PERSPECTIVE

City Building and Public Health: Threats and Opportunities in China
城市建设与公共卫生：中国面临的挑战和机遇

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Summary

本文系统性地论述了当前中国由于经济高速增长和快速城市化，导致的生活方式相关的健康问题。王锐博士认为城市建设环境的结构性和功能性可能会通过缺乏体力活动和不良饮食习惯对健康产生影响。作者对三个方面的文献进行回顾，从社区和地区层面了解城市建设模式和健康之间的因果关系。鉴于此，王博士指出目前需要更多更完善的经验证据，来支持中国的城市建设决策。因为绝大多数的现有依据是基于横断面数据得到的，只能得到相关性而非因果关系。而且几乎所有的实证研究都基于工业化国家和地区，其现状与中国国情具有显著差别。基于以上原因以及中国各城市间的差异性，研究者需要分析中国不同地区的纵向数据，才能得到较强的因果关系推论。在中国，土地的国家所有权是中国政府进行城市建设规划的优势；然而，由于时间因素的限制，王博士建议研究人员应当尽快行动，研究城市建设规划对健康的影响；政策制定者应当基于现有的有限证据及时作出决策，为人口日益增长且老龄化的城镇居民建设健康城市。[*]

Abstract

Evidence suggests that the physical and functional aspects of the urban built environment may affect one's health through physical activity and access to healthy food. Rapid economic growth and urbanization have significantly changed China's urban built environment, which can have long-term effects on people's lifestyle and health. To build healthier cities for China's growing yet aging urban population, researchers should act now to develop robust evidence of the relationship between urban form and health behavior while policymakers need focus on timely decision-making with the limited evidence available.

Urbanization and health challenges in China

More than three decades of rapid economic growth in Mainland China has dramatically improved Chinese people's material well-being, although at considerable environmental and health costs (World Bank and SEPA, 2007). China is now the world's second-largest economy, the largest market for new automobiles, and the largest emitter of CO_2 and SO_2. The concentration of production and population in urban regions characterizes modern economic development throughout the world. The proportion of Chinese people living in urban areas increased from slightly below 20% in 1980 to just above 50% in 2012, with an average of over ten million urban dwellers added annually. While a significant contributor to economic growth and a better standard of living, urbanization has brought many socio-economic, environmental, and governance problems, among which pollution and "modern" lifestyles particularly challenge human health.

[*] This Chinese summary was prepared by Zongshuan (Jack) Duan, MPH Candidate.

As the primary driving force of urbanization, the development of industries remains a key source of pollution and environmental degradation in China. Numerous Chinese cities are on the list of the World Health Organization's most polluted cities in the world, largely a result of urban and regional industrial pollution. The economic costs of premature mortality and morbidity associated with air pollution was found to equal 1.16% to 3.8% of China's Gross Domestic Product in 2003 (World Bank and SEPA, 2007), and has probably further increased since, as both air pollutant concentration and population exposure tend to increase with urban population size (Bettencourt et al., 2007). In addition, rapid motorization caused by income growth has been shifting the source of air pollution to vehicle emissions, a main contributor to airborne fine particulates and ground-level ozone. This is especially evident in large Chinese cities. For example, Beijing's recent ambient $PM_{2.5}$ concentrations ranged between 96.5 $\mu g/m^3$ and 154.3 $\mu g/m^3$, six to ten times the annual average limit (15 $\mu g/m^3$) recommended by the U.S. Environmental Protection Agency (Chan and Yao, 2008). The non-attainment days for ground-level ozone (hourly ozone concentration >100 ppbv) accounted for more than 10% of days from 1999 to 2007 (Beijing Municipal Environmental Protection Bureau, 1999-2007).

This article, however, focuses on lifestyle, a source of public health problems different from environmental pollution. Many health problems, especially certain chronic but costly conditions such as type 2 diabetes, are perhaps more affected by lifestyle choices such as diet and exercise. According to Popkin (2008), China's number of overweight adult males tripled (and doubled for females) between 1989 and 2000, and nearly a quarter of all Chinese adults were overweight by 2004. Consistent with these trends, China has the world's largest and still rapidly growing diabetes population (Popkin, 2008).

At least two aspects of the urban lifestyle can be reasonably believed to have contributed to health problems in China. The first is the lack of physical activity, which is likely related to urban expansion and motorization. Urban spatial expansion has made daily travel distance too long to rely on walking or bicycling for many people. Although China as a whole is considered to have just reached the income threshold of rapid motorization, as much as one-third of trips made by residents of cities like Beijing are by car.* The "Bicycle Kingdom" has quickly given away its road space to cars and buses. The other aspect contributing to urban health problems is insufficient healthy (or too much unhealthy) food in one's diet. The urban landscape of food supply changes with the development of market economies. China is experiencing the world's fastest growth in supermarkets (e.g. Carrefour, Wal-Mart and their domestic clones), with sales at these stores growing by as much as 40% annually (Hu et al., 2004). These supermarkets are spreading to secondary cities and towns, and starting to reach higher-income populations in rural areas. It is common to observe the replacement of free markets (also called "fresh" or "wet" markets, where fresh groceries are often sold by local providers) with supermarkets that supply more processed food. Additionally, there has been an overwhelming increase of fast food restaurants that supply Western and Chinese variants of pizza, hamburgers, fried chicken, etc. Unlike the food from free markets, supermarkets and fast food restaurants more often provide food and drinks with higher fat and sugar content.

How does city building affect public health?

City building is an important channel for the government to intervene in social behaviors that may affect the economy, the environment, and public health. This does not come as a surprise, as our behaviors are constrained and shaped by the environment we live in, especially in the urban built environment. In particular, urban land use and transportation policies and planning are expected to mediate the environmental, energy and health consequences of urban growth. However, policy and planning decisions can both promote and hinder achieving social goals depending on how

* See http://news.sohu.com/20130123/n364457668.shtml.

they are designed. Efficient and equitable policy making for urban public health requires a thorough understanding of the causal relationships between policy instruments (e.g. planning) and outcomes (e.g. travel and food consumption behaviors and health).

At least three streams of literature have advanced our knowledge on the relationship between city building and health. The first group of studies, primarily reported by public health scholars, addresses the relationship between the built environment and public health, measured mainly by the level of physical activity and the occurrence of chronic health issues, such as obesity. There have been several reviews of this literature, such as Brownson et al. (2009), Frank and Engelke (2001), Gebel et al. (2007), Humpel et al. (2002), Kahn et al. (2002), Lee and Moudon (2004), and Papas et al. (2007). Most studies find that physical activity and health indicators, such as body mass index, correlate with the form of the built environment, measured by population density, land-use mix, access to recreational facilities, street pattern, etc.

A closely related stream of literature, which grew out of transportation and planning scholars' interests in improving the built environment in order to reduce driving, traffic congestion, and related environmental and health impacts, addresses the relationship between the built environment and travel behavior. Crane (2000), Ewing and Cervero (2010), Guo and Chen (2007), Mokhtarian and Cao (2008), and Stead and Marshall (2001) provide helpful reviews of these works. Most studies have shown that features of the built environment, such as the "three Ds" (density, diversity and design),* street network connectivity, and the clustering of high-density land uses in urban centers (or nuclearity), are often associated with travel behaviors, including mode choice, trip frequency, trip distance, etc.

Different from the above studies' focus on the physical form of the built environment, a third, yet smaller literature concerns access to community resources, or functional rather than physical aspects of the built environment, such as access to parks or healthy food. For example, Zheng (2008) and Edwards (2008) study the relationship between health behaviors (or indicators) and access to transit, while Jeffrey et al. (2006), Moore et al. (2008), and Raja et al. (2010) look at access to certain food outlets and health.

The different strands of literature increasingly converge towards a common goal of understanding how the physical and functional aspects of the built environment affect human behavior and welfare at the community or regional scale. For example, Frank et al. (2006) found that in typical American suburbs, an increase in neighborhood walkability is associated with more active travel time, fewer vehicle miles traveled, fewer CO_2 emissions per capita, and fewer cases of obesity. Younger et al. (2008) further connects the literatures with a broader review of studies from multiple disciplines.

To advance our understanding of the effects of urban form on health (and travel behavior, energy consumption, etc.), more and improved empirical evidence is needed for two reasons. First, the vast majority of existing evidence is based on cross-sectional data and only confirms the correlations between the built environment and health, leaving causality unexplained or inappropriately claimed. A small number of studies, mainly by transportation scholars, utilize a range of more sophisticated statistical strategies (e.g., propensity matching and simultaneous equations) to address the residential sorting biases (people's tendency to locate in areas consistent with their preferences). Nevertheless, most of the results are still suggestive (Guo and Chen, 2007; Mokhtarian and Cao, 2008) and do not seem to be very consistent with each other (Guo, 2009; TRB, 2009).

* Diversity refers to land use mix. Design refers to features of transportation corridors related to comfort, safety or the attractiveness to pedestrians, cyclists, and transit riders.

Second, almost all empirical studies are from industrialized countries and regions, where health background, lifestyle, and the speed of urbanization are very different from those in developing countries. Given that pollution, carbon emissions, and health challenges emerge rapidly along with urbanization and motorization in countries like China, data and analyses are very much needed to enrich our knowledge in the developing country setting. In fact, the rapid and significant socio-economic changes in cities of the developing world provide researchers with rich spatial and temporal variations in the urban built environment. The few available studies in China and South America (e.g., Cervero et al., 2009; Van de Poel et al., 2009; Zegras, 2010) find associations between certain aspects of urban form and health indicators, physical activity, or car ownership/use. Unfortunately, due to the potential residential sorting bias, none of these studies were able to infer strong causality between the built environment and travel behavior and/or health.

Building healthier Chinese cities

Promoting healthier cities in China has global significance given the size of China's population and its economy. The next couple of decades likely represent the remainder of the critical time window for policy intervention given China's rapid urbanization. Once an urban area is (re)developed, the physical infrastructure and land use pattern generally last for decades and impact the further development of adjacent areas. If city building can indeed serve as both a cure and as a threat to public health, then China's ongoing rapid urbanization provides both a crucial opportunity to build a lasting wealth and a time period for cities to make terrible mistakes that will chronically threaten human health and socio-economic sustainability. How can China's cities be planned, designed, and built, in terms of both physical and functional forms of urban space, to facilitate healthier urban lives characterized by active lifestyles and healthier diets?

The empirical question of whether, and to what extent, the physical and functional forms of cities affect behaviors and health calls for robust causal inference in the Chinese context. To better address the selection bias in cross-sectional data, a small number of studies in the U.S. have utilized panel data (especially data of the relocated individuals and households) and policy experiments to provide robust policy evaluations and decision support. For example, using longitudinal changes of households that moved in the Puget Sound area, Krizek (2003) examines impacts of local accessibility on travel behavior. Boarnet et al. (2005) survey parents of children to examine the impact of changes in the built environment on non-motorized travel as a result of California's Safe Routes to School Program. Using the National Longitudinal Survey of Youth, Eid et al. (2008) utilize the moves of young adults to detect the causal relationship between sprawl and obesity. However, the cross-country transferability of these research findings is unknown, thus calling for studies using local data from China. Although data collection can be difficult and costly, the massive and quick changes in China's urban built environment should enable abundant opportunities to observe how human behavior responds to changes in city form. To conduct such urgently needed research, China's central and local governments should provide more support for data collection and sharing. In particular, longitudinal data are crucial to addressing self-selection induced bias in estimating the built environment – behavior – health relations (see, e.g. Cao et al. 2009; TRB 2005, 2009). For example, using data from the China Health and Nutrition Survey, an international collaborative longitudinal survey of households and communities in China, Wang and Shi (2012) examine the effect of the urban food environment (density of wet markets, density of supermarkets, and density of fast food restaurants) on children's nutritional intake. Difference-in-difference analyses suggest that the density of wet markets, rather than that of supermarkets, positively predicts children's nutritional intake, especially those in households with lower socioeconomic status. Compared to findings based on cross-sectional comparisons, this study provides a more robust causal inference and thus a more reliable warning sign for decision makers, as wet markets are disappearing from urban China's food environment.

However, robust evidence on the causal relationship between city building and public health may take time to emerge in China. With the fast pace of urbanization, decision makers may not have much time to wait for stronger and clearer causal evidence. The government can, however, make decisions based on available evidence and choose options that bring co-benefits (preferably through mechanisms other than lifestyle). For example, in addition to facilitating public transit service and utilization, clustered development can leave more unpaved open spaces that reduce the effect of an urban heat island, which can decrease outdoor air quality in urban centers by increasing the concentration of photochemical oxidants (Narumi et al., 2009). Also, making streets and intersections safer for pedestrians is often worthwhile even without inducing more walking. On the other hand, when our understanding of the effects of a particular public intervention is limited, policymakers should be very careful with unintended consequences. For instance, although people benefit from active travel, the immediate adjacency of sidewalks and bicycle lanes to motor traffic may expose cyclists and pedestrians to much higher near-road air pollutant emissions (e.g., ultrafine particulates) compared to riders of transit and private vehicles (Quiros et al., 2013). Similarly, without effectively enforcing food safety regulations, the development of wet markets with a large number of small food (re)sellers may increase public health risks.

Given Chinese cities' different population sizes, resource availability, and geographic and climate patterns, applying one-size-fits-all type polices may be inappropriate. Local context-based analysis for the adjustment of policies should be conducted so that the "best practices" can be appropriately diffused to different cities. For example, in northern Chinese cities with very cold winters, non-motorized travel tends to be less appealing, and more attention should be given to public transit access.

The state ownership of urban land in China is to the advantage of the government to enforce policies and plans related to city building, as the government can often determine the form and type of land use before a land parcel is leased to a developer. However, the window of opportunity that Chinese cities currently have to promote long-lasting health benefits through city building will not remain open. It is crucial for researchers to act promptly to study city building's effects on health behavior (along with other socio-economic and environmental consequences) and for policymakers to focus on timely decision-making based upon available knowledge.

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