Urbanization, Socioeconomic Status and Health in China*

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ABSTRACT

While the positive association between socioeconomic status (SES) and health is well documented, how this relationship varies with urbanization level is less clear. This article aims to show how SES gradients in health are altered by rapid urbanization in contemporary China. Using data from the China Health and Nutrition Survey (CHNS) in 1997, 2000, 2004, 2006, 2009 and 2011, we examine the confounding effects of urbanization on the SES-health and test hypotheses derived from two competing theories.

Results from logistic regression show that, the link between income and health is moderated by urbanization, and the protective role of education on maintaining health becomes more prominent in more urbanized areas; lifestyle is the pathway through which urbanization affects health, and a high-fat diet and decreased physical activity influence the SES-health relationship and increase health risks in more urbanized areas. The results suggest the importance of considering the role of structural factors in shaping the SES gradient in health.

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INTRODUCTION

The relationship between socioeconomic status (SES) and health outcomes has received intensive attention in the field of health studies. In the 1960s and 70s, the academic community optimistically predicted that health equality could be achieved, thanks to the remarkable evolution of medicine and epidemiology (Robert and House, 2000). Unfortunately, empirical evidence did not lend support to the prediction. Researchers found that health inequality between SES groups is persistent across time and regions, even though overall life expectancy has increased (Elo, 2009; Simth, 2004; Warren and Hernadaz, 2007; Williams, 1990). Chronic diseases have replaced acute infectious diseases as the leading causes of death, raising the importance of social factors in health. There is growing consensus that social characteristics are "fundamental causes" of diseases, because they embody access to important resources that help individuals to avoid diseases and their negative consequences (Link and Phalen, 1995). Numerous studies have uncovered SES gradients in health, which means that a better social position, as measured by education, income and occupation, is associated with a lower mortality risk and better health at all levels of the socioeconomic ladder (Alder et al., 1994).

The main explanation of SES gradients in health is accessibility of health resources. People with higher SES have better access to physical and psychological resources, including high-quality housing, medical services, cutting-edge technology and social support (Elo, 2009; Link and Phelan, 1995; Pampel, 2011). Moreover, since the distribution of health resources is uneven both socially and spatially, academic community noticed that more aggregated level conditions should be taken into consideration. Growing number of studies find that individuals' health is influenced not only by "what one is," but also by "where one lives". Among these studies, the effects of urban living have received considerable attention for two reasons. The rapid growth of cities worldwide is one of the most profound changes in human life since World War II. Both researchers and policy makers are very concerned about how such large-scale demographic changes affect individuals' well-being.

Two competing theories on urbanization and health inequality have been proposed. The double jeopardy theory claims the SES gradient in health may be steepened by urbanization (Robert, 1999). According to neo-materialism, the prices of health products and services are affected by the average income level. The higher the income inequality in a city, the more resources (i.e. clean water, medical care services) become unaffordable for low-SES groups. At the same time, low-SES groups are more vulnerable to resource shortages caused by higher population density and environmental pollution (Du et al., 2004; Fan and Rizzo, 2012). The theory is supported by the fact that the SES-mortality association is stronger in communities with higher levels of urbanization (Bassuk, Berkman and Amick, 2002).

Other scholars taking a different perspective state that the SES-health relationship is weaker in cities, because there is a health penalty of urbanization for the rich and social externalities for the poor (Di Cesare et al., 2013; Van de Poel et al., 2012; Allender et al., 2008). This theory suggests that in rapidly urbanizing areas, health advantages brought by high income growth would be suppressed because of unhealthy lifestyles and environmental deterioration. Wealthier people are more likely to suffer from the health penalty, since they are more capable to afford the unhealthy lifestyles, such as high-fat food, smoking and unsafe sex (Kim and Popkin, 2004). This situation is worsened by insufficient health education and services (Maruapul, 2011; Zhu, 2011). Meanwhile, poor and less-educated people may benefit from social externalities in urban areas. They may gain access to various health information and facilities. Moreover, the social diversity of urban life can provide them with additional guidance, whether from more educated members of their social network or from modern health systems.

China serves as an ideal field for testing these two theories for two reasons. First, China has experienced dramatic economic growth, social polarization, demographic changes and health deterioration over the past 30 years, which makes it a unique setting in which to explore the dynamics of urbanization and the SES gradient in health (Figure 1). Second, urbanization in China is characterized by strong state intervention, which differs from the situation in Western or former socialist countries (Ma, 2002). China's urbanization is not driven *by* economic development; rather, it is driven by the government *for* economic development. Since the tax-sharing reform in the mid-1990s, a large share of local government revenue has been drawn from urban renewal and real estate projects, which have fueled massive waves of urbanization. The

exogenous nature of urbanization in China makes it an ideal context in which to test the contextual constraints of the SES-health relationship.

[FIGURE 1 IS ABOUT HERE]

This study contributes to the existing literature in the following ways. First, it enriches knowledge in this field by systematically examining the effects of urbanization on the SES gradient in health, and the mechanisms of such effects, in the context of the world's largest developing country. Previous studies on China mainly discussed SES-health relationship and the effects of urbanization separately,while the literature that simultaneously examines the two aspects primarily focuses on large cities in developed countries or developing countries with ghettos. The present study increases our understanding by illustrating the situation in China and cities of various sizes.

Second, this study deepens our understanding of social stratification and health inequality. Previous research has shown how the state shapes an individual's social position, and then influences their health outcomes. This study emphasizes the value of taking urbanization, an important contextual characteristic, into consideration. Given that state intervention plays a crucial role in urbanization in China, this study reveals that the state influences individuals' health, not only by determining their life opportunities directly, but also by moderating the protective roles of income and education.

Third, this study treats urbanization as a process of accumulation of urban elements, rather than as emerging of a city in an administrative sense. The majority of the literature adopts a dichotomous definition to measure urbanization, which fails to capture the heterogeneity of experiences across various urban and rural areas. This study, using a composite urbanization index that treats urbanization as a spectrum and highlights the characteristics of urban life, is more effective to reveal the heterogeneity within and across places.

The findings of this study have policy implications. The World Health Organization has warned that the public health improvement gained by economic growth will be offset without effective strategies to reduce the health risk factors. To develop efficient health promotion programs, it is essential to identify the factors that affect the SES-health relationship, and to locate target populations and places.This study suggests that urbanization significantly affects the

SES gradient in health. In areas with higher urbanization levels, the health benefits enjoyed by higher-income populations are reduced, while the protective role of education is more prominent. Dietary changes and decreasing levels of physical activity are potential mechanisms. The findings call for immediate action to reduce the risk factors by healthy lifestyle intervention programs.

This article is organized as follows. First, we will review the considerable body of literature on SES, urbanization and health, from which we derive three research hypotheses. We then introduce the China Health and Nutrition Survey (CHNS) data, major measures and identification strategy. Next we present the main results for the effects of urbanization on the SES-health relationship and the effects of lifestyle as a mediator. Finally, we provide an interpretation of the implications of the study and acknowledge its limitations.

LITERATURE REVIEW

Socioeconomic Status and Health

The remarkable evolution of epidemiology since World War II has greatly influenced social research on health inequality. Leading causes of death have been replaced by chronic diseases, and the concept of health inequality has been broadened to encompass more than just inequality in receiving treatment. Increasing attention is paid to chronic health risks such as unhealthy lifestyles, inadequate health care, stressors, the built environment and workplace hazards (Vlahov and Galea, 2002). Link and Phelan (1995), in their influential work "Social condition as fundamental causes of health", argued that researchers should contextualize individually based risk factors and pay more attention to the structural factors that put people at risk. They highlighted the role of SES because it shapes individuals' exposure to various health risks and access to health-maintaining resources (Link and Phelan, 1995).

A rapidly proliferating body of literature has uncovered a solid association between health and individual SES, which is usually measured by income, education and occupational status. Income, or poverty, is a strong predictor of mortality and various measures of health, but the direction and magnitude varies by age and region (Elo, 2009; Smith, 2004; Van Doorslaer and Koolman, 2003). One of the main mechanisms by which income affects health is the

improvement in resource accessibility. Richer people are more able to afford favorable living conditions, nutritional food and medical services (Hayward et al., 2000; Pampel, et al., 2010; Hallerød and Gustafsson, 2011).

Among all indicators of SES, education is the most consistent determinant of health. It not only exerts an indirect effect through higher incomes, but also increases access to psychological resources, including self-discipline and social support, which are crucial for health (Pampel et al., 2010; Baker et al., 2011; Masters et al. 2012). Higher education is related to longer life expectancy and better health (Cutler et al., 2011; Smith, 2007). This association is persistent across developed and developing countries (Meara et al., 2008; Smith and Goldman, 2007). One of the most commonly cited mechanisms through which education affects health is the adoption of positive health behavior and healthy lifestyles (Elo, 2009; Mirowsky and Ross, 2003; Pampel, 2010). Economists have revealed the role of education in decision-making and problem-solving skills, and the relationship between education and non-cognitive skills such as persistence, self-efficacy and self-control, which are critical for maintaining health (Cutler et al., 2006; Pampel, 2010).

The Modifying Role of Urbanization

An increasing number of studies have noted that community attributes can modify the pathways through which SES influences health (Link and Phelan, 1995; Mulatu and Schooler, 2002; Wen, Browning and Cagney, 2002; Lutfey and Fresse, 2005). For example, education contributes to knowledge about health behavior and services, but this effect may be reduced in communities where access to high quality health services and recreational space is limited, trust is low and other residents have limited capacity to provide health-relevant support (Browning and Cagney, 2002).

The large-scale urbanization that has occurred worldwide has made it a prominent community-level attribute that has received intensive attention (Vlahov, Gibble and Freudenberg, 2004). Studies that integrated urban- and medical-sociological models flourished in Western communities in the 1990s, in response to environmental justice movements and other programs that aimed to eradicate racial and social class penalties in urban areas (Gelea and Vlahov, 2002). The development of statistical research methods, including multilevel modeling and geographic

information systems, made these studies feasible. Researchers have questioned whether urbanization flattens or steepens the SES gradient in health.

Two competing theories have been proposed. Double jeopardy theory claims that urbanization strengthens the SES-health relationship, because living costs are higher and physical and psychological hazards are more concentrated in cities than in rural areas. Thus, urban life raises the importance of SES in health protection (Robert, 1999). A comparative study of 47 countries found that health disparities between the rich and poor within the city were even more distinctive than those between urban and rural residents (Van de Poel, O'Donnell and Doorslear, 2009). The interaction between urbanization and SES brings a "double jeopardy" for low-SES groups.

Another theory claims that the SES gradient in health is flattened by urbanization, because there is a health penalty of urbanization for the rich and social externalities for the poor. The health benefits that a high income can bring may be outweighed by an unhealthy lifestyle and environmental deterioration due to urbanization (Di Cesare et al., 2013; Van de Poel et al., 2012; Allender et al., 2008). At the same time, there are social externalities for the poor. The urban poor may have access to health facilities and services such as hospitals and primary health care services. They may also have access to various health resources through educated members in their network. As a result, the health disparities between high- and low-SES groups may be reduced by urbanization.

Urbanization, SES and Health in Chinese Context

A rapidly proliferating number of studies have discussed the relationship between SES and health in contemporary China. However, their findings are mixed. Some studies have found that higher income is associated with better self-reported health, lower levels of chronic disease and fewer limitations on physical activity (Li and Zhu, 2006; Yang and Kanavos, 2012; Yu et al., 2000; Wang, 2012; Wu et al., 2004). Studies on the elderly have found an association between higher education and the ability to maintain functional independence, functional recovery and self-reported health (Liang et al., 2001; Liu and Zhang, 2004). Nevertheless, other studies have reported the opposite, with higher SES positively associated with unhealthy behavior, obesity and chronic diseases (Kim et al 2004; Zimmer and Kwong, 2004). One study found no wealth or education gradients in the prevalence of chronic diseases (Lei et al., 2012).

The rapid urbanization in post-reform China has attracted extensive attention. China has witnessed the largest scale of urbanization in human history, with the proportion of the urban population rocketing from 18 per cent (172.45 million) in 1978 to 51 per cent (690.76 million) in 2011 (NBSC, 2012). The health penalty of urbanization in China has been well addressed. It was estimated that one in every five Chinese adults suffered from cardiovascular disease (Hypertension) at the end of 2012 (China CDC, 2012). A longitudinal study revealed that urbanization was related to decreases in self-reported health, and greater levels of urbanization had larger effects (Van de Poel et al., 2012). Using nighttime light data and remote sensing image analysis, Le and Wei (2010) showed that higher urbanized regions were associated with higher concentrations of chronic diseases. Chen and her collage, using the similar measurement of urbanization, find that the absolute level of urbanization is adversely associated with self-reported physical and mental health (Chen et al, 2014).

There are few attempts to examine the how the effects of SES varied by urbanization level. For instance, using decomposition analysis, Yang and Kanavos (2012) found that income and educational attainment had more prominent influences on health inequality in cities than in rural areas. For the urban population, 76-79 per cent of inequalities were driven by socioeconomic-related factors, compared with only 48 per cent for the rural population.

Lifestyle as a Mechanism

How dose urbanization moderate the effects of SES on individual's health outcomes? A significant body of research raises the importance of lifestyle. According to health lifestyle theory, lifestyle is a bridge between structure and human agency, and is formed through two processes (Cockerham, 2005). In the first step, structural conditions shape the life chances (options of lifestyles). For example, urbanization increases accessibility of processed and high-fat food, and sedentary occupation. In the second step, human agency chooses lifestyles from the limited options, according to their SES background (life choice). From sociological perspective, social strata works as "social carrier" of particular lifestyle (Cockerham, 1997). The association between lifestyle and SES is supported by numerous empirical studies. In general, people with higher SES have healthier lifestyles. For instance, they are more likely to participate in regular

exercise, adopt healthy diets and to receive physical checkups (Robert and House, 2000; Pampel, 2010).

Some studies conducted in developing countries have found different associations between SES and lifestyle. Higher-income groups in such countries tend to have unhealthier lifestyles, including smoking, drinking and high-calorie diets (Danaei et al., 2013; Delisle et al., 2012; Kim et al., 2004; Sodjinou et al., 2008). One possible explanation is that some unhealthy lifestyles are considered privileges in these countries.

In China, the close association between chronic diseases and unhealthy lifestyles has led to the assumption that lifestyle is the mechanism by which urbanization affects health (Gong et al., 2012). However, no empirical study has directly tested this assumption. Researchers have shown that China has experienced extreme dietary changes over the past three decades (Drewnowski and Popkin, 1997). A comparative study found that unlike in the U.S., Chinese people adopt a more unhealthy diet when their incomes increase (Kim et al., 2004). Moreover, there has been a tremendous decline in the intensity of occupational activity in China since the 1990s (Popkin et al., 2007). Occupational activity is the major source of energy expenditure for Chinese adults, as leisure activities and exercise have not become as prevalent as in Western countries (Bell, Ge and Popkin 2001). Thus, the dramatic decline in occupational activity predicts various health risks.

Unanswered Questions

Previous studies provide informative evidence on the relationships between urbanization, SES and health. However, they still leave several questions for further exploration.

First, few study evaluated whether the effects of SES on health varied by urbanization level in developing countries. Growing number of studies that examine the heterogeneous effects of SES in different urban areas to date are mainly conducted in developed countries. Even so, they disproportionately focus on large cities. Towns, suburban and rural areas have tended to be neglected (Gans, 2009). Evidence from developing countries is scarce. In China, the majority of studies examined the effects of SES and urbanization separately, which are insufficient to provide a comprehensive picture of health inequality.

Second, previous studies mainly adopted a dichotomous administrative definition to measure urbanization, which is insufficient to accurately capture changes in urban elements. A dichotomous administrative measure adopts the idea of a "threshold," and considers urbanization as a static situation rather than an accumulative process. In fact, lifestyle changes also occur in rural areas with increased urban components, such as the emergence of modern markets. In China, there are great regional disparities in socioeconomic development across the nation. Certain towns and villages in coastal areas may have higher urbanization levels than small cities and towns in western provinces. Thus a dichotomous administrative measure may be misleading.

In addition, considerable studies use night-light data to measure urbanization. This method is initiative for measuring urban expansion over time (Li et al. 2012, Chen et al. 2014). However, the reliability of the measurement is sensitive to several conditions, including the location of large infrastructure projects and energy efficiency strategies of cities.

Third, existing studies pay insufficient attention to physical health outcomes. The few studies that examined the effects of urbanization on the SES-health relationship focused on self-reported health, which were less efficient for measuring the health changes caused by urbanization. Subjective health is highly sensitive to individuals' expectations. By changing living standards and the neighborhood environment, urbanization greatly changes health expectations (Wen et al., 2006).

Forth, there is little empirical evidences for the role of lifestyle in shaping urbanization-SES-health relationship in China. A large number of studies have proposed lifestyle as an important pathway through which urbanization affects health in China. However, to the best of our knowledge, few empirical studies have tested this assumption. Van de Poel and his colleagues (2012) found that lifestyle was not significantly associated with health outcomes. Given that China's urbanization was on a fast track until the late-1990s, and it took some time for urbanization to affect lifestyles and for those new lifestyles to affect health, their data (1997 to 2004) may not have covered a long enough period to observe the effects of lifestyle.

The present study addresses the above issues in three ways. First, it establishes a framework that integrates fundamental causes theory, lifestyle theory and concepts of urban sociology, and explores how urbanization influences the SES gradient in health and its mechanisms. Second, it uses a time-varying continuous measure of urbanization, which can measure the accumulative process of urbanization and its effects on health more accurately. Third, it uses a physical health

outcome, prevalence of hypertension, to measure the effect of urbanization on health. Hypertension is an important health indicator in China. By the end of 2007, hypertension was the most widespread chronic disease with the highest incidence. This measure avoids the reporting bias of subject health measures, and has policy implications.

RESEARCH QUESTIONS, ANALYTIC FRAMEWORK AND HYPOTHESES

This study aims to answer two questions, derived from the aforementioned criticisms of the extant literature: (1) how does urbanization affect the SES-health relationship in contemporary China? and (2) through which pathway does urbanization exert its effects? These questions are examined within an integrated framework and the three research hypotheses are tested to provide empirical evidence. The analytical framework is based on fundamental causes theory and health lifestyle theory. Moreover, we introduce the assumptions of urban sociology to examine the contextual constraints of life choices. In this study, urbanization is defined as the "social patterns and behaviors associated with living in cities" (Van de Poel et al., 2012), rather than changes in the proportion of the population living in urban areas. Thus, we focus on the evolution of urban life components within a community and their effects on health. The framework is illustrated in Figure 2. The solid lines are the associations that I examine in this study.

[FIGURE 2 IS ABOUT HERE]

SES and Health

Arrow 1 derives from fundamental causes theory, which states that social conditions are fundamental causes of disease. The theory calls for contextualizing individual risk factors, and for more attention to be paid to the structural factors that put people at risk (Link and Phelan, 1995). The core concept of fundamental causes theory involves access to resources that help individuals avoid diseases and their negative consequences through a variety of mechanisms.

In ever-changing China, income and education may still play important roles in maintaining health, but the direction and magnitude of their effects may differ. People with higher incomes

have better access to high quality resources. At the same time, they are more likely to afford unhealthy lifestyles, including eating a high-fat diet and drinking alcohol, and to spend less energy on occupational activities, commuting or housework. As chronic diseases are highly associated with behaviors than the physical environment, higher-income groups may face a higher risk of developing hypertension. Previous studies have revealed that the effect of income on health is curvilinear. In China, people with very low incomes may benefit from an increase in income through acquiring basic resources such as nourishing food, sanitation and primary health care. Therefore, I expect the effect of income in China to be curvilinear. People at the high end of the income distribution suffer the most severe health penalty from urbanization. In contrast, education may play a consistent role in maintaining health by improving knowledge or enhancing non-cognitive abilities. From fundamental causes theory and the existing literature, I derive my first hypotheses as follows:

H1: SES is associated with health outcomes (Arrow 1).

H1.1: People with high incomes have higher health risks than their low-income counterparts.

H1.2: Higher educational attainment is related to better health outcomes.

Urbanization, Lifestyle and Health

Based on health lifestyle theory and concepts of urban sociology, I proposed hypotheses about the relationship between urbanization, lifestyle and SES gradients in health.

Health lifestyle theory was proposed at the turn of the twenty-first century, revealing the role of agency and structure in maintaining health (Cockerham, 2005). According to this theory, a health lifestyle is defined as "collective patterns of health-related behavior based on choices from options available to a person according to their life chances" (Cockerham, 1997). Life choices are a proxy for agency, while life chances are a form of structure. The interaction between life choices and life chances shapes lifestyles, and in turn generates health outcomes.

Urbanization influences life chances of all SES groups, among which changes in diets and intensity of physical activities are highly related with health outcomes. Studies have found that Chinese diets are moving toward Western-style diets, dominated by processed foods and a higher fat content, with economic development and urbanization. Because the rich are more able to

afford to this type of diet, they may suffer from higher risks of obesity and chronic diseases. Moreover, Urbanization changes the occupational structure and leads to a tremendous decline in the intensity of occupational activity (Popkin et al., 2007). It lightens the load of domestic chores by introducing more electrical appliances. It also encourages vehicle use and thus reduces the physical demand of transportation. Because higher-income occupations (i.e. professionals, officials and managers) are more sedentary, and higher-income families can afford more household appliances, higher earners may be at higher risk of health deterioration.

Health lifestyle theory also emphasizes the power of agency. Individuals can influence lifestyle and health outcomes by making choices among their available life chances. Education plays crucial role in this process. Urbanization is usually associated with heterogeneity, increased environmental hazards, stressors and unhealthy lifestyles. Residents of highly urbanized areas need to be sophisticated to carefully distinguish and avoid these health risks. As a result, lifestyles raise the importance of education for staying healthy. From the above analysis, we derive the second and third research hypotheses:

H2: The SES-health relationship varies by urbanization level (Arrow 2).

H2.1: In more urbanized areas, people with high incomes have higher health risks than their counterparts in less urbanized areas.

H2.2: In more urbanized areas, education plays a more important role in maintaining health than in less urbanized areas.

H3: Lifestyle is a mechanism through which urbanization affects SES gradients in health (Arrow 3).

H3.1: A high-fat diet decreases the role of income in maintaining health, strengthens the education-health relationship and increases health risks in more urbanized areas.

H3.2: Decreased physical activity decreases the role of income in maintaining health, strengthens the education-health relationship and increases health risks in more urbanized areas.

DATA, MEASUREMENT AND METHODS

Data

This study uses the China Health and Nutrition Survey (CHNS) data from 1997, 2000, 2004, 2006 and 2009. Adults aged 18-65 in each wave are used for the analyses. The CHNS was designed to examine how socioeconomic changes in China affect the health and nutritional status of the population. Using a multistage, random cluster sampling method, the survey collects intensive information on individuals, households and their communities in nine provinces in China: Liaoning (from 1997), Shandong, Jiangsu, Henan, Heilongjiang (not in 1997), Hubei, Hunan, Guangxi, and Guizhou. It provides unique, large-scale panel data to study health issues in post-reform China. To control for the sample attrition due to poor health status, people who die in subsequent waves are excluded in current study. Mortality is an important measurement for investigating the health determinants, thus we plan to examine it in a separate study. We also exclude respondents who report being physically handicapped or pregnant during the survey year. After leaving out any observations with missing information for any individual- or community-level variables, the sample size for analysis is 34,552 person-year records (14,007 observations). The number of observations in each wave is listed in Appendix 2.

The descriptive statistics for the working sample are presented in Table 1. Nearly 34 per cent of respondents are from urban or suburban areas. Their average age is 43.0, 62.7 per cent of them have completed junior high school education. The prevalence rate of hypertension is 8.5 per cent. This number steadily increases during the survey years, as illustrated in Table 3. This trend is consistent with that released by the National Statistics Bureau. Respondents obtain 28.8 per cent of energy from fat, on average. According to Chinese DRIs (2013 Chinese Dietary Reference Intake), the proportion of calories obtained from fat should be 20-30 per cent for adults to stay healthy. The high percentage reported in the survey indicates the potential widespread risk of hypertension and obesity. Forty-two per cent of respondents report heavy physical activity, because a large number of them engage in agricultural activities.

[TABLE 1 IS ABOUT HERE]

Measurement

Health Status

This study focuses on physical health status, measured by diagnosed hypertension. We construct a dichotomous variable that equals one if a respondent has ever been diagnosed with high blood pressure. This measure, however, may suffer from an underreporting bias. Rural people and the poor are less likely to visit a doctor than urban and rich people, which may lead to overestimation of the negative effect of urbanization and income on health. To address this potential problem, we include medical insurance enrollment in the estimation to capture the effect of medical resource accessibility. The Chinese government implemented the New Cooperative Medical Scheme in 2003 in rural areas, aiming to reach universal coverage in 2010. To encourage peasants to take part in this scheme and to achieve the goal set by the central government, it is a common practice for local governments to offer peasants free physical examinations. Thus, systematic differences between urban and rural areas in hypertension diagnosis may decrease over time.

Urbanization

One of the key independent variables in the analysis is urbanization, which is measured by the index used in Jones-Smith and Popkin's (2010) study. Using data collected from a community survey, the two principle investigators of the CHNS designed and constructed a multi-component scale to measure urban features on a continuum in China, then tested and validated it (Jones-Smith and Popkin, 2010). It measures 12 aspects of urbanization, including population density, economic activity, traditional markets, modern markets, transportation and health infrastructure, sanitation, communication, social services, diversity and housing. The detailed construction procedure and the dataset of the index are available on the CHNS website[1]. This scale consistently fits the data released by the National Bureau of Statistics (Appendix 1).

We use this measurement rather than an administrative measure for two reasons. First, it uses data collected from 218 communities, within which households were selected for the survey. The community-level measure more accurately captures the community attributes that affect local residents. Second, it represents gradations on the continuum from rural to urban environments, and is more flexible in capturing changes in a community and their effects on health outcomes.

[1] Detailed information and the dataset can be found at http://www.cpc.unc.edu/projects/china/data/datasets.

We examine the distribution of the index over five survey years and various community types. The results are shown in Table 2. The distribution generally fits the administrative measure, and reveals changes over time within/between communities. Urban areas report the highest index scores, followed by towns, suburban sites and villages. The urbanization index steadily increases over the survey years within each type of community, but suburban areas and towns experience the rapidest development. The greatest variance is found among suburban areas and the variance continues to increases in recent waves, indicating large-scale city expansion in some areas. Provincial capital cities and economically developed cities have more resources and higher motivation to merge the rural communities on their fringes. It is clear that even within the same administrative group, communities may systematically differ according to their location. The administrative measure fails to reveal these differences.

[TABLE 2 IS ABOUT HERE]

Individual SES

This study measures individual SES by income and education. Because half of the respondents come from rural areas and do not engage in any paid employment, we use household income per capita to reflect economic status. The income data are inflated to 2011. To capture the potential non-linear effects of income on health, we calculate the standard deviation of income for each community in each wave, and categorize all respondents into three groups: high income (one standard deviation above the mean), low income (one standard deviation below the mean) and medium income (all other households). Education is measured by a dichotomous variable, which equals 1 if the respondent completed junior high school education.

Lifestyle

Two dimensions of lifestyle are examined in this study: dietary intake and physical activity. We use percentage of calories from fat to measure dietary style. Previous studies have proven that fat is an important indicator of calorie balance, and is positively related to obesity and hypertension. This measure is widely used by epidemiologists and economists. Using the 24-hour dietary recall and weighting methods, the CHNS provides rich information on the food consumption of respondents.

To capture respondents' daily energy consumption, the CNHS asks detailed questions about five types of physical activity: (1) occupational activity, measured by time spent on light, moderate or heavy physical activities during work time; (2) commuting, measured by time spent on commuting by walking, cycling, bus or car; (3) domestic work, measured by time spent on cleaning, cooking, laundry and childcare; (4) physical exercise, measured by time spent engaging in a variety of sports such as gymnastics, swimming and basketball; and (5) recreational activities, measured by time spent watching TV/DVD, playing video/computer games, writing and drawing. Based on this information, respondents are divided into six categories according to their level of physical activity: very light, light, moderate, heavy, very heavy and other. The "other" category includes people who are unable to work. This constructed variable is available on the website of the CHNS.[2] In this study, we further group respondents into four groups: light, moderate and heavy activity, and other.

Control variables

In addition to individuals' demographic characteristics, we control for alcohol consumption, tobacco use, medical insurance enrollment and labor market participation. These factors are proven to be distributed unevenly between rural and urban areas, and are highly associated with hypertension. We also include province and survey year fixed effects, to remove the region- and year-specific heterogeneity.

Method

We pool the five waves of data and use logistic regression models to estimate the effect of urbanization on the income-health relationship, characterized by the following equation:

$$Hypertension_{ic} = \beta_1 SES_{ic} + \beta_2 urbanization_c + \beta_3 SES_{ic} * urbanization_c + X_{ic}\Gamma + \varphi_r + \delta_y + \varepsilon_{ic}$$

where $Hypertension_{ic}$ is a dichotomous variable that equals one if the respondent *i* in community *c* is diagnosed with hypertension; SES_{ic} represents the education and income level of respondent

[2] http://www.cpc.unc.edu/projects/china/data/datasets/data_downloads/longitudinal.

I; and $urbanization_c$ denotes the urbanization index of community *c*. This specification includes province and survey year fixed effects, denoted as φ_r and δ_r, to control for changes over region or year that have similar effects on respondents within a province or year. X_{ic} is a vector of individual-level control variables. We are interested in β_3, which are the effects of urbanization on the SES-health relationship. A statistically significant coefficient indicates that the effect of income on health differs by urbanization level. Respondents within a community experience similar living conditions, thus the error may not be independent. We address this problem by adjusting for community clustered effects.

We further explore the role of diet and physical activity in mediating the effects of urbanization with the following specification:

$$Hypertension_{ic} = \beta_1 SES_{ic} + \beta_2 urbanization_c + \beta_3 SES_{ic} * urbanization_c + \beta_4 lifestyles + X_{ic}\Gamma + \varphi_r + \delta_y + \varepsilon_{ic}$$

where $lifestyles_{ic}$ represents the calorie consumption or intensity of activity of respondent *i*. If the magnitude of β_3 changes when these two variables are introduced, and if the coefficient of β_4 is statistically significant, it indicates that dietary changes and/or a decline in activity levels are important mechanisms through which urbanization mediates the income-health relationship.

EMPIRICAL RESULTS

Descriptive Statistics

We first calculate the means and 95 percent confidence intervals for the urbanization level, prevalence of hypertension and lifestyle measures for each survey year to illustrate the changes over time. Table 3 shows that the level of urbanization increases steadily over the 12 years, paralleled by a pronounced rise in the hypertension rate from 3.4-4.3 per cent in 1997 to 11.7-13.2 per cent in 2009. This period also witnesses prominent dietary changes. In 1997, the average intake of calories from fat is 26.5-27.1 per cent. This proportion increases to 30.2-30.7

per cent in 2009, which exceeds the upper limit recommended by Chinese DRIs. At the same time, there is a decrease in levels of physical activity. The proportion of heavy activities declines by 25 per cent during this period.

[TABLE 3 IS ABOUT HERE]

Logistic Regression Results

To gain a better understanding of the effect of urbanization on health outcomes, we conduct a logistic regression analysis (Table 4). Model 1 shows that income is positively associated with hypertension. Compared with those on low incomes, people with incomes one standard deviation above the mean are more likely to develop hypertension. Holding other variables constant, the predicted odds of developing hypertension for the high-income group is 22.5 per cent ($e^{0.203}-1=0.225$) higher than that of the low-income group. Consistent with existing studies, education is a strong protective factor of health. For those who complete junior high school, the predicted odds of developing hypertension is only 87.0 per cent ($e^{-0.140}=0.87$) of that of their less educated counterparts. Hypotheses 1.1 and 1.2 are supported.

[TABLE 4 IS ABOUT HERE]

In Models 3 and 4, we include the interaction between the urbanization index and SES to examine whether the SES gradient in health is steepened or flattened by urbanization. Model 3 shows that the income-health relationship differs by urbanization level. The significantly positive coefficient of the interaction term indicates that in more urbanized communities, the probability of developing hypertension is more likely to increase with income than in less urbanized areas. This trend is illustrated in Figure 3. Although the risk of hypertension increases as the urbanization index increases, the high-income group suffers from the most rapid increase compared to the low and medium income groups. Hypothesis 2.1 is supported.

When SES is measured by income, the results provide evidence for the theory that the SES gradient in health is flattened by urbanization. According to previous studies, rich people in developing countries face higher health risks because they are more likely to afford unhealthy

lifestyles. Such lifestyles are recognized as health risks in Western countries, whereas they are still considered a symbol of wealth or privilege. More urbanized areas have a greater concentration of unhealthy lifestyle elements, such as fast food stands, restaurants and bars, thus their rich residents may face greater health risks than those in less urbanized communities.

[FIGURE 3 IS ABOUT HERE]

Model 4 reveals that education plays a more important role in maintaining health in more urbanized areas. People who complete junior high school in these communities are less likely to develop hypertension than their counterparts in less urbanized areas. Hypothesis 2.2 is supported. The gap in health between high and low levels of education is increased by urbanization, which suggests a "double jeopardy" for less educated groups. This trend is visually presented in Figure 4. One possible explanation is that resources that both enhance and pose risks to health are highly concentrated in urban areas. Residents need more knowledge to recognize and avoid the risks, and to take advantage of the various resources that may enhance their health.

[FIGURE 4 IS ABOUT HERE]

To further explore the mechanisms through which urbanization affects the SES-health relationship, we examine the roles of diet and physical activity as the mediators in Table 5. Models 1 and 2 test the effects of dietary intake. The results show that a high-fat diet is positively associated with hypertension risk. Models 3 and 4 examine the role of physical activity in maintaining health. The results show that a decrease in physical activity is a strong predictor of health risk. Compared with those who report light activity levels, the predicted odds of developing hypertension are 18 per cent and 27 per cent lower for those who report medium and heavy activity levels, respectively.

[TABLE 5 IS ABOUT HERE]

To examine whether lifestyle is a mechanism through which urbanization influences the SES-health relationship and health outcomes, we examine the changes in the coefficients of the SES-

urbanization interaction terms and the urbanization index. The results of the generalized Hausman specification test are shows in Table 6. When dietary intake and physical activity are included in the estimations, the coefficients of the urbanization index decrease by 0.045 and 0.058, respectively. The changes are statistically significant at the 0.05 level, indicating that urbanization exerts direct effects on health outcomes through lifestyle. In addition, when dietary intake is included, the protective role of education in higher urbanization decreases, which indicates that more educated people may enjoy health advantages by adopting healthier dietary habits. The final row in Table 6 shows that physical activity is an important pathway through which urbanization affects the income-health relationship. This finding implies that richer people in more urbanized areas may lead more sedentary lifestyles and consequently suffer higher health risks than their counterparts in less urbanized communities. Generally, both Hypotheses 3.1 and 3.2 are supported.

[TABLE 6 IS ABOUT HERE]

CONCLUSION AND DISCUSSION

The SES gradient in health provides useful insight into how an individual's position on the social ladder generates various outcomes that limit his or her life opportunity and life quality. Using CHNS panel data spanning 12 years, this study explores how SES gradient in health is moderated by urbanization, one of the most important contextual factors in contemporary China. Although many researchers have called for an integrated analytical framework that combines micro and macro perspectives, few empirical studies have been conducted in China. This study uncovers an SES-gradient in health in China. Moreover, the SES gradient may be moderated by urbanization. In highly urbanized areas, the income gradient is flatter because rich people lose their advantages. In contrast, the education gradient in health becomes steeper because better educated people enjoy greater advantages. This study further shows that lifestyle is an important channel through which urbanization affects health outcomes and the SES gradient in health. High-fat diets and a decrease in physical activity are main contributors to the health penalty of

urbanization in China. People who are more likely to afford these facilities have higher possibilities of adopting unhealthy lifestyles.

The results shows that the double jeopardy theory and the health penalty theory coexistent in the context of China. The applicability of the two theories depends on which dimension of SES we focus on. China is undergoing dramatic socioeconomic, nutritional and epidemic transitions. Newly affluent Chinese people adopt diverse Western lifestyles without fully recognizing the related health risks. Rapid urbanization in the late 1990s may have worsened the situation. Residents have less time to prepare intellectually and culturally. Compared with communities experiencing moderate changes, education in rapidly urbanized communities plays a more crucial role in maintaining health by helping residents to identify and avoid health risks.

Rural to urban migrants are excluded from the analysis. As the CHNS does not collect information about *hukou* type (local vs. non-local *hukou*), it is impossible to differentiate migrants from local people. Excluding migrants may introduce bias. Younger and healthier people are more likely to migrate than their counterparts, leaving the less healthy and elderly behind in areas of low urbanization. People only tend to return to their hometowns when they get old or become ill. In such circumstances, the negative effect of urbanization on health would be underestimated. In this study, we do not consider this as a major problem. First, we focus on the growth of urban elements and its complex associations with health, rather than the effect of urban living experiences. Second, even there is potential bias, at least we estimate the bottom-line of the effects of urbanization.

It should be noted that we do not overlook the other mechanisms through which urbanization may influence the health of different SES groups. There are several important directions worthy of further exploration. Environmental deterioration is an obvious candidate. There is growing concern about the pollution of air, water and solids due to urbanization. Environmental pollution has acute and chronic effects on mortality, morbidity and clinical symptoms (He et al., 2002; Fu et al., 2007; Zhu et al., 2011; Ebenstein, 2012). The health advantages enjoyed by richer people may be suppressed because all people living in the same place are exposed to similar pollution conditions.

This study contributes new knowledge to the literature in several ways. First, we propose and test an integrated analysis framework that connects the macro and micro attributes of health, and tests its validity in the context of China. The findings reveal that the SES-gradient in health

varies due to aggregated factors, and lifestyles are an important pathway linking individual- and community-level attributes. Second, the results show that both the double jeopardy theory and the health penalty theory can explain the effects of urbanization on health inequality in developing countries. They are, in fact, complementary rather than competing theories. The mixed findings in the literature may be due to the fact that different dimensions of SES affect health in diverse ways among different populations. Mixing the various dimensions together may lead to inconsistent conclusions. This study suggests that the effects of urbanization on the SES-health gradient are highly heterogeneous, thus further studies are needed to decompose SES and evaluate the effects of urbanization in time- and region-specific contexts. Third, previous studies have found that the effect of urbanization on SES-related health is only significant in terms of subjective health in China (Van De Poel et al., 2012). Using two new waves of CHNS data, I observe the negative effect of urbanization on the SES-health relationship, and the findings suggest that urbanization takes time to exert its influence on health outcomes, especially through lifestyle changes.

From a policy perspective, this study suggests that there is an urgent need to design and conduct health education and intervention programs to reduce the health risks caused by urbanization. More than US$ 6.7 billion was invested to treat cardiovascular diseases in 2009 (Hu et al., 2012). This expense continues to grow due to the increasing number of patients and rising medical costs. The current Chinese government considers urbanization the most important driving force of the domestic economy, which indicates that more people will join the urban population in the coming years. If there is no effective strategy to cope with the negative effects of rapid urbanization, the health benefits brought by economic development may be reversed. Our study suggests that health education programs may be necessary and effective ways to help people stay healthy. In addition, more public facilities and green spaces are needed to encourage people to engage in physical exercise.

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FIGURE 1. GDP PER CAPITA, URBANIZATION RATE AND MORBIDITY RATE IN CHINA (1998-2003)

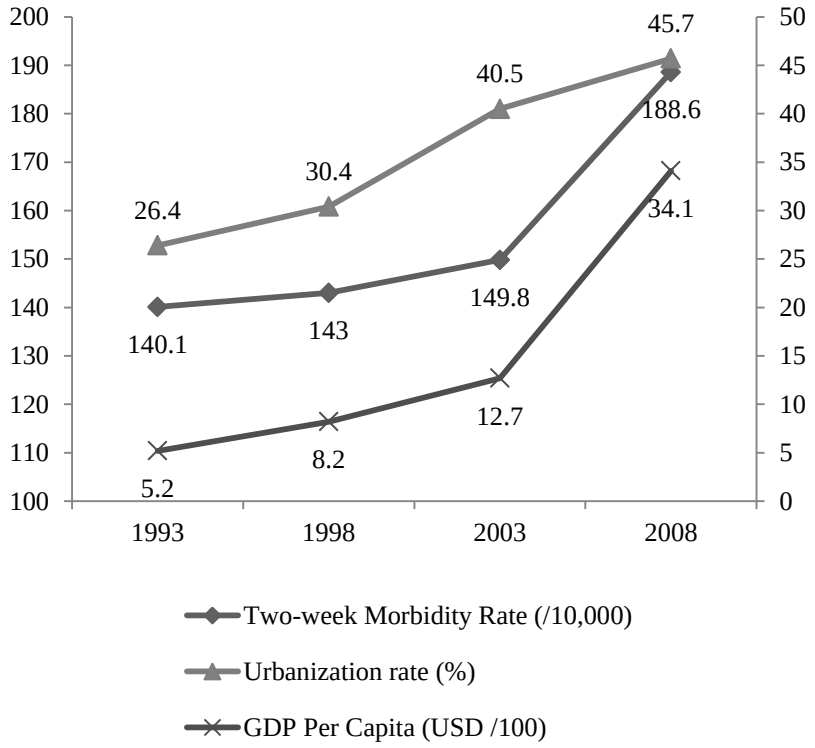


FIGURE 2. ANALYTICAL FRAMEWORK OF URBANIZATION, SES AND HEALTH

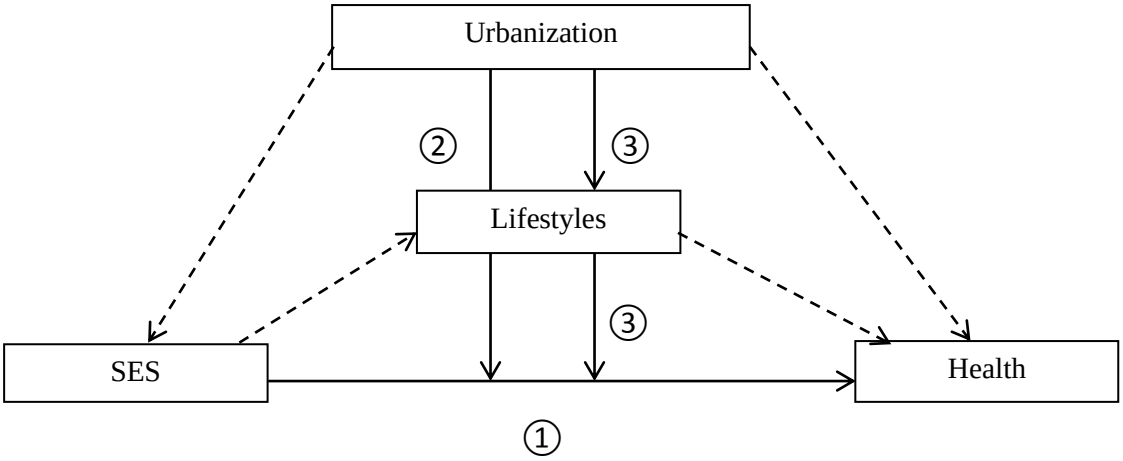


FIGURE 3. LOGISTIC REGRESSION ESTIMATION OF HOUSEHOLD INCOME AND HYPERTENSION

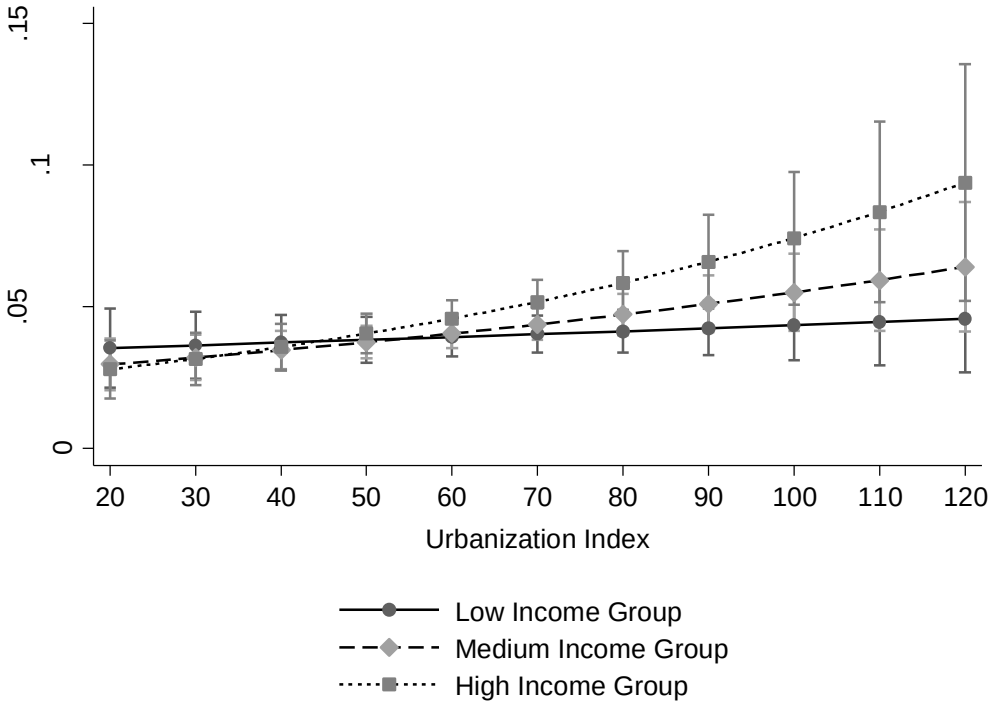


FIGURE 4. LOGISTIC REGRESSION ESTIMATION OF EDUCATION AND HYPERTENSION

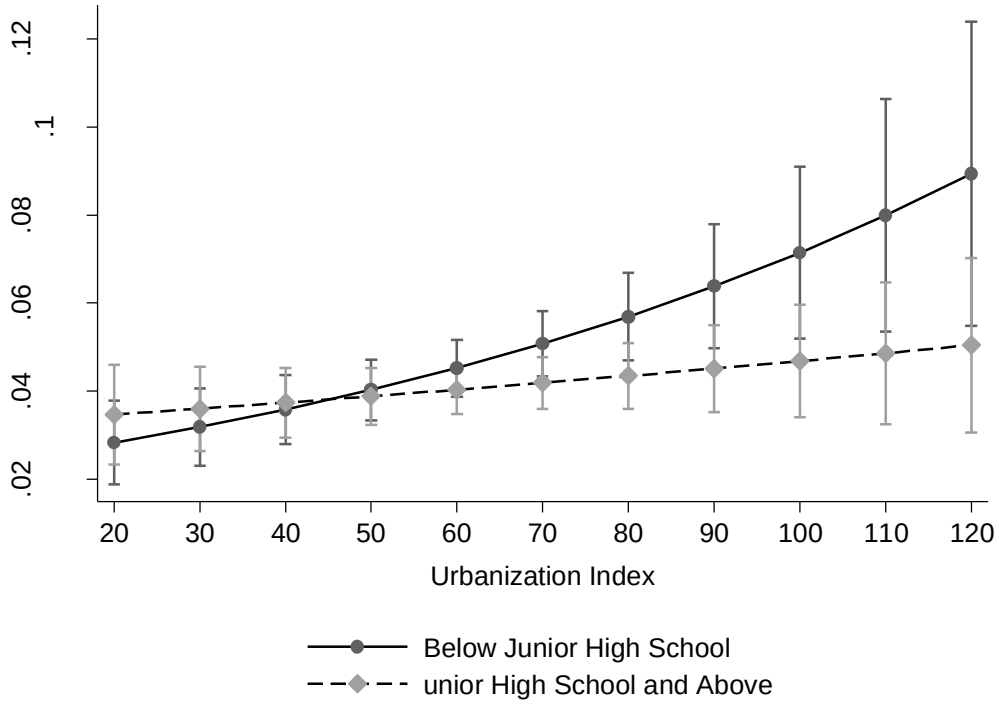


TABLE 1. DESCRIPTIVE STATISTICS OF WORKING SAMPLE (N=34,552)

Variable	Mean	Standard Deviation
Age	43.099	12.213
Male	0.473	-
Urban *Hukou* (Yes=1)	0.401	-
Married	0.855	-
Junior High School and Above (Yes=1)	0.627	-
Per Capita Household Income (Inflated to 2011)	8016.849	9256.181
Urbanization Index	61.297	19.813
Prevalence of CVD	0.085	0.280
Per cent of Calories from Fat	0.288	0.113
Activity Level		
Light	0.406	0.491
Medium	0.168	0.374
Heavy	0.421	0.494
Other	0.005	0.069
Medical Insurance (Yes=1)	0.446	-
Drink (Yes-=1)	0.348	-
Smoke (Yes=1)	0.294	-
Community Type		
Urban	0.143	0.350
Suburban	0.194	0.396
Town	0.153	0.360
Village	0.509	0.500
Province		
Liaoning	0.0955	0.294
Heilongjiang	0.119	0.323
Jiangsu	0.123	0.329
Shandong	0.107	0.310
Henan	0.106	0.308
Hubei	0.106	0.307
Hunan	0.111	0.314
Guangxi	0.115	0.319
Guizhou	0.118	0.322

TABLE 2. URBANIZATION INDEX FOR FOUR TYPES OF SURVEY SITES OVER FIVE WAVES

Community Type	Survey year				
	1997	2000	2004	2006	2009
Urban	73.855	79.137	87.355	87.835	88.312
	(8.286)	(6.683)	(7.008)	(7.659)	(6.809)
	32	*36*	*36*	*36*	*36*
Suburban	56.570	65.937	70.168	72.252	72.214
	(14.980)	(15.539)	(17.386)	(18.113)	(18.934)
	32	*37*	*37*	*37*	*37*
Town	68.915	76.637	78.006	79.546	83.918
	(10.411)	(8.189)	(10.944)	(11.842)	(11.106)
	31	*36*	*35*	*37*	*37*
Village	40.365	44.873	47.778	49.849	53.862
	(12.508)	(10.708)	(11.706)	(12.635)	(12.051)
	94	*108*	*108*	*108*	*108*
Total	53.269	58.714	62.358	63.969	66.732
	(18.372)	(18.410)	(20.042)	(20.140)	(19.229)
	189	*217*	*216*	*218*	*218*

Notes: (1) Standard deviations are in parentheses.
(2) Numbers in italics indicate the number of communities.

TABLE 3. PREVALENCE OF CVD, URBANIZATION INDEX, CALORIE INTAKE AND OCCUPATIONAL ACTIVITY IN EACH SURVEY YEAR

	1997	2000	2004	2006	2009
Urbanization Index	53.327	58.714	62.359	63.969	66.731
	(52.801, 53.729)	(58.277, 59.151)	(61.897, 62.824)	(63.496, 64.443)	(66.296, 67.167)
Prevalence of Hypertension	0. 038	0.063	0.087	0.106	0.125
	(0.034, 0. 043)	(0.058, 0.069)	(0.081, 0.093)	(0.098, 0.113)	(0.117, 0.132)
Percentage of Calories from Fat	0.268	0.289	0.290	0.284	0.304
	(0.265, 0.271)	(0.286, 0.291)	(0.288, 0.292)	(0.281, 0.287)	(0.302, 0.307)
Activity Level					
Light	0.344	0.360	0.411	0.423	0.475
	(0.331, 0.355)	(0.349, 0.372)	(0.400, 0.422)	(0.411, 0.435)	(0.464, 0.487)
Medium	0.173	0.161	0.180	0.171	0.158
	(0.163, 0.182)	(0.152, 0.170)	(0.171, 0.189)	(0.162, 0.180)	(0.149, 0.166)
Heavy	0.479	0.472	0.397	0.404	0.362
	(0.467, 0.492)	(0.461, 0.484)	(0.386, 0.408)	(0.392, 0.415)	(0.357, 0.373)
Other	0.003	0.005	0.010	0.001	0.003
	(0.001, 0.005)	(0.003, 0.007)	(0.008, 0.012)	(0.000, 0.001)	(0.002, 0.005)
Number of Observations	6,131	6,819	7,182	6,933	7,487

Notes: the numbers in the parentheses following an estimate are the 95% confidence intervals.

TABLE 4. LOGISTIC REGRESSION ESTIMATES FOR THE EFFECTS OF SES AND URBANIZATION ON DIAGNOSED HYPERTENSION (N=34,552)

Dependent Variable: Diagnosed by a doctor as a patient with hypertension (1=Yes; 0=Otherwise)				
Variable	(1)	(2)	(3)	(4)
Household Income Level (Ref.: Low)				
Medium	0.056	0.058	-0.293	0.060
	(0.067)	(0.067)	(0.207)	(0.067)
High	0.203*	0.211*	-0.451+	0.215*
	(0.088)	(0.088)	(0.267)	(0.089)
Junior High School and Above (1=Yes)	-0.140+	-0.162*	-0.165*	0.374+
	(0.080)	(0.079)	(0.079)	(0.217)
Urbanization Index (/10^2)		0.791*	0.266	1.215***
		(0.322)	(0.392)	(0.364)
Income * Urbanization (/10^2) (Ref.: Low * Urbanization)				
Medium * Urbanization			0.539+	
			(0.285)	
High * Urbanization			1.017*	
			(0.398)	
Junior High School * Urbanization (/10^2)				-0.823*
				(0.330)
Community Type (Ref.:Urban)				
Sub-urban	0.060	0.127	0.126	0.085
	(0.121)	(0.129)	(0.129)	(0.133)
Town	-0.019	0.014	0.016	-0.015
	(0.129)	(0.132)	(0.132)	(0.132)
Village	-0.226	-0.023	-0.020	-0.059
	(0.142)	(0.184)	(0.184)	(0.183)
Male	0.171*	0.172*	0.175*	0.164*
	(0.079)	(0.079)	(0.079)	(0.079)
Age(/10)	2.212***	2.203***	2.213***	2.221***
	(0.333)	(0.332)	(0.331)	(0.332)
Marital Status (Married=1)	0.200*	0.195*	0.192*	0.196*
	(0.097)	(0.097)	(0.097)	(0.097)
Urban *Hukou*	0.291**	0.211*	0.213*	0.211*
	(0.092)	(0.087)	(0.087)	(0.086)
Active in Labor Market (1=Yes)	-0.305***	-0.290***	-0.297***	-0.268***
	(0.061)	(0.059)	(0.059)	(0.059)
Constant	-10.206***	-10.715***	-10.386***	-10.995***
	(0.841)	(0.896)	(0.926)	(0.903)
Log Pseudo Likelihood	-8353.964	-8346.067	-8342.726	-8339.458
Pseudo R-squared	0.173	0.174	0.174	0.174

Notes: (1) Log odds are reported.

(2) Numbers in parentheses are robust standard errors adjusted for the clustering on communities.

(3) †, *, **, and *** represent the significance at the 10, 5, 1 and 0.1 percent level.

(4) Controlled for quadratic age, alcohol drinking, smoking, medical insurance coverage, survey year and province fixed effects.

TABLE 5. LOGISTIC REGRESSION ESTIMATES FOR THE EFFECTS OF SES AND URBANIZATION ON DIAGNOSED HYPERTENSION: LIFESTYLES AS MECHANISMS (N=34,552)

Dependent Variable: Diagnosed by a doctor as a patient with hypertension (1=Yes; 0=Otherwise)				
Variable	(1)	(2)	(3)	(4)
Household Income Level (Ref.: Low)				
Medium	-0.292	0.058	-0.289	0.056
	(0.207)	(0.067)	(0.207)	(0.068)
High	-0.458+	0.208*	-0.459+	0.198*
	(0.268)	(0.088)	(0.266)	(0.088)
Junior High School and Above (1=Yes)	-0.171*	0.352	-0.191*	0.338
	(0.079)	(0.218)	(0.079)	(0.218)
Urbanization Index ($/10^2$)	0.221	1.156**	0.052	0.985**
	(0.392)	(0.364)	(0.386)	(0.358)
Income * Urbanization ($/10^2$) (Ref.: Low * Urbanization)				
Medium * Urbanization	0.534+		0.527+	
	(0.285)		(0.285)	
High * Urbanization	1.016*		1.003*	
	(0.399)		(0.395)	
Junior High School * Urbanization ($/10^2$)		-0.797*		-0.808*
		(0.330)		(0.330)
% Calories from Fat	0.516*	0.485*		
	(0.226)	(0.227)		
Activity Level (Ref. : Light)				
Medium			-0.187*	-0.192**
			(0.073)	(0.074)
Heavy			-0.318***	-0.314***
			(0.084)	(0.083)
Other			-0.179	-0.180
			(0.218)	(0.217)
Community Type (Ref.:Urban)				
Sub-urban	0.125	0.086	0.134	0.095
	(0.128)	(0.132)	(0.128)	(0.132)
Town	0.030	-0.001	0.016	-0.015
	(0.132)	(0.132)	(0.132)	(0.131)
Village	-0.006	-0.044	0.015	-0.023
	(0.183)	(0.183)	(0.183)	(0.182)
Age(/10)	2.206***	2.213***	2.259***	2.265***
	(0.331)	(0.332)	(0.331)	(0.331)
Male	0.181*	0.170*	0.190*	0.179*
	(0.079)	(0.079)	(0.079)	(0.079)
Marital Status (Married=1)	0.196*	0.199*	0.199*	0.202*
	(0.097)	(0.097)	(0.098)	(0.098)
Active in Labor Market (1=Yes)	-0.294***	-0.266***	-0.235***	-0.207***
	(0.059)	(0.059)	(0.062)	(0.061)
Constant	-10.487***	-11.078***	-10.238***	-10.833***
	(0.927)	(0.904)	(0.919)	(0.896)
Log Pseudo Likelihood	-8339.267	-8336.418	-8330.205	-8327.088
Pseudo R-squared	0.174	0.175	0.175	0.176

Notes: (1) Log odds are reported.

(2) Numbers in parentheses are robust standard errors adjusted for the clustering on communities.

(3) †, *, **, and *** represent significance at the 10, 5, 1 and 0.1 percent levels.

(4) Controlled for quadratic age, urban *hukou*, alcohol drinking, smoking, medical insurance coverage, survey year and province fixed effects.

TABLE 6. COEFFICIENT COMPARISON ACROSS LOGISTIC REGRESSION MODELS (GENERALIZED HAUSMAN TEST)

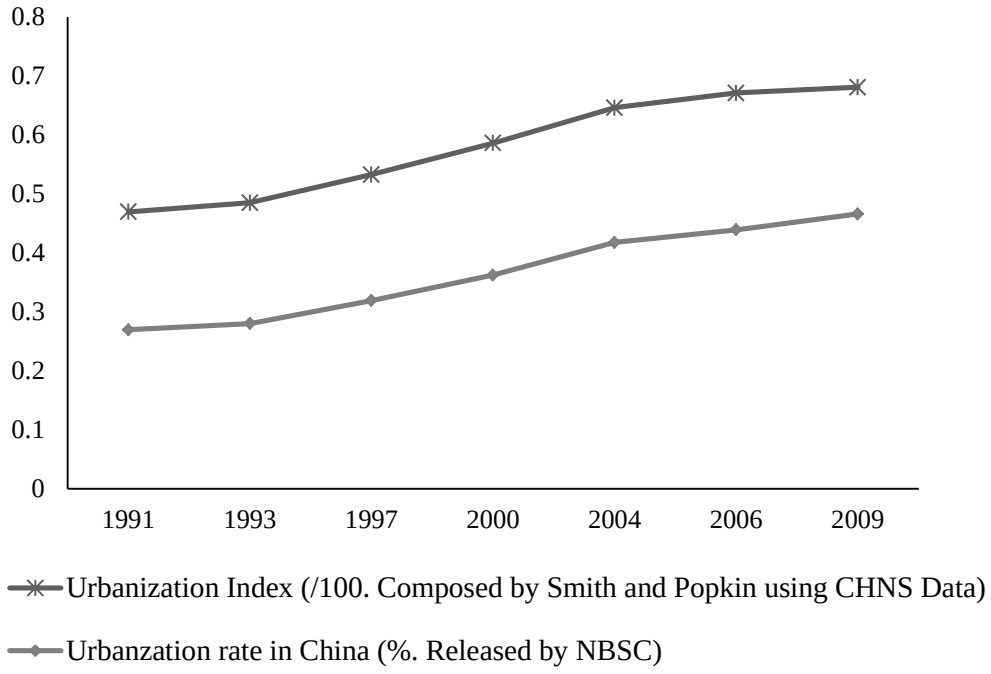
Panel 1: Coefficients of Logistic Regression Models of Hypertension on Urbanization, Income, Urbanization-Income and Lifestyle

	Baseline Model	Model 1		Model 2	
	Urbanization * Income	Baseline + Dietary Intake	M1-Baseline	Baseline + Physical Activity	M2-Baseline
Urbanization Index	0.265	0.220	-0.045*	0.013	-0.252***
Urbanization * Medium Income	0.539	0.533	0.006	0.494	-0.045**
Urbanization * High Income	1.016	1.016	0.000	0.966	-0.050***

Panel 2: Coefficients of Logistic Regression Models of Hypertension on Urbanization, Education, Urbanization-Education and Lifestyle

	Baseline Model	Model 1		Model 2	
	Urbanization * Education	Baseline + Dietary Intake	M1-Baseline	Baseline + Physical Activity	M2-Baseline
Urbanization Index	1.214	1.156	-0.058*	0.985	-0.229***
Urbanization * Junior High School	-0.823	-0.797	0.026*	-0.807	0.006

APPENDIX 1. URBANIZATION RATE IN CHINA



APPENDIX 2. OBSERVATIONS IN EACH WAVE

Survey Year	Number of Waves Respondents Took Part In					
	One	Two	Three	Four	Five	**Total**
1997	6,131	0	0	0	0	6,131
2000	2,890	3,928	0	0	0	6,819
2004	2,069	2,340	2,773	0	0	7,182
2006	1,091	1,682	1,997	2,163	0	6,933
2009	1,826	961	1,432	1,669	1,609	7,487
Total	14,007	8,912	6,202	3,822	1,609	34,552