, independent of personal characteristics (119, 120). As more multidisciplinary work in urban health develops, more experimental and observational studies likely will assess the role of green space and urban planning in promoting health.

**URBAN CLIMATE** Highways and streets can pollute water through runoff, destroy green space, influence motor vehicle use and accident rates, and contribute to the urban heat sink, absorption of heat that can increase by several degrees the temperature in cities. On warm days, urban areas can be more than 5°F warmer than surrounding areas, an effect known as the urban heat island effect (37). This effect is primarily due to dark surfaces absorbing heat and the limited ability of urban areas (with relatively few trees) to cool the air through transpiration. Global climate change may exacerbate this effect. Heat is a concern in urban areas in several ways, and ambient air temperature has been associated with a large number of hospitalizations and deaths yearly (10, 78). Heat exposure may result in direct health effects, including syncope or heat exhaustion, or exacerbate existing health disorders. Excess heat in urban areas can also exacerbate pollution, as cooling equipment (e.g., air conditioners) is put into heavier use to compensate for rising

urban temperatures (60). Particular groups may be most at risk of the effects of heat in urban areas. Epidemic heat-related deaths have been particularly pronounced among socioeconomically disadvantaged and socially isolated elderly persons (67, 113).

**OTHER FEATURES OF THE URBAN PHYSICAL ENVIRONMENT** Several other aspects of the urban physical environment may have specific relations to human health, and a full review of all relevant features of the physical environment is beyond the scope of this chapter. However, we note that city structures like bridges and skyscrapers may be vulnerable to natural or manmade disasters, as recent earthquakes in Japan and Iran and the September 11, 2001 terrorist attacks on New York City demonstrate, respectively. Features of the urban social environment, such as population density and social contagion, coupled with these vulnerable urban structures, can result in substantial health consequences after disasters in urban areas (39, 111). Other threats to health in cities include hazardous waste landfills, often located in or near urban areas, which may be associated with risks of low birth weight, birth defects, and cancers (127). Noise exposure, a common urban problem, may contribute to hearing impairment, hypertension, and ischemic heart disease (96).

## The Urban Social Environment

The social environment has been broadly defined to include “. . . occupational structure, labor markets, social and economic processes, wealth, social, human, and health services, power relations, government, race relations, social inequality, cultural practices, the arts, religious institutions and practices, and beliefs about place and community” (9). This definition, by its very complexity, suggests that there are multiple ways in which the urban social environment may affect health. Building on the extant theoretical and empirical literature we consider here five features of the urban social environment that may be particularly important determinants of health in cities. Although these concepts have, in large part, arisen from sociological theory, many of them have been increasingly integrated into public health thinking that explores the relation between contextual characteristics and health.

**SOCIAL DISORGANIZATION/STRAIN** Social disorganization theory was first developed in studies of urban crime by sociologists in Chicago in the 1920s and 1930s. In brief, social order, stability, and integration are conducive to conformity, whereas disorder is conducive to crime and poor integration into social structures (114). A parallel theory, frequently referred to as anomie/strain theory, suggests similar explanations for the relations between social structure and behavior. Drawing on the work of Durkheim (26), Merton suggested that anomie is the lack of societal integration, which arises from the tension between aspirations of industrialized persons and the means available to them to achieve those aspirations (86). In the urban context in particular, the exposure of persons of all social classes to high

aspirations that are practically unachievable produces strain or pressure on these groups to take advantage of whatever effective means to income and success they can find, even if these means are illegitimate or illegal. Hence, Merton argued that social strain can be associated with crime. Contemporary anomie/strain theories suggest that other sources of strain in modern living, including confrontation with unpleasant stimuli, may be associated both with deviant behavior and with poor health (5, 19). A substantial body of research has established a relation between stress and social strain and mental and physical health (e.g., 27, 72, 98), and newer work has posited that features of the urban neighborhood context are associated with social strain and adverse health behaviors (13, 40).

**SOCIAL RESOURCES** Separate from social strain, individual social experiences also may be important determinants of health in cities. For example, limited social support may predispose persons to poorer coping and adverse health (63, 82). Scant evidence exists that social connectedness in cities is better or worse than in nonurban areas. Informal social ties are an important feature of city living that ultimately affect social support, network, and cohesion (38). Social capital effects, including manifestations at the contextual level (e.g., at the level of the whole city or of urban neighborhoods) and at the social network level, are thought to offer both general economic and social support on an ongoing basis and also make specific resources available at times of stress (63). Social capital is often defined in terms of features of social organization and is associated with lower all-cause mortality (65, 116), reduced violent crime (66), and self-reported health (118) among other health outcomes. In the context of cities, the greater spatial proximity of one's immediate network may well accentuate the role of networks in shaping health. Social networks are associated, importantly, with a range of health behaviors (58, 79).

**SOCIAL CONTAGION** Social learning theory emphasizes the importance of observing and modeling the behaviors and attitudes of others (8). This is particularly the case in densely populated areas where there are several persons on whom behavior can be modeled to determine behavior. In diverse urban settings, social learning can set both social norms and norms for social network behaviors. Similarly, theories of collective socialization emphasize the influence of the group on the individual (21, 134). These theories suggest that persons who are in positions of authority or influence in specific areas can affect norms and behavior of others in direct and indirect ways. One of the concepts that is linked to social learning that may have substantial implications for public health is contagiousness. Models of biological contagion, particularly in the context of infectious disease, are well established. For example, in recent years, group practices and social norms have been considered particularly important in transmission of sexually transmitted diseases and the transmission of human immunodeficiency virus (HIV) (101, 130). Newer theories include the possibility of contagiousness of ideas and social examples. In epidemiology it is understood that all things being equal, urban populations, characterized



by high population density are at higher risk of transmission of biological organisms. Also, because concentrated urban populations share common resources (e.g., water) the practices of one group can affect the health of others. These observations may be extended to behavior and to health. For example, media representations of suicide may have some influence on the suicide of those exposed to them such that suicide becomes more likely (100). Several studies have provided both theoretical and empirical reasons to suggest that media representations of suicide could have some influence on a person's suicidality (35). In the urban context, the concentrated proximity of persons and sources of information may be a crucible for the exacerbation of this effect.

**SPATIAL SEGREGATION** Spatial segregation of different racial/ethnic and socioeconomic groups also may be an important determinant of health in cities. Many cities worldwide are highly segregated with multiple historical, logistical, and practical barriers to mixing social groups. In their seminal work of mental disorder in urban areas, Faris & Dunham (32) describe a Chicago that had concentric circles wherein dwelled distinct groups whose social status was relatively unchanged even with migration of populations over time. Spatial segregation can have multiple effects, including the enforcement of homogeneity in resources and social network ties, suppressing diversity that may benefit persons of lower socioeconomic status. Persons who live in segregated communities may have disproportionate exposure, susceptibility, and response to economic and social deprivation, toxic substances, and hazardous conditions (132). One study of infectious disease transmission suggested that residential segregation contributes to the transmission of tuberculosis through concentrated poverty. Urban characteristics such as dilapidated housing and inadequate access to health care in turn are associated with concentrated poverty in cities (1). Racial segregation also may affect health through its influence on access to health care services. Segregated communities frequently face shortages of health care providers and disproportionately low rates of health insurance; both factors are among the most important predictors of differential access to medical care (81). More segregated communities may have lower levels of social capital, which, as discussed above, has been associated with poor health (64). Also, spatial heterogeneity permits persons of higher socioeconomic status to appreciate the issues faced by others and to use their power, money, and prestige to influence the development of better distributed salutary resources. Conversely, it is worth noting that spatial segregation, by virtue of keeping persons who are different apart from one another, may serve to minimize social strain (107).

**INEQUALITY** Although it is related to many of the other features of the urban social environment discussed here, the particular role of inequality as a potential determinant of health in urban areas is worth noting briefly. Although there is ample evidence for the relation between poor individual and group socioeconomic status and health (4), in the urban context, rich and poor populations live in physically proximate neighborhoods. We do not consider disadvantage per se a hallmark of

urban areas because in many instances aggregate wealth in cities is greater than it is in nonurban areas, but rather it is the relative proximity of rich and poor that is a common characteristic of cities worldwide. Empirical and theoretical work suggests that this inequality in the distribution of income and other resources may, in and of itself, shape health through multiple mechanisms. Ecologic evidence has long suggested that countries with more egalitarian distribution of income have lower mortality rates (103). In the early 1990s, a series of publications spurred further interest in the role of income distribution as an area-level determinant of health (131). Recent empirical evidence, although controversial, suggests that inequalities in income distribution contribute to health differentials between states and cities (62, 77, 105). The principal proponents of the hypothesized relation between income distribution and health suggest that perceived and actual inequity, caused by the discrepancies in income distribution, erode social trust and diminish the social capital that shapes societal well-being and individual health (65). Therefore, inequalities in urban areas may be important modifiers of the role of several other features of the social environment discussed here.

## Health and Social Services

The relation between provision of health and social services and urban living is complicated and varies between cities and countries. In wealthy countries, cities are characterized by a rich array of health and social services (17, 33). Even the poorest urban neighborhood often has dozens of social agencies, each having a distinct mission and providing different services. Many of the health successes in urban areas in the past two decades, including reductions in HIV transmission, teen pregnancy rates, tuberculosis control, and new cases of childhood lead poisoning, have depended in part on the efforts of these groups (36). In addition, many urban areas serve as referral centers for surrounding communities, and as such there is often greater availability of health and social services in urban areas. In general there are far fewer physicians and hospitals in nonurban areas, and the travel time to health care providers is greater than in nonurban areas (94).

However, as previously discussed, many cities are characterized by sharp disparities in wealth between relatively proximate neighborhoods (131). These disparities are often associated with disparities in the availability and quality of care (7, 128). The presence of well-equipped, lucrative practice opportunities in the same city decreases the likelihood that service providers will work in lower-paid, public service clinics, particularly when these latter services face limited resources and wavering political commitment (34). Also, low-income urban residents continue to face significant obstacles in finding health care both in wealthy and less-wealthy countries (57). In the U.S. context, persons with lower socioeconomic status are more likely to lack health insurance coverage (48, 133). In turn, uninsured persons face barriers to care, receive poor quality care, and are more likely than are insured persons to use emergency systems (87). Recent immigrants, homeless people, inmates released from jail or prison, all disproportionately represented in

urban areas, also face specific obstacles in obtaining health care (3, 51, 53, 59). In turn, these populations put a burden on health systems not adequately funded or prepared to care for them. Social services for disadvantaged or marginalized populations are often susceptible to changing municipal fiscal realities with the resultant decrease in service frequently coinciding with times of greater need in the urban population (33). In the past few years, for example, the decline in the national economy and tax revenues has forced many cities and states to reduce services at the very time unemployment, homelessness, and hunger are increasing (95). Internationally, several studies have highlighted the potential inadequacies of health systems in preventing and treating conditions such as malaria, dengue, and tuberculosis, spread of which is facilitated by high-density living characteristic of cities (69, 88, 117).

In summary, multiple mechanisms may explain how cities affect mental health, with different mechanisms being potentially important for different morbidities. Indeed, a big picture perspective on the relation between the urban context and health would suggest that these relations are undoubtedly complicated and that any single analysis that isolates a feature of urban living and health is just scratching the surface. Whereas specific features of cities may affect specific diseases adversely, other features may offer protection. Interrelationships between features of the urban environment further make generalization difficult. For example, further refinements on social strain theory in urban areas include an appreciation of the fact that in urban areas persons with different socioeconomic statuses may be differentially faced with stressors and have varying levels of access to resources that may help them cope with stressors. In particular, in urban areas, formal local resources can complement or substitute for individual or family resources for transient urban populations. Therefore, the relation between urban stressors and health is likely buffered by salutary resources (e.g., health care, social services) that are oftentimes more prevalent in urban compared with nonurban areas (41). Although these resources may be available to urban residents, socioeconomic disparities in cities are linked to differential access to these resources, which suggests that persons at different ends of the socioeconomic spectrum may have different opportunities to benefit from the resources available in cities.

## INTERNATIONAL CONSIDERATIONS

In considering the mechanisms that may explain the relations between the urban context and health, we refer to potential differences in the role of certain mechanisms cross-nationally. This point is worth emphasizing, particularly in light of the varying pace of urbanization worldwide. The pace of urbanization is projected to differ by region of the world and by initial city size. In particular, most global population growth in the coming decades will occur in less wealthy regions of the world, with the most rapid pace of growth expected to occur in Asia and Africa (49). Although North America and Europe are currently the most urbanized

regions, the number of urban dwellers in the least urbanized region, Asia, in 2000 was already greater than the urban population in North America and Europe combined. The proportion of people living in megacities is expected to rise from 4.3% of the global population in 2000 to 5.2% in 2015 (123). The growth rate of megacities in the developing world will be much higher. For example the anticipated growth rate for Calcutta, India, between 2000 and 2015 is 1.9%, compared with an anticipated growth rate of 0.4% for New York City, United States (15, 123). However, whereas the growth of large cities in developing countries will account for approximately one fifth of the increase in the world's population, small cities will account for almost half of this increase (109). A growing number of relatively small cities throughout the world will contain most of the world's population in the twenty-first century, and most of the growth in cities will take place in less wealthy countries.

Therefore, the relative importance of characteristics of the urban environment that may affect health may vary substantially in different cities and in different parts of the world. For example, in many rapidly growing urban areas in the developing world, lack of safe water and poor sanitation are likely to account for a greater proportion of the morbidity and mortality in a specific city than are all other factors identified here. As cities become more established, an aging infrastructure can threaten health and growing inequalities, and social strains can influence both health behaviors and access to resources. In addition, the course of urbanization in different cities worldwide may have different implications for health. A newly urbanizing city is likely to be under different and probably more substantial strains than is a long-established urban area. Therefore, when considering how cities may affect health it is important for the public health researcher or practitioner to consider both place, i.e., the particulars of a given city, and time, i.e., the trajectory of urbanization in a particular city. There are no simple solutions summarizing the relations between the different factors that can affect health in various countries. Rather, specific investigations and interventions would do well to bear in mind the relevant local and temporal context that may guide an appreciation of relevant and salient risk determination in a given urban area.

## CHALLENGES IN THE STUDY OF URBAN HEALTH

### Defining Cities and Urbanization

Given the growing preponderance of cities and the increasing contribution of urban populations to the world's total population, one might expect that our enumeration of "urban dwelling" populations is based on a universally agreed upon definition of "urbanization" and "urban." However, and perhaps unfortunately for the current science, there are multiple and inconsistent definitions of both urbanization and urban. An appreciation of this complication is essential to understanding how urbanization may affect human health. It is generally accepted that urbanization is the process of becoming urban, and it reflects aggregate population growth in

cities, be it through natural population increase or migration. By contrast, different authors have used terms such as urbanism or urbanicity to refer to the inhabitation of human populations in concentrated areas at a given point in time.

Wirth (135), in his seminal essay "Urbanism as a way of life," suggested three distinct characteristics of urban areas: size, density, and heterogeneity of populations. Although this definition may be intuitive, and indeed most authors would consider this definition valid, there are multiple practical barriers to the quantification of what an urban area is that can then be applied to research or practice. The fundamental problem is that no definition of urban places has been universally adopted by national governments, and as such, multiple, inconsistent definitions of urban are used by different countries.

The U.S. Bureau of the Census (16) defines an urbanized area in the following way: "An urbanized area comprises a place and the adjacent densely settled surrounding territory that together comprise a minimum population of 50,000 people. . . . The 'densely settled surrounding territory' adjacent to the place consists of territory made up of one or more contiguous blocks having a population density of at least 1000 people per square mile." However, this definition raises a number of questions and is substantially different from the definition employed in other countries. Among 228 countries on which the United Nations has data, about half use administrative definitions of urban (e.g., living in the capital city), 51 use size and density, 39 use functional characteristics (e.g., economic activity), 22 have no definition of urban, and 8 define all (e.g., Singapore) or none (e.g., Polynesian countries) of their population as urban (15). These official statistics (i.e., all the statistics above) rely on country-specific designations and do not use a uniform definition of urban. In specific instances, definitions of urban in adjacent countries vary tremendously. For example, the Bolivian definition of urban includes localities containing 2000 or more inhabitants. In neighboring Peru, populated centers with 100 or more dwellings grouped contiguously and administrative centers of districts are considered urban. Therefore, global statistics on urbanization depend on international definitional differences that may be a function of statistical or historical precedent and, in some cases, political expedience. Ultimately, compounding these difficulties, definitions of urban have changed over time in different countries, and these different definitions are frequently embedded in calculations about changing urban proportions.

In addition to challenges in defining an urban area, the definition of urbanization also is complicated by multiple considerations in how to assess "population growth in cities." Urbanization, at its simplest level, may be calculated as the change in the proportion of the national population that is urban. However, this change in proportion is dependent both on the urban population growth and on the relative growth of the rest of the country. There are different implications for countries and cities where urbanization is driven by rural-urban migration or international migration compared with other countries where urbanization is driven largely by natural growth of cities. Together with changing urban proportions, changes in the absolute number of urban residents are also meaningful. Thus, although countries

of vastly different sizes can share urbanization rates, these urbanization rates can represent vastly different absolute numbers of urban residents. Also, the percent of national growth influenced by growth in urban areas ultimately is reliant on the change of the overall national population. Thus, net urban growth is again differently meaningful in the context of larger and smaller countries.

## Specification of the Research Question in Urban Health

Clear specification of a research question is the necessary first step in all etiologic research and is often one of the hardest steps. One of the greatest challenges in the study of urban health is in adequate specification of research questions that address how and why the urban context may affect health. Three primary reasons exemplify why the specification of a research question may be particularly challenging in urban health. First, much of what may be considered urban health research in the literature thus far has arisen from different disciplines, using different theoretical frameworks and applying disciplinary orientations and terminologies. For example, in demography and epidemiology, research into the role of urbanization in shaping health may focus on how population change in cities, resulting from migration and population growth, may influence the distribution of diseases (e.g., 99, 137). In contrast, the study of urbanization in sociology may focus on social activities and social organization in cities and their association with changing behaviors and consequences thereof. In considering how urban living may affect health, the study of changing urban population size and how individuals acquire different urban lifestyles is important. Although both arguably are features associated with changing cities, they may lend distinct understandings to health and health behavior. Second, many questions in urban health research do not meaningfully exist in isolation. Understanding how the urban context affects health requires consideration of multiple, often competing, influences. Continuing to consider the example of urbanization, different disciplines might study various aspects of urbanization that potentially exert varying effects on population health. This interdependence of research questions complicates the empirical task of assessing how cities may affect health. Specification of relevant research questions must at least acknowledge, if not take into account, the interrelated processes that ultimately determine health in cities. Third, as is the case with all research, clear specification of a research question rests, at least implicitly, on the acknowledgment of a theoretical framework that suggests how and why the characteristics of interest may affect health. The absence of such a framework in the study of urban health complicates the specification of research questions in the field, as well as the interpretation of research findings.

## Complexity of Causation in the Urban Context

As discussed at various points in this chapter, cities are complex communities of heterogeneous individuals, and multiple factors may be important determinants of

population health in cities. For example, understanding the role that racial/ethnic heterogeneity plays in shaping the health of urban populations requires an understanding of the role of segregation in restricting access to resources in urban neighborhoods (2) as well as the potential for greater tolerance of racial/ethnic differences in cities compared with nonurban areas. Assessing how the urban context may affect health raises challenges and introduces complexity that is often not easily addressed through the application of simple analytic methods.

In addition, cities are different from one another and may change over time. Empirical inquiry in health presupposes that identifiable factors influence health, and these factors can be identified (and potentially intervened upon). Typically, public health studies imply, for example, that we can generalize about how different foods will affect health across individuals, at least within the confines of effect modification across groups (e.g., age groups) or under different circumstances (e.g., at different levels of caloric intake). However, cities are characterized by multiple factors (e.g., population density, heterogeneity) that in many ways make each city unique. The complexity of cities and of city living may mean that urban characteristics important in one city may not be important in other cities, limiting the generalizations that can be drawn about how urban living influences health. Further complicating this task is the fact that cities change over time, and this change has implications for the relative contribution of different factors in determining health in cities. For example, municipal taxation of alcohol and cigarettes may control alcohol and cigarette consumption in a particular city at one point in time (47). However, changing social norms around smoking and alcohol use may either obviate or reinforce the influence of taxation. As such, in considering urban characteristics that affect health it may be important to note both the prevailing context within which such characteristics operate and that the role of these characteristics may change over time.

## Choice of Appropriate Study Design

A broad array of methods in multiple disciplines have been used to address questions that pertain to urban health. In general, three types of published studies attempt to address somewhat different questions relevant to urban health: studies comparing rural and urban communities, studies comparing cities within countries or across countries, and studies examining intraurban variations in health.

Studies comparing rates and prevalence of morbidity and mortality in urban and rural areas are likely the most common, although they have become less common in recent years. These studies typically contrast several urban areas with rural areas in the same country or consider morbidity and mortality in urban versus nonurban areas; investigators frequently define the latter as all areas that do not meet urban criteria. Such urban-rural or urban-nonurban comparisons are useful to draw attention to particular features of urban areas that may be associated with health and that merit investigation. However, these studies are limited in

their ability to shed light on what these features may be and on how urban areas may affect residents' health. That different urban-rural comparisons have provided conflicting evidence about the relative burden of disease in urban and nonurban areas is not surprising. Changing conditions within cities over time and differences in living conditions between cities suggest that these studies provide, at best, a crude snapshot of how the mass of urban living conditions at one point in time may affect population health.

The second type of study that attempts to address how cities affect health involves comparisons of health between cities, either within a country or between countries. Using the city itself as the key unit of analysis, these studies compare different cities to reach conclusions about urban characteristics associated with health. In comparing health between cities, these studies contribute to investigators' ability to discern features of cities that may promote or negatively affect population health. This research may suggest city-level practices that are amenable to intervention that could improve population health. Most saliently, these studies serve to highlight urban characteristics that, at least at the macro level, may be important determinants of urban health. However, by considering the city as the unit of analytic interest, these studies implicitly assume that aggregate behaviors or characteristics at the city level are equally important for all residents of those cities. This view limits to an analysis of city-wide characteristics that may or may not affect all urban residents equally the consideration of how cities may affect the health of urban residents.

The third group of studies that has contributed to our understanding of how city living may affect health is not frequently conceived of by researchers as studies of urban health per se. This group of studies has become more common in the past decade and often has included studies of how living in particular urban communities may be associated with health. Most commonly, these studies focus on spatial groupings of individuals (typically conceived of as neighborhoods, although several studies assess the contribution of administrative groupings that are not necessarily meaningful to residents as neighborhoods) and typically consider the impact of one's community of residence within an urban area on an individual's health. Relatively fewer studies have considered how membership in other urban communities, particularly social networks, may be associated with behavior and health (e.g., 72). Although these studies contribute important insights into urban conditions and their implications for health, they may be difficult to generalize to other cities or, more broadly, to urban areas. That is, the observation in one study that the quality of neighborhood sidewalks is associated with the likelihood of physical activity among urban residents may not necessarily be relevant in another urban context in which fear of assault is an important determinant of outdoor activity.

Therefore, different study designs can fruitfully address different questions that may be important to urban health. Unfortunately, results from these studies are frequently conflated, and the appreciable but nuanced differences in conclusions that can be drawn from different studies are not used to guide hypothesis generation



to further urban health inquiry. Clear specification of the research question, coupled with appropriately choosing a study design, can point to inquiry and intervention in urban health.

## A Common Language for Urban Health

The complexity of causation and the diversity of mechanisms that may explain how characteristics of the urban environment may affect the health of urban populations suggest that cross-disciplinary work is needed to improve our understanding, both general and specific, of the role urban context plays in shaping population health. Theoretically informed efforts that combine the perspectives of different traditions or disciplines, that use quantitative and qualitative methods when appropriate, and that apply theoretically driven sampling strategies are more likely to provide answers to questions about both how and why characteristics of urban living may affect health. Quantitative and qualitative methods may inform each other and help minimize the extent to which a priori decisions about conceptual frameworks may shape both the hypothesis being tested and the answers obtained from such inquiries. However, the isolation of academic disciplines from one another often means that there is little shared vocabulary between disciplines and that researchers and practitioners schooled in different academic traditions face considerable challenges when working together.

We suggested previously that the study of urban health may benefit from being constituted as a discipline by bringing together expertise and interests from academics and practitioners with complementary skills (125). Absent such a radical solution, many encouraging signs show that interest is growing in urban health as a cogent field of inquiry. Papers offering frameworks for the study of urban health have recently increased (42, 91, 124), as has the formation of cross-disciplinary meetings dedicated to urban health (11, 43). Also, public health practitioners and researchers have developed specific training programs and institutes aimed at teaching students skills from multiple disciplines (e.g., urban planning, epidemiology) that are relevant to the study of urban health. Meanwhile, international projects, particularly the Healthy Cities movement sponsored by the WHO, are working directly with local governments to promote health in cities. Most of the work of the Healthy Cities movement thus far has been in high-income countries, although more recently, the WHO supported Healthy City projects in low-income countries. In the first evaluation of these projects, evidence showed that key stakeholders had an improved understanding of the role of the urban environment in shaping health but had limited political will to act on this awareness (55). Although success of the Healthy Cities movement remains difficult to assess, it represents a worldwide effort to raise awareness among key decision makers about the role of cities in shaping health, potentially setting the stage for local interventions. All these efforts will be necessary eventually to guide public health training, research, and efforts to improve health in complex urban areas.

## DIRECTIONS FOR URBAN HEALTH RESEARCH AND PRACTICE

Throughout this review we consider the study of urban health inquiry into how features of the urban context may affect the health of populations. We also identify substantial challenges that may complicate urban health inquiry and practice. Moreover, we argue that the study of urban health lends itself to the creative application of methods from multiple disciplines and the nuanced appreciation of the role of multiple factors that may determine population health in cities. Despite this complexity, key factors can explicitly distinguish and guide the study and practice of urban health.

First, we need to consider whether there are specific features of the urban context that are causally related to health. Appropriate specification of the research question of interest is critical. For example, understanding how living in a city as a whole may affect smoking behavior requires a different set of tools than do questions about how intraurban differences in pollution affect variability in neighborhood prevalence of asthma. Similarly, understanding the quantitative relation between social capital in urban communities and resident well-being requires different tools than do questions about why social capital may have different implications for health in different communities or how social capital is produced or eroded in urban contexts.

Second, it is important to consider if these features are differentially distributed between urban and nonurban areas and within urban areas (e.g., between urban neighborhoods). As a corollary to this consideration, it becomes essential to consider the extent to which these features are unique to a particular city or differ between cities and, as such, to learn whether salutary features of the urban environment are adaptable in different contexts. For example, undoubtedly, much can be learned from well-studied urban areas in wealthy countries that can be applied to public health practice in less wealthy countries.

Third, identifying which characteristics of the urban context, and under which circumstances, are modifiable, is an important theoretical, empirical, public health question. In many ways the choice of an appropriate urban health framework may dictate, at least implicitly, the choice of both the question asked and the methods used in addressing the question. For example, a comprehensive framework that includes national-level policies that shape municipal financing may suggest that inquiry into and intervention on national policies may be of primary importance to urban health. In contrast, a framework that considers primarily physical characteristics of cities will address how features of the built environment at the local level can affect residents' health. Thus far, relatively little has been written about the processes through which the urban context may affect health and about further elucidation of these processes. A comprehensive appreciation of the processes that influence urban health can and should guide research and practice.

In conclusion, we note that although in this review we highlighted challenges inherent to the study of urban health, this work is informed by an appreciation for

the potential of urban health inquiry. Although the study of urban health embeds substantial complexity, research with clearly specified research questions and appropriate study designs can help focus our appreciation of the relation between specific features of the urban context and health, both in specific cities and as generalizable to cities in national and international contexts. Recent methodologic advances, particularly the widespread acceptance of multilevel methods in public health research, have made it possible to test hypotheses about urban characteristics and their relation to specific health outcomes. Newer methods may eventually contribute to an improved understanding of the competing influences on the health of urban populations over time (75). Such research can inform local intervention and policies across urban areas. We hope that efforts such as this review, aimed to structure our thinking about cities and health, are helpful in stimulating both empirical and theoretical developments that can lead to improved health in cities worldwide.

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**ERRATA**

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