Article



Internal migration and health stratification in urban China

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Abstract

This study examines health stratification in contemporary urban China in light of rapid internal migration and evolving socio-institutional arrangements in the society. Much of this has been linked to the *hukou* system or household registration system which has created a stratification system based on place of origin (rural or urban) and occupation (agricultural or non-agricultural). The research question was probed using a nationally representative survey. The results show that as a group, migrants in urban areas were healthier than urban natives, and residents with non-agricultural *hukou* were healthier than those having agricultural *hukou*. Institutional impacts on health status were largely indirect, as manifested partly through self-selective mechanisms of migration and partly through socio-economic stratification in urban society. Nevertheless, institutional arrangements had salient direct impacts on individuals' access to health resources, which were robust even after controlling for related demographic and socio-economic factors.

Keywords

internal migration, health stratification, hukou system, urban China

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Research background

China has witnessed substantial internal migration in recent decades. The latest population census shows that internal migrants in China numbered around 221 million in 2010, which accounts for one-sixth of the national population. Most internal migrants target urban areas, contributing to increasing levels of urbanization. In 2011, the population of urban residents in China surpassed the rural population for the first time in history. By the end of 2014, urban residents accounted for around 54.8 percent of the national population.¹ Continuing migration and rapid urbanization pose increasing challenges to the health and social services system in urban China. This is especially striking in view of the existing tension in the public health system, persisting health care difficulties and inequality in urban society (Li et al., 2015).

In this study, the term "urban residents" refers to individuals who currently live in urban areas and have stayed there continuously for at least one month, with or without local urban registration in the hukou system. According to the type and location of hukou registration, urban residents mainly comprise the following groups: (a) non-agricultural hukou residents registered locally; (b) agricultural hukou residents registered locally; (c) non-agricultural *hukou* residents registered elsewhere and (d) agricultural hukou residents registered elsewhere. The first group consists of the urban residents who are non-migrants registered in the local urban area and hold non-agricultural hukou. The second group includes residents in outlying urban districts, marriage migrants (most likely females from rural areas) and their children with agricultural hukou, and the like. The last two groups consist of migrants from other urban or rural areas. Under the hukou registration system and related institutional arrangements, these four groups of urban residents are associated with different socio-economic status, access to resources and health outcomes (Chan, 2009; Wu and Treiman, 2004). It has been well documented that compared with urban natives, migrants with agricultural hukou in urban China have socio-economic disadvantages. They usually face various institutional barriers, are exposed to greater health risks, and have less access to health resources (Solinger, 1999). However, few studies have systematically examined the issue of health stratification in contemporary urban China. Thus, we know little about the health differences among the four groups of urban residents, and how health stratification is related with or shaped by institutional and socio-economic arrangements inherent in the hukou registration system.

¹Calculated from the data published by the National Bureau of Statistics of China. Available at: http://data.stats.gov.cn/english/tablequery.htm?code=AC03

In this study, we aim to fill this gap by investigating health stratification among China's urban residents. Special attention is paid to health-related disparities in terms of health status, access to health resources and use of health services among the four groups of urban residents. We examine the following research questions: First, how do the four groups of urban residents compare in their health status, access to health resources and use of health services? Second, how much of the observed difference is attributable to their socio-economic characteristics? Third, what is the institutional impact of the *hukou* system on health stratification in contemporary urban China?

The study is expected to contribute to the existing literature for several reasons. First, using a nationally representative sample survey which oversampled migrants, the study provides an opportunity to examine migrants by hukou type (agricultural vs. non-agricultural) and compare them with their urban native counterparts. This has not been done in previous research. Second, the study employs several health-related measures, including subjective health status, objective biometrics, access to health resources and service use, which could contribute to more targeted policy and public health interventions. Third, the different impacts of institutional and socio-economic factors are explored and this could shed light on how the hukou system affects different groups of urban natives and migrants. The paper is organized into five sections. In the next section, we review China's hukou registration system briefly with special focus on the institutional division among the four groups of urban residents; the second section also surveys the existing literature on migration and health; the third section introduces the data source and research methods employed in this study; the fourth section presents the major findings; and the fifth section summarizes the main findings and policy implications.

The hukou system and the migration-health relationship

The hukou registration system in China

The *hukou* registration system in China was established in the 1950s for the purpose of "maintaining social peace and order, safeguarding the people's security, and protecting their freedom of residence and movement" (Liu, 2005: 135). Two dimensions of *hukou* registration, i.e., type (agricultural vs. non-agricultural) and location (rural vs. urban in different administrative areas), serve to classify Chinese citizens and are used as a basis for socio-economic planning and administration. Originally, the division between agricultural and non-agricultural *hukou* closely followed occupational lines, as did the division between rural and urban registrations. Urban residents were normally ascribed with non-agricultural *hukou* and registered in local urban areas, which ensured their job allocation to non-agricultural sectors under the strict *hukou* registration and central rationing system.

Underpinned by the central rationing system, the hukou system laid the foundation for marked socio-economic stratification between agricultural and non-agricultural hukou holders. Superior entitlements in education, job allocation, health resources, housing and other benefits were provided to non-agricultural hukou holders in urban areas. Agricultural hukou holders, on the other hand, were entitled to farmland in rural areas but not formal urban jobs (Christiansen, 1990; Wong, 1994). Conversion from agricultural to non-agricultural hukou was not possible except in particular circumstances such as enrolling in an institution of higher education, joining the army, or being recruited by urban industries (Chan, 2009; Wu and Treiman, 2004). Migration to urban areas which did not entail converting rural into urban *hukou* was rare since it was extremely difficult for people without a local urban hukou to secure employment in the cities under the central rationing system. Marriage migration, mostly involving women, provided a limited pathway for rural residents to reside in urban areas (Huang, 2001). Even though marriage migrants were allowed to change their registration location to urban areas because of the patrilocal living arrangement, the strict hukou regulation prohibited them from converting agricultural hukou to a non-agricultural one. As a result, marriage migrants from rural areas held agricultural hukou registered in urban areas, and the children of such female migrants were born with agricultural hukou registered in urban areas as well, since hukou could be inherited only from the mother (Chan and Zhang, 1999).

The situation did not change much until the early 1980s, when rapid economic development and social changes necessitated institutional changes in the *hukou* and "grain rationing" systems². From the mid-1980s, temporary residence was allowed nationally, which made migration possible without changing the holders' *hukou* (Solinger, 1999). Subsequently, the grain rationing system was abolished in 1992, and the regulation of mother–child *hukou* inheritance was relaxed from 1998 (Chan, 2009; Wang, 2004). In addition, the management of the *hukou* system was devolved gradually to lower administrative levels, and local

²Established in 1955, the "grain rationing" system was part of the central planning policy. Under the system, only non-agricultural *hukou* holders were supplied with ration certificates, which were necessary in order to buy basic staples such as grain, meat, cooking oil, sugar, and cotton (Chan, 2009; Liu, 2005).

governments started to manage internal migration and *hukou* administration differently based on their socio-economic circumstances. The institutional changes, along with economic development and urbanization, resulted in increasing diversity of urban residents in contemporary China, not only in terms of *hukou* characteristics but also of their socioeconomic status.

The migration-health relationship

The literature on the relationship between migration and health has grown, especially in the context of international migration. In general, immigrants tend to be healthier than the native-borns despite immigrants usually having lower socio-economic status and poorer access to health care (Abraido-Lanza et al., 1999; Khlat and Courbage, 1996; Marmot et al., 1984; Palloni and Arias, 2004; Sharma et al., 1990; Turra and Elo, 2008). This is labeled as the "healthy immigrant paradox" in the literature. The "healthy migrant effect" and the "salmon bias" hypotheses are proposed as two selection mechanisms affecting the migration-health relationship. The former suggests that migration is selective of healthier individuals from the origin, and as such, migrants tend to be healthier compared with non-migrants in the areas of origin and destination. The latter suggests that migrants whose health conditions deteriorate substantially are more likely to return to the area of origin, leaving healthier migrants in the destination area. Limited socio-economic resources and poor social supports in the destination area underlie the process of health-selective return for migrants. These migration selection mechanisms are part of the overall process whereby social stratification generates health inequality (Palloni and Ewbank, 2004).

Previous studies have examined the migration selection mechanisms empirically and found similar results in various contexts, including rural–urban migration in China (Palloni and Ewbank, 2004; Qi and Niu, 2013). For instance, the rural–urban migrants in China are healthier young adults relative to the non-migrant population in the rural areas and the natives in the urban destinations (Chen, 2011; Niu, 2013; Wang et al., 2011). Nevertheless, due to *hukou*-related restrictions, these migrant agricultural *hukou* holders have relatively lower educational attainment, lower health-related knowledge, fewer socio-economic resources, and are more exposed to health risks in their working and living conditions compared with urban natives (Hu and Chen, 2007; Niu et al., 2011; Roberts, 1997). Although some studies have been done investigating health selection mechanisms in China's rural–urban migration (e.g., Qi and Niu, 2013), to date, very few studies have examined the migration–health relationship in the broader context of China's internal migration and its evolving *hukou* system (Chan, 2009, 2012). Thus, little is known about whether and how the migration–health relationship varies across different types of *hukou* holders. This study is an attempt to consider different types of migrants and non-migrants in the context of a unified analytical framework in order to better understand the migration–health relationship in contemporary China.

Data source and research methods

Data source

This study employed data from the survey of Internal Migration and Health in China (IMHC). The IMHC is a joint project conducted by the University of California, Los Angeles and the Capital University of Medical Sciences in Beijing in 2008. The survey used multi-stage stratified probability sampling: First, all the township units in China, about 50,000, were divided into 75 strata, based on the proportions of migration and urbanization as well as the average education of the population. Two township units were selected randomly with probability proportional to size from each of those strata. Second, each selected township unit was divided into small enumeration districts, and four enumeration districts were chosen randomly. Finally, within each selected enumeration district, five individuals were selected. Areas (i.e., township units) having larger in-migration or out-migration were over-sampled.

In total, 3,000 respondents aged from 18 to 64 were selected randomly from 150 Chinese township units, and these respondents were interviewed using a structured survey questionnaire. The survey collected detailed information on respondents' socio-economic characteristics, migration characteristics and related history, health status, health-related behaviors and use of health services. In addition to the personal interview, each respondent was given a brief medical examination by medical staff recruited for the survey. In this study, we focused on the subsample of urban residents in the IMHC, which yielded a sample of 2,003 respondents.

We measured health status using a variety of subjective and objective indicators to capture the multi-dimensional nature of health. The subjective health measures included self-rated general health, chronic diseases, physical discomfort and depression. The objective health indicators of interest to this study were blood pressure, lung capacity and body mass index, as recorded in the medical examination. Using these health measures, we constructed a series of dichotomous outcome variables for individual health. In addition to the health measures, we also selected three indicators of health resources and use of health services: medical insurance coverage, inability to see a doctor due to financial difficulties in the past 12 months, and type of hospital accessed for health services. All the variables of interest, their definitions and measurements are presented in Table 1.

| Variable | Definition | Measurement |
|---------------------------------|--|---|
| Self-reports | | |
| General health | In general, how would you rate your own health? | 0 = excellent/ good/fair (89.7%) 1 = poor (10.3%) |
| Chronic condition | Having been diagnosed with at least one of the following 11 chronic diseases: hypertension, diabetes, hypercholesterol- emia, heart disease, stroke, lung disease, kidney disease, gastrointestinal disease, cancer, hepatitis and tuberculosis. | 0 = no (56.6%) 1=yes (43.4%) |
| Frequent physical discomfort | Frequently having at least one of the following symptoms in last three months: headache, diz- ziness, eye pressure, sore throat, joint or muscle stiff- ness, neck/shoulder/back pain, leg heaviness, chest pressure, irregular heartbeat and stomach discomfort | 0 = no (76.8%) 1 = yes (23.2%) |
| Depression | CES-D scale (20 items) for depression; a score of 16 or above is defined as positive for depression. | 0 = no (78.0%) 1 = yes (22.0%) |
| Objective biometrics | | |
| Overweight or Obese | Defined as positive if Body Mass Index is no less than 25. | 0 = no (64.2%) 1 = yes (35.8%) |

Table 1. Operational definition and quantification of health indicators.

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(continued)

| Variable | Definition | Measurement |
|---|---|--|
| High blood pressure | Defined as positive if systolic blood pressure is 140 or higher or diastolic blood pressure is 90 or higher. | 0 = no (76.5%) 1 = yes (23.5%) |
| Low lung capacity | Defined as positive if the average of three measures of peak flow is less than 250ml. | 0 = no (72.9%) 1 = yes (27.1%) |
| Health resources & service use | | |
| Medical uninsurance | Are you not covered by the medical insurance system? | 0 = no (69.4%) 1 = ves (30.6%) |
| Financial difficulty in meeting medical needs | In the past 12 months, have you ever been unable to see a doctor because of economic reasons when you needed medical treatment? | 0 = no (88.4%) 1 = yes (11.6%) |
| Choice of hospital | Do you usually go to a public hospital or a private clinic if you see a doctor? | 0 = public hospital (83.4%) 1= private clinic (16.6%) |

Table 1. Continued

Research methods

This study sought to explore health stratification in urban China and its institutional and socio-economic determinants. In the analysis, we assumed that institutional barriers exist only for migrants and defined institutional impacts as migration-related institutional impacts. As such, the differences between migrants and urban natives with comparable socio-demographic characteristics reflect the impact of institutional barriers for migrants. Furthermore, any other within-group difference, either among urban natives or among migrants, cannot be attributed to institutional barriers related to migration. This assumption is plausible and useful. On the one hand, having a local urban *hukou* makes a great difference in accessing social resources under the current *hukou* system (Chan, 2009, 2012). On the other hand, given this assumption, the impacts of socio-economic conditions on health stratification can be isolated from migration-related institutional barriers by employing the logic of difference-in-differences analysis. This entails a comparison of the health-related

differences between migrants and urban natives, in comparable socioeconomic conditions, and "separating" the effects of institutional factors on health from those of socio-economic factors.

First, we used bivariate analysis to examine inter-group health differences among the four groups of urban residents. Next, multivariate binary logit models were fitted for each of the health variables to examine potential determinants of the observed health differences. We built a series of nested models to elaborate the mechanisms underlying the migrationhealth relationship, and to identify institutional impacts on health stratification net of demographic and socio-economic divisions in health.

The nested models that we estimated include the following: (a) Model 1, the baseline model which fitted health differences on migration status and hukou type without controlling for variables; (b) Model 2 controlled for the selected demographic factors, such as age and gender. It examined the migration-related health differences net of different demographic compositions among those groups; and (c) Model 3 further included socio-economic and environmental factors, such as education, occupation, working conditions and place of residence. These socio-economic and environmental factors could affect health stratification in various ways (Adler and Ostrove, 1999; Kitagawa and Hauser, 1973; Marmot et al., 1987; Mustard and Frohlich, 1995). For instance, the place of residence signifies structural differences in the living environment, and thus, is expected to be relevant for individuals' health-related differences. Similarly, working conditions, such as undesirable physical conditions and extremely long working hours, could wear down individual health more rapidly (e.g., House and Cottington, 1986). As such, we tested the impact of these socio-economic and environmental factors empirically, net of the demographic compositional effect examined in Model 2. After taking into consideration the theoretically relevant and measurable demographic, socio-economic and environmental factors, any remaining healthrelated differences between migrants and urban natives are likely to reveal migration-related institutional impacts on health stratification.

Major findings

Demographic profile and socio-economic stratification in urban China

First, it is important to take a look at the demographic profile and socioeconomic characteristics of the urban residents under study; these are presented in Table 2. Among the four groups of respondents outlined above, more females (62.4 percent) were surveyed than males in the

| I able 2. Deniographic and socio-ec | | icitization of the samp | /) silianindsar nai | o, uuiweigineu). | |
|-------------------------------------|--------|-------------------------|---------------------|------------------|--------------|
| | | Urban na | ıtives | Migrai | nts |
| | Total | Non-agricultural | Agricultural | Non-agricultural | Agricultural |
| Sample size (N) | 2,003 | 1,255 | 399 | 172 | 177 |
| Gender | | | | | |
| Male | 37.6 | 35.9 | 33.6 | 45.4 | 52.0 |
| Female | 62.4 | 64.1 | 66.4 | 54.7 | 48.0 |
| Age | | | | | |
| Mean | 42.8 | 45.2 | 42.1 | 35.0 | 35.1 |
| (SD) | (12.8) | (12.0) | (13.5) | (12.6) | (11.2) |
| Education | | | | | |
| Primary or lower | 20.7 | 14.7 | 41.7 | 7.0 | 29.9 |
| Some secondary | 61.1 | 64.4 | 47.7 | 63.4 | 66.1 |
| College or above | 18.1 | 21.0 | 10.6 | 29.7 | 4.0 |
| Marital status | | | | | |
| Never married | 14.5 | 10.4 | 16.3 | 32.6 | 21.5 |
| Married/cohabiting | 81.8 | 85.3 | 81.5 | 64.0 | 75.1 |
| Separated/divorced/widowed | 3.7 | 4.2 | 2.3 | 3.5 | 3.4 |
| Occupation | | | | | |
| Professional or cadre | 18.5 | 23.0 | 5.8 | 23.3 | 10.2 |
| Skilled worker | 24.0 | 20.5 | 20.1 | 28.5 | 53.1 |
| Unskilled worker/farmer | 14.9 | 10.9 | 26.1 | 9.3 | 23.2 |
| Others | 42.7 | 45.6 | 48.1 | 39.0 | 13.6 |
| | | | | | (continued) |

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| | | Urban na | ltives | Migrar | ıts |
|--|---|---|---|---|---|
| | Total | Non-agricultural | Agricultural | Non-agricultural | Agricultural |
| Working income per month (CNY) | | | | | |
| Less than 1,000 | 51.8 | 48.2 | 72.2 | 45.1 | 37.6 |
| 1,000 to 2999 | 41.7 | 45.0 | 25.8 | 42.1 | 54.3 |
| 3,000+ | 6.5 | 6.8 | 2.1 | 12.8 | 8.1 |
| Working hours per week ^b | | | | | |
| 20 hrs or less | 35.7 | 36.8 | 42.9 | 35.7 | 11.4 |
| 21 to 50 hrs | 39.2 | 44.3 | 28.8 | 34.5 | 31.4 |
| More than 50 hrs | 25.1 | 18.9 | 28.3 | 29.8 | 57.1 |
| City of current residence ^a | | | | | |
| Beijing/Shanghai | 12.4 | 10.2 | 9.5 | 20.4 | 26.6 |
| Other big city | 39.3 | 42.2 | 28.8 | 37.2 | 45.2 |
| Middle or small city | 48.3 | 47.7 | 61.7 | 42.4 | 28.3 |
| ^a City of current residence is classified by s and middle-sized or small cities. Big cit provincial capitals, and four special econo or administratively lower-level cities. ^b Wc | ize and level o ies include mu mic zones (She orking hours a | f administration into thre micipalities directly unc enzhen, Xiamen, Zhuhai re rounded into integers | e groups: megalopol der the central gove and Shantou). Midd | lis, such as Beijing and Sh smment, excluding Beijin le-sized or small cities are | anghai, big cities, g and Shanghai, e all other smaller |

sample; the gender composition was more balanced for migrants than for urban natives. The imbalance in gender composition in the sample largely resulted from the relatively higher response rate among urban females. As a group, migrants were younger and better educated than urban natives, while non-agricultural *hukou* holders were older but better educated than agricultural *hukou* holders in the sample. More urban natives in the sample were married or cohabiting at the time of survey than migrants.

Although the hukou type does not closely follow occupational lines in contemporary China, it is still an important social marker. According to the sample, nearly a quarter of the non-agricultural hukou holders (23 percent of the natives and 23.3 percent of migrants) worked in professional positions or cadres; only a few worked in unskilled positions. In contrast, respondents with agricultural *hukou* were disproportionately less likely to work in professional or cadre positions (only 5.8 percent of the natives and 10.2 percent of the migrants). According to self-reported monthly working income, migrants with non-agricultural hukou had the highest income among the four groups of urban residents, followed by migrants with agricultural *hukou* and urban natives with non-agricultural *hukou*. Urban natives with agricultural hukou had the lowest working income on average. Compared with urban natives, migrants had longer working hours: some 57.1 percent of migrants with agricultural hukou worked more than 50 hours per week, while only 18.9 percent of urban natives with nonagricultural hukou did so. Among the sampled respondents, migrants were concentrated in large cities rather than in other kinds of urban areas. More than a quarter of migrants with agricultural hukou were in Beijing or Shanghai compared with around one-fifth of migrants with non-agricultural hukou.

Health stratification in urban China: An overview

The demographic and socio-economic differences among the four groups of urban residents have implications on their health conditions. Table 3 summarizes and compares urban respondents in terms of various health indicators by migration status and *hukou* type.

Differences in the health indicators among the urban respondents were found to be significant. Based on self-reported health measures, more urban natives reported poor health than migrants. Across the four groups overall, urban natives with agricultural *hukou* did not fare well compared with the others: they reported the highest levels of poor general health (with the exception of chronic conditions), frequent physical discomfort and depression. Urban natives with non-agricultural *hukou* came

| | Urban na | tives | Migran | lts | | |
|---|------------------------------|-------------------------|-----------------------------|--------------------------|---------------------|--------|
| | Non-agricultural $(N=1,255)$ | Agricultural (N=399) | Non-agricultural (N=172) | Agricultural $(N = 177)$ | X ² (df) | q |
| Self-reports | | | | | | |
| Poor general health | 9.96 | 15.79 | 5.23 | 5.11 | 23.1(3) | <0.001 |
| Chronic condition | 46.63 | 43.97 | 35.09 | 26.86 | 29.7(3) | <0.001 |
| Frequent physical discomfort | 23.92 | 26.52 | 21.64 | 12.57 | 14.1(3) | 0.003 |
| Depression | 20.96 | 26.07 | 18.60 | 23.16 | 5.9(3) | 0.115 |
| Objective biometrics | | | | | | |
| Overweight or obese | 39.75 | 33.68 | 28.03 | 18.75 | 33.2(3) | <0.001 |
| High blood pressure | 25.77 | 23.16 | 14.56 | 16.25 | 15.2(3) | 0.002 |
| Low lung capacity | 25.98 | 35.28 | 20.89 | 22.01 | 18.7(3) | <0.001 |
| Health resources and service use | | | | | | |
| Medical uninsurance | 26.06 | 27.89 | 43.27 | 56.32 | 80.7(3) | <0.001 |
| Financial difficulty in meeting medical needs | 10.21 | 14.57 | 12.28 | 14.37 | 7.1(3) | 0.068 |
| Choice of hospital | 11.86 | 31.08 | 9.94 | 23.43 | 92.2(3) | <0.001 |
| | | | | | | |

in second; this group reported the highest level (46.6 percent) of chronic conditions. In contrast, migrants with agricultural *hukou* reported the lowest levels of health problems in three out of four measures (i.e., with the exception of depression). These inter-group health differences are all statistically significant.

The objective biometrics recorded by medical professionals also showed that migrants in the sample were healthier than urban natives. Specifically, migrants with agricultural *hukou* were the least likely to be overweight/ obese (18.8 percent) and had the second lowest rates of low lung capacity (22.0 percent) and high blood pressure (16.3 percent). Migrants with non-agricultural *hukou* had the lowest rates of low lung capacity (20.9 percent) and high blood pressure (16.4 percent), and the second lowest rate of those who were overweight/obese (28 percent). Among the four groups, urban natives with non-agricultural *hukou* were most likely to be overweight/ obese (39.8 percent) or have high blood pressure (25.8 percent), while urban natives with agricultural *hukou* had the highest incidence of low lung capacity (35.3 percent).

Significant inter-group differences also came up in terms of health resources and use of health services. Medical insurance coverage was lowest for migrants with agricultural hukou (43.7 percent), and second lowest for migrants with non-agricultural hukou (56.7 percent). In contrast, urban natives with non-agricultural hukou had the highest insurance coverage (73.9 percent). Nearly 15 percent of respondents with agricultural hukou, either migrants or urban natives, had not seen a doctor when they needed to during the past 12 months for financial reasons. Respondents with agricultural hukou were also more likely to resort to private clinics for medical services. In China, private clinics are less well developed and they are usually small-scale and poorly equipped. In contrast, public hospitals usually provide better quality services, in part because they are state-owned, and as such, they have well-trained professionals and are equipped with more advanced medical facilities. Urban natives or those with urban hukou can access these services. Migrants without urban hukou have to pay for the services of public hospitals because they are usually excluded from the local urban medical insurance system, and therefore the costs can be prohibitive for them. In addition, migrants usually face greater financial and time constraints in accessing the services of public hospitals. Migrants want to save and are less willing to pay for costly medical services. Also, they work longer hours which constrains them from seeking the services of public hospitals which are crowded and entail longer waiting times.

The salient health disparities outlined above indicate important health inequalities associated with migration status and *hukou* type among urban

residents. In view of the ever-growing internal migration and *hukou*related socio-economic implications, this could have striking implications on population health. It is important to explore potential determinants of these observed health disparities, and to test the relative importance of demographic, socio-economic and institutional factors.

Determinants of health disparity: Demographic and socioeconomic vs. institutional factors

To explore the underlying determinants of the observed health disparities, we analyzed the specific impacts of demographic characteristics, socioeconomic status and *hukou*-related institutional arrangements by employing nested multivariate regression models.

Table 4 presents the estimated coefficients of Model 1 for each of the selected health outcomes, fitted with migration status and *hukou* type only. As a whole, migrants were healthier than urban natives, non-agricultural hukou holders were healthier than agricultural hukou holders, and migrants with agricultural hukou also seemed healthier than other urban residents in some health dimensions examined in this study. Specifically, migrants were less likely to report a chronic condition (by 37.5 percent = 1exp(-0.47)), and less likely to be diagnosed as overweight/obese (by 40.5) percent = $1 - \exp(-0.52)$) or with high blood pressure (by 50.3 percent = 1exp(-0.70)) than urban natives. Those with agricultural *hukou* were more likely to report poor general health (by 71.6 percent = exp(0.54)-1) and depression (by 33.6 percent = exp(0.29)-1), and they were also more likely to be diagnosed with low lung capacity (by 53.7 percent = exp(0.43)-1 compared with the non-agricultural *hukou* holders. Yet, agricultural hukou urban residents were also less likely to be diagnosed as overweight/obese (by 23.7 percent = $1 - \exp(-0.27)$) compared with the non-agricultural hukou holders.

The interaction effect of migration status and *hukou* type shows that, compared with other urban residents, migrants with agricultural *hukou* were significantly less likely to report frequent physical discomfort. Therefore, the baseline model results in Table 4 suggest that health stratification in contemporary urban China exists not only between migrants and local citizens, but also among different *hukou* type holders. Except for average health differences, the category of migration status interacts with that of *hukou* type only for some health outcomes, for which agricultural *hukou* migrants tend to come out healthier. This may imply that different health selection mechanisms operate for migrants with different *hukou* types. Above all, urban natives with agricultural *hukou* seem to be the least healthy group for most of the health indicators examined here.

| Table 4. Logit m | odels of selec | ted health inc | licators fitted on migra | tion status and | hukou type only | (Model 1). | |
|---------------------|-------------------|-------------------|---------------------------------|-----------------|------------------------|----------------------|------------------------|
| | General health | Chronic condition | Frequent physical discomfort | Depression | Overweight or obese | Low lung capacity | High blood pressure |
| Mig. | -0.68 | -0.47^{**} | -0.16 | -0.14 | -0.52** | -0.28 | -0.70** |
|) | (0.36) | (0.17) | (0.20) | (0.21) | (0.19) | (0.21) | (0.24) |
| Agri. hukou | 0.54** | -0.10 | 0.14 | 0.29^{*} | -0.27^{*} | 0.43^{**} | -0.15 |
|) | (0.17) | (0.12) | (0.13) | (0.13) | (0.12) | (0.13) | (0.14) |
| Mig.*Agri.hukou | -0.56 | -0.28 | -0.80^{*} | -0.03 | -0.30 | -0.36 | 0.28 |
|) | (0.51) | (0.26) | (0.33) | (0.30) | (0.30) | (0.30) | (0.34) |
| Intercept | -2.21** | -0.14^{*} | -1.15^{**} | -1.32^{**} | -0.42^{**} | -1.04^{**} | -1.06^{**} |
| | (60.0) | (0.06) | (0.07) | (0.07) | (0.06) | (0.07) | (0.07) |
| Ν | 1,995 | 1,983 | 1,981 | 1,996 | 1,886 | 1,881 | 1,887 |
| p < 0.05; p < 0.01. | | | | | | | |

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Note: Mig. refers to "migrant," and Agri. hukou refers to "agricultural hukou." The figures in parentheses are standard errors.

Table 5 displays the estimated coefficients of Model 2, fitted on migration status and *hukou* type controlling for age and gender. After controlling for differences in demographic characteristics, the health disparities between migrants and urban natives declined substantially, but the impacts of *hukou* type remained largely robust. Compared with non-agricultural *hukou* holders, those having agricultural *hukou* were significantly more likely to report poor general health and depression, and they also had higher incidence of low lung capacity. Moreover, the interaction effect of migration status and *hukou* type shows that migrants with agricultural *hukou* were significantly less likely to report frequent physical discomfort compared with other urban residents.

The health differences associated with migrant type, as illustrated in Model 1 (Table 4), are largely a result of the different demographic characteristics between migrants and urban natives. In other words, the migration-health relationship in urban China can be explained largely by the selective demographic traits (e.g., younger age composition) of the migrants. According to the results shown in Table 5, females were significantly more likely to report frequent physical discomfort and more likely to be diagnosed with low lung capacity, but less likely to be overweight/ obese or have high blood pressure compared with males. Older individuals were more likely to report poor general health, chronic conditions and frequent physical discomfort. They were also more likely than younger respondents to be diagnosed as overweight/obese, with low lung capacity or with high blood pressure. The results suggest the significance of biological and socio-cultural differences related with age and gender in affecting individual wellbeing. These results are consistent with the literature (e.g., Rodin, 1986).

In addition to the demographic factors discussed above, Model 3 brings in socio-economic and environmental variables to examine the impact of socio-economic conditions on the observed health differences (see Table 6). Model 3 shows that, after considering the major demographic, socio-economic and environmental factors, health differences between migrants and urban natives are no longer significant. Moreover, *hukou* type is only significantly relevant to self-reported general health among the health indicators examined in this study. Nevertheless, migrants with agricultural *hukou* were still significantly less likely to report frequent physical discomfort than other urban residents, suggesting that the "healthy migrant effect" is particularly salient for migrants with agricultural *hukou*.

After controlling for other variables in Model 3, the demographic impacts on health remain largely robust. Older respondents were more likely to report poor health or to be diagnosed with various health problems. Middle-aged respondents, particularly those aged between 39 and

| Mig. Inelifi condition discontict Depression or obese Mig. -0.35 0.01 0.23 -0.06 -0.07 Agri. <i>hukou</i> (0.36) (0.18) (0.21) (0.21) (0.20) Agri. <i>hukou</i> 0.63^{**} 0.03 0.22 0.30^{**} -0.03 Agri. <i>hukou</i> 0.63^{**} 0.03 0.22 0.30^{**} -0.13 Mig*Agri. <i>hukou</i> -0.64 -0.46 -0.89^{**} -0.04 -0.13 Mig*Agri. <i>hukou</i> -0.64 -0.46 -0.89^{**} -0.13 (0.23) Mig*Agri. <i>hukou</i> -0.64 -0.46 -0.89^{**} -0.31^{**} -0.53^{**} Mig*Agri. <i>hukou</i> -0.64 -0.46 -0.41^{**} (0.13) (0.13) Mig*Agri. <i>hukou</i> 0.63^{**} 0.04^{**} 0.21^{**} -0.53^{**} Female 0.21 0.10^{**} 0.12^{**} 0.31^{**} -0.53^{**} Age (ref=18-28) 0.94^{**} </th <th></th> <th>General</th> <th>Chronic</th> <th>Frequent physical</th> <th>(</th> <th>Overweight</th> <th>Low lung</th> <th>High blood</th> | | General | Chronic | Frequent physical | (| Overweight | Low lung | High blood |
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| Mig. -0.35 0.01 0.23 -0.06 -0.06 -0.07 Agri. Inukou $0.36)$ (0.18) (0.21) (0.21) (0.20) Agri. Inukou $0.63*$ 0.03 0.22 $0.30*$ -0.13 Mig*Agri. Inukou $0.63*$ 0.03 0.22 $0.30*$ -0.13 Mig*Agri. Inukou $0.63*$ 0.03 0.22 $0.30*$ -0.13 Mig*Agri. Inukou $0.53*$ 0.03 0.22 $0.30*$ -0.13 Mig*Agri. Inukou -0.64 -0.46 $-0.89**$ -0.04 -0.53 Mig*Agri. Inukou -0.64 -0.46 $-0.89**$ -0.03 (0.13) Mig*Agri. Inukou 0.21 -0.19 0.31 (0.12) (0.13) Age (ref=18-28) $0.24*$ 0.710 (0.12) (0.12) (0.12) (0.10) Age (ref=18-28) $0.94*$ 0.710 (0.12) (0.12) (0.12) Age (ref=18-28) < | | health | condition | discomtort | Depression | or obese | capacity | pressure |
| Agri. Indou (0.36) (0.18) (0.21) (0.21) (0.20) Agri. Indou 0.63^{**} 0.03 0.22 0.30^{*} -0.13 Mig*Agrilutou 0.63^{**} 0.03 0.22 0.30^{**} -0.13 Mig*Agrilutou -0.64 -0.46 -0.89^{**} -0.04 -0.53 Mig*Agrilutou -0.64 -0.46 -0.89^{**} -0.04 -0.53 Mig*Agrilutou -0.64 -0.46 -0.89^{**} -0.30^{*} -0.53 Mig*Agrilutou -0.64 -0.46 -0.89^{**} -0.30^{*} -0.53^{**} Kemale 0.21 -0.19 0.41^{**} 0.22 -0.31^{**} Age (ref=18-28) 0.24^{**} 0.71^{**} 0.12^{**} 0.22^{**} -0.31^{**} Age (ref=18-28) 0.94^{**} 0.71^{**} 0.49^{**} 0.12^{**} 0.30^{**} 1.39^{**} Age (ref=18-28) 0.94^{**} 0.71^{**} 0.49^{**} 0.71^{**} 0.2 | Mig. | -0.35 | 0.01 | 0.23 | -0.06 | -0.07 | 0.03 | -0.20 |
| Agri. hukou 0.63^{**} 0.03 0.22 0.30^* -0.13 (0.17) (0.12) (0.14) (0.13) (0.13) (0.13) $Mig^*Agri.hukou$ -0.64 -0.46 -0.89^{**} -0.04 -0.53 $Mig^*Agri.hukou$ -0.64 -0.46 -0.89^{**} -0.04 -0.53 $Remale$ (0.21) (0.23) (0.30) (0.31) $Mig^*Agri.hukou$ 0.21 -0.19 0.41^{**} 0.22 -0.31^{**} $Mig^*Agri.hukou$ 0.21 -0.19 0.41^{**} 0.22 -0.31^{**} $Remale$ 0.21 -0.19 0.41^{**} 0.22 -0.31^{**} $Mig^*Agri.hukou$ 0.21 -0.19 0.41^{**} 0.22 -0.31^{**} $Mig^*Agri.hukou$ 0.21 0.10 (0.12) (0.10) (0.12) $Mig^*Agri.hukou$ 0.21 0.41^{**} 0.22 -0.31^{**} $Mig^*Agri.hukou0.16(0.12)(0.12)(0.10)(0.20)Mig^*Agri.hukou0.94^{**}0.71^{**}0.49^{*}0.22-0.31^{**}Mig^*Agri.hukou0.94^{**}0.71^{**}0.49^{**}0.10^{**}(0.21)Mig^*Agri.hukou0.94^{**}0.17^{**}0.22^{**}0.0011.39^{**}Mig^*Agri.hukou0.94^{**}0.17^{**}0.13^{**}0.19^{**}0.13^{**}Mig^*Agri.hukou0.94^{**}0.16^{**}0.12^{**}0.10^{**}0.16^{**}$ | _ | (0.36) | (0.18) | (0.21) | (0.21) | (0.20) | (0.22) | (0.26) |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | Agri. hukou | 0.63** | 0.03 | 0.22 | 0.30* | -0.13 | 0.48** | 0.02 |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | _ | (0.17) | (0.12) | (0.14) | (0.13) | (0.13) | (0.13) | (0.15) |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | Mig*Agri.hukou | -0.64 | -0.46 | -0.89** | -0.04 | -0.53 | -0.31 | 0.15 |
| $ \begin{array}{llllllllllllllllllllllllllllllllllll$ | _ | (0.52) | (0.28) | (0.33) | (0.30) | (0.31) | (0.32) | (0.37) |
| Age (ref=18-28) (0.16) (0.10) (0.12) (0.12) (0.10) 29–38 0.94^{**} 0.71^{**} 0.49^{*} 0.001 1.39^{**} 29–38 0.94^{**} 0.71^{**} 0.49^{*} 0.001 1.39^{**} 29–38 0.94^{**} 0.71^{**} 0.49^{*} 0.001 1.39^{**} 39–48 0.99^{**} 1.07^{**} 0.85^{**} 0.001 1.39^{**} 39–48 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $39–48$ 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $39–48$ 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $49+$ 1.38^{**} 1.87^{**} 1.23^{**} 0.13 0.20 $49+$ 0.30 (0.19) (0.17) (0.20) 10^{**} 1.23^{**} -1.61^{**} -1.61^{**} -1.81^{**} $49+$ -3.45^{**} -1.28^{**} | Temale | 0.21 | -0.19 | 0.41^{**} | 0.22 | -0.31^{**} | 1.50^{**} | -0.85** |
| Age (ref=18-28) $29-38$ 0.94^{**} 0.71^{**} 0.001 1.39^{**} $29-38$ 0.94^{**} 0.71^{**} 0.49^{*} 0.001 1.39^{**} $29-38$ 0.94^{**} 0.71^{**} 0.49^{*} 0.001 1.39^{**} $39-48$ 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $39-48$ 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $39-48$ 0.99^{**} 1.07^{**} 0.85^{**} 0.30 1.65^{**} $49+$ 1.38^{**} 1.87^{**} 1.23^{**} 0.13 1.99^{**} $49+$ 1.38^{**} 1.87^{**} 1.23^{**} 0.13 0.20 $10.31)$ (0.16) (0.21) (0.17) (0.21) (0.20) 10.45^{**} -1.28^{**} -2.33^{**} -1.61^{**} -1.81^{**} $10.32)$ (0.16) (0.20) (0.17) (0.20) | - | (0.16) | (0.10) | (0.12) | (0.12) | (0.10) | (0.14) | (0.12) |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | Age (ref=18-28) | | | | | | | |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 29–38 | 0.94^{**} | 0.71** | 0.49* | 0.001 | 1.39^{**} | -0.07 | 1.15^{**} |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | _ | (0.34) | (0.18) | (0.22) | (0.19) | (0.22) | (0.20) | (0.32) |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 39-48 | 0.99** | 1.07^{**} | 0.85** | 0.30 | 1.65^{**} | 0.44^{*} | 2.04** |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | _ | (0.33) | (0.17) | (0.21) | (0.18) | (0.21) | (0.19) | (0.30) |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 49+ | 1.38^{**} | 1.87^{**} | 1.23** | 0.13 | 1.99^{**} | 0.59** | 2.69** |
| Intercept $-3.45^{**} -1.28^{**} -2.33^{**} -1.61^{**} -1.85^{**}$ (0.32) (0.16) (0.20) (0.17) (0.20) | - | (0.31) | (0.16) | (0.19) | (0.17) | (0.20) | (0.18) | (0.29) |
| (0.32) (0.16) (0.20) (0.17) (0.20) | ntercept | -3.45^{**} | -1.28^{**} | -2.33** | -1.61^{**} | -1.85^{**} | -2.52** | -2.68** |
| | - | (0.32) | (0.16) | (0.20) | (0.17) | (0.20) | (0.20) | (0.29) |
| N 1,995 1,983 1,981 1,996 1,886 | 7 | 1,995 | 1,983 | 1,981 | 1,996 | 1,886 | 1,881 | 1,887 |

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|--------------------------------|-------------------|-------------------|------------------------------|------------|------------------------|----------------------|------------------------|
| | General health | Chronic condition | Frequent physical discomfort | Depression | Overweight or obese | Low lung capacity | High blood pressure |
| Mig. | -0.32 | 0.08 | 0.34 | -0.06 | -0.06 | 0.03 | -0.24 |
| | (0.37) | (0.19) | (0.21) | (0.22) | (0.20) | (0.22) | (0.26) |
| Agri. hukou | 0.45* | 0.05 | 0.22 | 0.12 | -0.22 | 0.28 | -0.08 |
| 1 | (0.19) | (0.13) | (0.15) | (0.15) | (0.14) | (0.15) | (0.16) |
| Mig*Agri.hukou | -0.50 | -0.51 | -0.77^{*} | -0.02 | -0.45 | -0.21 | 0.35 |
| | (0.53) | (0.28) | (0.34) | (0.31) | (0.32) | (0.32) | (0.38) |
| Female | 0.19 | -0.12 | 0.46** | 0.22 | -0.36^{**} | 1.40^{**} | -0.88** |
| | (0.18) | (0.11) | (0.13) | (0.13) | (0.11) | (0.14) | (0.13) |
| Age (ref=18-28) | | | | | | | |
| 29–38 | 0.90* | 0.65** | 0.69** | 0.24 | 1.21** | -0.03 | 1.26^{**} |
| | (0.39) | (0.21) | (0.26) | (0.23) | (0.25) | (0.24) | (0.36) |
| 39-48 | 0.86^{*} | 0.98** | 1.06^{**} | 0.49^{*} | 1.43^{**} | 0.45^{*} | 2.09** |
| | (0.39) | (0.21) | (0.26) | (0.23) | (0.25) | (0.23) | (0.35) |
| 49+ | 1.11^{**} | 1.79^{**} | 1.38** | 0.14 | 1.65^{**} | 0.45^{*} | 2.61** |
| | (0.38) | (0.21) | (0.25) | (0.23) | (0.25) | (0.23) | (0.34) |
| Education (ref=Primary edu) | | | | | | | |
| Secondary | -0.06 | 0.07 | -0.02 | -0.33* | -0.18 | -0.20 | -0.02 |
| | (0.19) | (0.14) | (0.15) | (0.15) | (0.14) | (0.15) | (0.15) |
| | | | | | | | (continued) |

| Table 6. Continued | | | | | | | |
|---|-------------------|-------------------|------------------------------|------------|------------------------|----------------------|------------------------|
| | General health | Chronic condition | Frequent physical discomfort | Depression | Overweight or obese | Low lung capacity | High blood pressure |
| Post-secondary | -1.42^{**} | -0.14 | 0.26 | -0.83** | -0.19 | -0.59* | -0.20 |
| | (0.46) | (0.20) | (0.23) | (0.24) | (0.21) | (0.24) | (0.25) |
| Not married | 0.44 | 0.04 | 0.24 | 0.78** | -0.39* | 0.19 | 0.12 |
| | (0.26) | (0.17) | (0.20) | (0.18) | (0.19) | (0.19) | (0.22) |
| Occupation (ref =Skilled worker) | | | | | | | |
| Professional/cadre | -0.19 | 0.29 | -0.30 | 0.04 | 0.01 | -0.34 | 0.10 |
| | (0.32) | (0.17) | (0.21) | (0.21) | (0.18) | (0.21) | (0.22) |
| Unskilled worker/farmer | 0.21 | 0.39* | 0.08 | 0.22 | 0.18 | 0.17 | 0.26 |
| | (0.26) | (0.16) | (0.19) | (0.19) | (0.17) | (0.20) | (0.20) |
| Others | -0.16 | 0.12 | -0.24 | 0.29 | 0.14 | 0.09 | 0.23 |
| | (0.27) | (0.17) | (0.20) | (0.19) | (0.18) | (0.19) | (0.21) |
| Working hrs/week (ref=21-50hrs/week) | | | | | | | |
| ≤20 hrs/week | 0.61^{**} | 0.10 | 0.32 | 0.01 | 0.07 | 0.17 | 0.33 |
| | (0.23) | (0.15) | (0.17) | (0.17) | (0.15) | (0.16) | (0.17) |
| >50 hrs/week | 0.04 | -0.12 | -0.41^{*} | 0.09 | -0.16 | -0.03 | 0.09 |
| | (0.22) | (0.13) | (0.16) | (0.15) | (0.14) | (0.16) | (0.17) |
| No. undesirable | 0.10^{*} | 0.11^{**} | 0.13** | 0.12** | -0.01 | -0.07 | 0.07* |
| working conditions | | | | | | | |
| | (0.04) | (0.03) | (0.03) | (0.03) | (0.03) | (0.04) | (0.03) |
| | | | | | | | (continued) |

| Table 6. Continued | | | | | | | |
|--|-----------------------|-------------------|-----------------------------------|-------------------|------------------------|----------------------|------------------------|
| | General health | Chronic condition | Frequent physical discomfort | Depression | Overweight or obese | Low lung capacity | High blood pressure |
| Residence (ref.= Middle/small cities) | | | | | | | |
| Big cities | -0.31 | 0.21^{*} | -0.11 | -0.15 | -0.09 | -0.04 | -0.42** |
| 1 | (0.17) | (0.11) | (0.12) | (0.12) | (0.11) | (0.12) | (0.13) |
| Beijing/Shanghai | -1.52** | -0.20 | -0.88** | -0.35 | 0.15 | -0.27 | -0.16 |
|) | (0.41) | (0.16) | (0.21) | (0.20) | (0.18) | (0.21) | (0.20) |
| Intercept | -3.23** | -1.64^{**} | -2.52** | -1.72^{**} | -1.43^{**} | -2.13** | -2.83** |
| I | (0.50) | (0.30) | (0.35) | (0.33) | (0.33) | (0.34) | (0.43) |
| Ν | 1,995 | 1,983 | 1,981 | 1,996 | 1,886 | 1,881 | 1,887 |
| p < 0.05; ** $p < 0.01$. Note: Mig. refers to "migrant," | ' and Agri. <i>hu</i> | kou refers to ' | 'agricultural <i>hukou.</i> '' Th | ie figures in par | entheses are stan | ıdard errors. | |

48 (i.e., born in the 1960s) were more likely to show depressive symptoms than younger respondents. This might be understood in light of dynamic life trajectories. Middle-aged individuals are more likely to be the "sandwich generation," having the burden of caring for both offspring and elderly parents while working at the same time.

Net of the demographic compositional differences, socio-economic factors play a significant role in urban residents' health stratification. Higher educational attainment shows protective effects on individual health, and this is especially significant for self-rated general health, depression and the risk of low lung capacity. After controlling for other factors in Model 3 (Table 6), urban residents with post-secondary education were 75.8 percent (=1-exp(-1.42)) less likely than those with no more than primary school education to report poor general health, 56.4 percent (=1-exp(-0.83)) less likely to have depression, and 44.6 percent (=1-exp(-0.59)) less likely to have low lung capacity, on average. The health benefits of education could be achieved through improving individuals' health-related knowledge, promoting healthier life styles and other similar pathways.

As for education, job characteristics also show significant impacts on individual health. Compared with skilled workers, unskilled workers and farmers were 47.7 percent (=exp(0.39)-1) more likely to report at least one chronic condition. The working schedule also has some relevance to the observed health differences, although it is likely that the relationship is not unidirectional. Those working regularly for extended hours were less likely to report frequent physical discomfort, while respondents who worked for shorter hours (no more than 20 hours per week) were more likely to report poor general health. These findings suggest that working schedule or routine interplays with health status, being both a result and a cause of health. On the one hand, current health condition could be affected by the previous work load. A routine of extended working hours is likely to have cumulative detrimental health impacts in the long run. On the other hand, health conditions can affect an individual's work activities. Healthier individuals are more capable and likely to work full time or for extended hours.

In addition to occupation and work schedule, the characteristics of the working environment are also important predictors of individual health. After controlling for other factors in the model, respondents working in poorer conditions were more likely to report poor health and to be diagnosed with various health problems. For instance, respondents who experienced more undesirable conditions³ in their work settings were

³Undesirable conditions in the work setting include: 1) very cold, 2) very hot, 3) very wet, 4) very dirty, 5) crowded, 6) dangerous, 7) exposed to dust or harmful solid materials and 8) exposed to fumes, gases or hazardous liquids. The variable, "number of undesirable working conditions," ranges from 0 to 8.

more likely to report poor general health, chronic conditions, frequent physical discomfort and depression. Moreover, the likelihood of being diagnosed with high blood pressure also increased significantly when the number of undesirable working conditions increased.

Similarly, place of residence also plays a role in respondents' self-reported and objective health outcomes. Compared with respondents living in middle-sized or small cities, those living in big cities were less likely to be diagnosed with high blood pressure but more likely to report chronic conditions after controlling for other factors in the model. Respondents living in megalopolises, such as Beijing and Shanghai, were less likely to report poor general health or frequent physical discomfort. These residence-related health differences may signify the health impacts of city-specific public resources on their residents' wellbeing.

The results in Model 1 through Model 3 suggest that the observed health variations among urban residents, by migration status and *hukou* type, are largely attributable to different demographic and socio-economic characteristics of these groups. Although migrants as a group are healthier than urban natives (see also Chen, 2011; Qi and Niu, 2013; Wang et al., 2011), to a great extent, the migration-related health differences are the result of positively-selected demographic characteristics. In contrast, health differences by *hukou* type are more likely to result from differences in socio-economic stratification between these groups.

The analysis of health disparities in urban China discussed above suggests that to date, the migration-related institutional arrangements have largely lost their direct impact on individuals' health outcomes in urban society. Yet, it is noteworthy that the *hukou* system can still impact on health through socio-economic stratification and different social entitlements, especially where there are differences in institutional arrangements and resource allocation at the local level. Interacting with socio-economic stratification, migration status and *hukou* type still make a significant difference to the health resources accessible to urban residents and their service use behaviors, as shown below.

Health resources, service use and institutional impact

Table 7 presents the estimated logit model coefficients for the three indicators of health resources and service use. According to these results, migration status and *hukou* type have significant impacts on the respondents' health insurance coverage, accessibility of health resources and health service use. When the group differences (i.e., without controlling for other variables) were considered (as shown in Model *a* in Table 7),

|) | | | Financial | مالتصالح | Choire o | f haenital |
|-----------------------------|---------------------|------------------------|--------------------------------------|--------------------------------------|----------------------------------|---------------------------------------|
| | Medical u (1=yee | minsurance s, 0=no) | rulaticial in meetir needs (1= | duncury ig medical iyes, 0=no) | CHOICE O (1=priva 0=public | t nospitat te clinic, hospital) |
| | Model a | Model b | Model a | Model b | Model a | Model b |
| Mig. | 0.78** | 0.52** | 0.16 | 0.44 | -0.19 | -0.16 |
| | (0.17) | (0.18) | (0.26) | (0.27) | (0.27) | (0.28) |
| Agri. hukou | 0.09 | -0.32* | 0.39* | 0.28 | 1.21^{**} | 0.87** |
| | (0.13) | (0.15) | (0.17) | (0.19) | (0.14) | (0.16) |
| Mig*Agri.hukou | 0.40 | 0.63^{*} | -0.14 | -0.18 | -0.18 | -0.02 |
| | (0.25) | (0.28) | (0.36) | (0.38) | (0.34) | (0.36) |
| Female | | 0.02 | | 0.21 | | 0.32^{*} |
| | | (0.12) | | (0.17) | | (0.15) |
| Age (ref=18-28) | | | | | | |
| 29–38 | | -0.47* | | 0.28 | | -0.67^{**} |
| | | (0.20) | | (0.32) | | (0.25) |
| 39-48 | | -0.76^{**} | | 0.76* | | -0.42 |
| | | (0.21) | | (0.31) | | (0.25) |
| 49+ | | -1.48^{**} | | 0.62* | | -0.64^{*} |
| | | (0.21) | | (0.31) | | (0.25) |
| Education (ref=Primary edu) | | | | | | |
| Secondary | | -0.43^{**} | | -0.19 | | -0.69** |
| | | (0.15) | | (0.19) | | (0.17) |
| | | | | | | (continued) |

| Table 7. Continued | | | | | | |
|---------------------------------------|-----------------------|---------------------|-------------------------------------|---------------------------------------|-----------------------------------|---------------------------------------|
| | Medical un (1=yes, | ninsurance 0=no) | Financial in meetin needs (1= | difficulty g medical yes, 0=no) | Choice of (1=priva 0=public | : hospital te clinic, hospital) |
| | Model a | Model b | Model a | Model b | Model a | Model b |
| Post-secondary | | -1.12^{**} | | -0.49 | | -0.58* |
| | | (0.23) | | (0.34) | | (0.27) |
| Not married | | 0.15 | | 0.56^{*} | | 0.03 |
| | | (0.17) | | (0.23) | | (0.21) |
| Occupation (ref =Skilled worker) | | | | | | |
| Professional/cadre | | -0.97** | | -0.54 | | -0.65* |
| | | (0.19) | | (0.31) | | (0.25) |
| Unskilled worker/farmer | | -0.96** | | 0.16 | | 0.26 |
| | | (0.19) | | (0.24) | | (0.20) |
| Others | | -0.14 | | 0.02 | | -0.24 |
| | | (0.18) | | (0.25) | | (0.22) |
| Working hrs/week (ref=21-50 hrs/week) | | | | | | |
| ≤20 hrs/week | | 0.49** | | 0.36 | | -0.01 |
| | | (0.17) | | (0.22) | | (0.20) |
| >50 hrs/week | | 0.38** | | 0.15 | | 0.10 |
| | | (0.14) | | (0.20) | | (0.17) |
| No. undesirable working conditions | | 0.05 | | 0.17^{**} | | 0.04 |
| | | (0.03) | | (0.04) | | (0.04) |
| | | | | | | (continued) |

| Table 7. Continued | | | | | | |
|---------------------------------------|--------------------|------------------------|-------------------------------------|---|----------------------------------|---|
| | Medical u (1=ye | minsurance s, 0=no) | Financial in meetir needs (1= | l difficulty ng medical syes, 0=no) | Choice o (1=priva 0=public | of hospital ate clinic, c hospital) |
| | Model a | Model b | Model a | Model b | Model a | Model b |
| Residence (ref.= Middle/small cities) | | | | | | |
| Big cities | | -0.36^{**} | | -0.14 | | 0.02 |
| | | (0.12) | | (0.16) | | (0.14) |
| Beijing/Shanghai | | -0.47* | | -0.53* | | -1.96^{**} |
| 1 | | (0.18) | | (0.27) | | (0.38) |
| Intercept | -1.04^{**} | 0.52 | -2.17^{**} | -3.00** | -2.00^{**} | -0.94^{*} |
| I | (0.06) | (0.31) | (0.0) | (0.44) | (60.0) | (0.37) |
| Ν | 1,983 | 1,983 | 1,980 | 1,980 | 1,986 | 1,986 |
| *n / 0.05: **n / 0.01 | | | | | | |

p < 0.02; ""p < 0.01. Note: Mig. refers to "migrant," and Agri. *hukou* refers to "agricultural *hukou*." The figures in parentheses are standard errors.

migrants were about 1.18 (=exp(0.78)-1) times more likely to be left out of medical insurance systems compared with urban natives. Urban residents with agricultural *hukou* were 0.48 (=exp(0.39)-1) times more likely to have experiences of not seeing a doctor when needed due to financial difficulties, and 2.35 (=exp(1.21)-1) times more likely to resort to private clinics for medical services than non-agricultural *hukou* holders.

The impacts of migration status and *hukou* type on the use of health services (with the exception of "financial difficulty in meeting medical needs") remain largely significant even after controlling for the major demographic, socio-economic and environmental factors (in Model *b*). Holding the demographic, socio-economic and environmental characteristics constant, migrants were still significantly more likely to be left out of the medical insurance system. Overall, medical insurance coverage was lowest for the agricultural *hukou* migrants and highest for agricultural *hukou* urban natives in contemporary urban China. Individuals having agricultural *hukou* were 1.39 (=exp(0.87)-1) times more likely to resort to private clinics rather than public hospitals for medical services. This health seeking behavior does not differ significantly between migrants and urban natives after controlling for other variables in the model.

Demographic and socio-economic factors are also important predictors of respondents' access to health resources and use of health services. For instance, younger and less educated respondents were more likely to be left out of the medical insurance system. Older respondents were more likely to experience financial difficulties in meeting their medical needs. Those who are married were less likely to face financial difficulties and were thus more able to meet their medical needs. Females, those in the youngest age group, and those with the lowest level of education were also more likely to resort to private clinics. Compared with skilled workers, the urban professionals/cadres and unskilled workers/farmers were both less likely to be left out of the medical insurance system; the former were also less likely to choose private clinics for medical services. Those either working part time or working routinely for extended hours were more likely to have no medical insurance, and those with poor working conditions were more likely to face financial difficulties in meeting their medical needs.

City size was also found to be associated with variation in access to health resources. Respondents living in big cities or megalopolises (such as Beijing and Shanghai) were less likely to be left out of the medical insurance system. After controlling for other factors in the full model, these residents were also less likely to encounter financial difficulties in meeting their medical needs, or to resort to private clinics for medical services. This locality effect partly reflects the positive externality of the wider availability of health resources in these big cities.

Discussion and conclusion

Using data from a nationally representative sample survey, this study examines health stratification in urban China in light of rapid internal migration under current institutional arrangements. Migration status and *hukou* type were considered in order to identify four major groups of urban residents, namely, migrants with non-agricultural or agricultural hukou, and urban natives with non-agricultural or agricultural hukou. We found that migrants, as a group, were healthier than urban natives, and residents with non-agricultural hukou were healthier than those having agricultural hukou. According to self-reported health indicators, urban natives with agricultural hukou had the poorest health and urban natives with non-agricultural hukou were next, while migrants with agricultural hukou had the best health. This finding reinforces the notion that health is an important prerequisite for migration. Moreover, the urban labor market may exert greater selectivity for migrants with agricultural hukou than those with non-agricultural *hukou*. As a result, migrants with agricultural hukou reported better health conditions than their counterparts with nonagricultural hukou. Also, urban natives with agricultural or non-agricultural hukou were the least healthy groups in terms of objective health measures.

These overall health differences are largely attributable to the different demographic profiles and socio-economic circumstances of these groups. The migration-related health difference reflects the joint impacts of positively-selected demographic characteristics and the relatively poorer socioeconomic and environmental circumstances of migrants compared with urban natives. When demographic and socio-economic factors were held constant, health disparities by migration status and hukou type declined substantially. Therefore, it is reasonable to conclude that to date, the institutional arrangements associated with migration status and hukou type have largely lost their direct impacts on health outcomes in urban societies. Counteracting with the positive selection mechanism on health (such as younger age structure and relatively higher educational attainment), migrants' position in the socio-economic ladder in the urban destination mediates the institutional impacts and reduces the initial health advantage of migrants over time. This can be partly explained by migrants' relatively poor working conditions, poor access to health resources and constraints in the use of health services. Nevertheless, direct institutional impacts persist in defining urban residents' access to health resources and use of

health services. In part, due to migrants' mobility and informal employment, current institutional arrangements do not promote migrants' inclusion in the medical insurance system, particularly for migrants with agricultural *hukou*. Although the medical insurance system has developed rapidly throughout China in recent decades, the stratification of the current insurance system by region and *hukou* type and uneven socio-economic development continue to create great disparities in accessing health services. Due to financial difficulties, urban residents with agricultural *hukou* tend to resort to private clinics for health services. In general, private health clinics provide inferior quality services. Migrants with agricultural *hukou* are even more disadvantaged because of their low socio-economic status and institutional exclusion in accessing and availing of health services.

Barriers to accessing health services suggest that migrants may be even more vulnerable to health risks, given their already difficult circumstances—long working hours, poor working environments, and low socio-economic status. These conditions are reflected in the poorer health of return migrants (Ezzati et al., 2002; Niu, 2013; Qi and Niu, 2013) and reinforced in some longitudinal studies on migration and health (Tong and Piotrowski, 2012).

Lastly, it is important to note that the type and size of place of residence could affect public health resources and socio-economic inequalities to some extent. This study found that residents in middle-sized or small cities fared worse in terms of health and health service use compared with those in big cities. This situation further underlines the complexity of health stratification in urban China. The correlation between local health resources and population health points to the reality of regional segmentation in China's current medical insurance and health service systems. It is crucial to reform the unequal system and build up a nationally balanced health service network that meets public health needs and minimizes health inequality in the long run.

Due to data limitations, the study was not able to examine the dynamics of health for different groups of urban residents; detailed retrospective health information is needed for such an analysis. With the cross-sectional data design, we excluded former migrants (including return migrants) from the current analysis. Urban native females were over-represented in the sample due to non-response in the survey. We addressed this issue by modeling its effect explicitly in our multivariate analysis. The relatively small sample size, especially that of migrants, prevents the simultaneous testing of other health-related effects. With better data, more detailed investigation of the dynamics of health and health stratification could be undertaken in future studies.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this paper.

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