

RESEARCH REPORT

**ENVIRONMENT AND HEALTH: A SURVEY STUDY OF LABOR
MIGRANTS IN SHENZHEN**

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INTRODUCTION

China has observed rapid economic development and remarkable de facto urbanization in recent decades. From 1978 to 2005, the share of agriculture in GDP declined from 27.9% to 12.6%, and the corresponding share of agriculture in employment shrank from 70.5% to 44.8% (National Bureau of Statistics, 2006). Meanwhile, millions of working-age individuals flocked into urban areas, especially big cities in the eastern coastal area, to pursue more job opportunities and/or attractive lifestyles. The massive and sustaining population migration has aroused significant issues and concerns on the environmental change and related population health.

Shenzhen is one of the biggest cities in China, and it hosts millions of working-age migrants each year recently. In 1980, Shenzhen has a migrant population of about 12 thousand, which increased rapidly to around 990 thousand by 1990, and further to 5.76 million by 2000. In 2006, migrants in Shenzhen amount to 6.49 million (Shenzhen Yearbook Editorial Board, 2007). Meanwhile, the average population density in Shenzhen increased from 170 persons per square kilometer (PPSK) in 1980 to 859 PPSK in 1990, 3591 PPSK in 2000, and further to 4334 PPSK in 2006 (ibid.). With the ever-increasing magnitude of migrants, various types of residence, including urban villages and the kissing buildings, were erected rapidly in Shenzhen to meet the expanding accommodation needs. In addition, with the sustaining labor supply and relatively low labor cost, various types of factories and enterprises also flourish. The rapidly expanding productive and consumptive activities add new risks and issues into the city's environment and population health. This situation invites serious empirical investigation, especially in the face of the potential labor force (and migrants) decline in the wake of population transition all through the nation.

In this study, we explore the environmental impacts on labor migrants' health in Shenzhen. The research questions we are interested to address include 1) the condition and potential variation in labor migrants' health, 2) the variation in their living and working conditions, and 3) major environment-related health risks and policy implications.

This study is important in that: first, Shenzhen has a significant amount of migrants from all around China. The migrants account for more than 80% (82.8%) of its total residents in 2000 (Yang et al. 2002). Second, the migrants constitute selected groups of healthier and more educated individuals from the migrant-sending areas (An et al. 2006), and they are important human resources not only to Shenzhen, but also to their hometown and to the nation as a whole. And third, Shenzhen is a Special

Economic Zone, and it has been in a leading position in developing economy and carrying out policy reformation. As such, the environment-health relationship observed, the major health issues identified, as well as the policy interventions implied in Shenzhen are insightful not only for Shenzhen, but will also throw lights for the policy makers and service providers in other migrant-receiving cities. Above all, the findings in Shenzhen are expected to contribute to our understanding about the relationship between de facto urbanization and population health in contemporary China in general.

RESEARCH BACKGROUND: POLICY EVOLUTION IN SHENZHEN

As a special economic zone, Shenzhen has played an active role not only in pursuing economic growth, but also in developing and trying out new policies and regulations related to migrants' admission and management (Fu 2008). This is also to the request of its rapidly expanding population of migrants. During the past three decades, the share of migrants in Shenzhen has multiplied for more than ten times, and accordingly the migration admission policy has evolved progressively from a control- and management-oriented policy to a more friendly and service-oriented one. Despite its incompleteness, the evolution of migration policy in Shenzhen has had great impacts on various migrating cohorts.

Early in the 1980s, the development of Shenzhen under the Special Economic Zone policy motivated great inflows of capital and labor. With its rapid economic and population growth, the social infrastructure became incompatible soon and lagged far behind. As a result, the city faced great challenges and problems in many aspects including public order maintenance. In 1984, the Shenzhen Bureau of Public Security decided to issue temporary residential permit to migrants in order to regulate the population inflows. One year later, Shenzhen government published for the first time the Provisional Regulations on Temporary Residents Administration. This document dictated regular and aperiodic "cleaning up or deporting" of the so-called "three-lacks-persons" (*sanwu ren yuan*, also called three not people)¹. And according to the Shenzhen Population Record, the deported "three-lacks-persons" amounted to 300 thousands between 1985 and 1988 (Fu 2008). The administrative ideology and logics embodied in the document characterized the migration policy and actions throughout the 1980s and 1990s.

Along with the economic development and industrial structure upgrading, the

¹ "Three-lacks-persons" refer to the floating individuals having no identity card, no temporary residence permit, and no work permit.

migrants admission and management policy evolved gradually as well. Early in the 2000s, Shenzhen started to transfer some processing and compensation trades (*Sanlai Yibu*, i.e., processing with materials or given samples, assembling supplied components) outside and the inflow of labor migrants slowed down. Finally, the shortage of labor migrants emerged silently in some coastal areas since 2003, which was mainly a sign of structural shortage of labor supply. The changing economic structure and scenario of labor supply, among other factors, ignited a reform in migrants admission and management policies.

Late in 2003, Shenzhen started to develop its administrative system towards a synthetic one with one-stop service. The system was progressed into a hierarchical administrative network involving city government, districts and streets. Shenzhen government published the Suggestions on Strengthening Rental Housing Management in 2005. This document and the following Notice on Implementing Rental Housing Management Modes Roundly paved the way to a synthetic and more friendly administrative system. In August 2008, Shenzhen initiated the residence identity system for migrants, which starts to give migrants (especially the long-term card holders) equal rights to enjoy many basic social welfare including free compulsory education, governmental indemnificatory rental housing in the hosting city.

The evolution of migration policy in Shenzhen targets at an increasingly equalizing status of migrants as compared with the natives. Yet, to date, there is still significant gap in the rights and welfare statuses of migrants and those of the local residents. An example to the point can be the ongoing social medical insurance system, which distinguishes the labor migrants from other employees in applicable insurance types and aspects alike². Similarly, the employment and pension statuses differ substantially for labor migrants and for the local residents. As such, a systematic investigation of the situation of labor migrants can be expected to facilitate the policy evolution process and improve the situation of migrants as a whole.

LITERATURE REVIEW

Previous studies have illustrated that migrants, especially the rural-urban labor migrants are particularly vulnerable to detrimental health factors (e.g., Huang et al. 2001; Xiang 2004; Wang et al. 2006; Zhao et al. 2008; et al.). And potential explanations implied in the existing literature include the following: 1) Labor migrants usually have *fewer health-related knowledge*, and *lower awareness* of

² See http://www.chinalawedu.com/new/21602_4000_/2010_3_26_ma628943547162301028533.shtml.

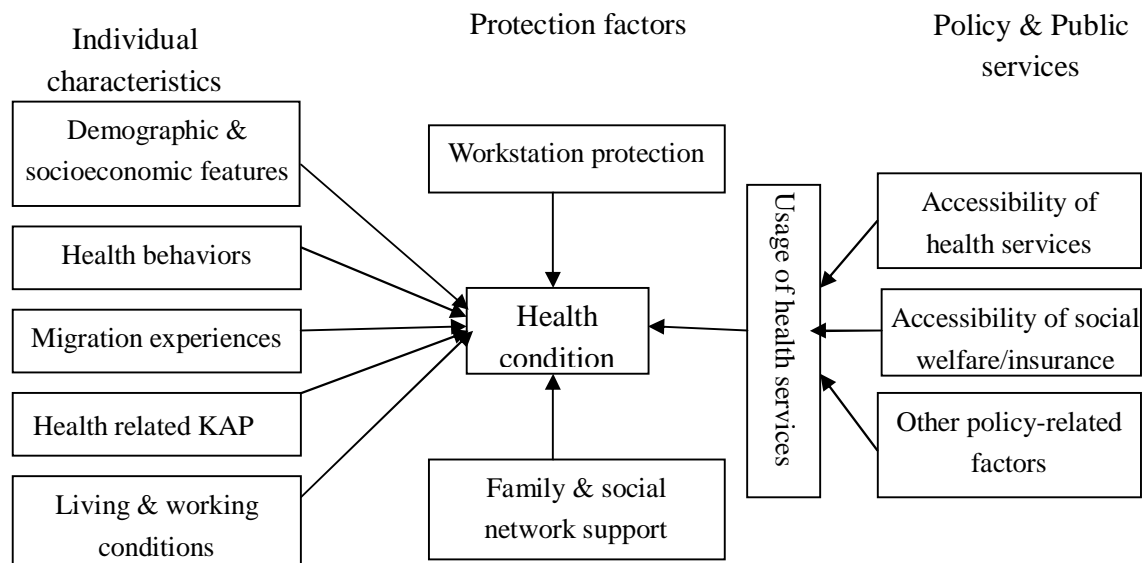
health risks, needs and services available as compared with the residents in the hosting cities (Wang, An, et al. 1999; Zheng et al. 2001; Huang et al. 2005a, 2005b; Zhang et al. 2006; Cheng et al. 2007; et al.); 2) Migrants are *financially less well-off* while have predominant incentives to save and send money back home, which makes them more likely to sacrifice personal health for economic reasons (Ge et al. 2004; Zhang et al. 2007; et al.); 3) Migrants usually encounter *disconnection/truncation of the original social network*, and they have less social support and are more likely to expose to risky behaviors (Xie et al. 2006; Xie et al. 2007; Zhang & Lu 2005; et al.); 4) Migrants also tend to have *undesirable/unsafe living and working conditions*. For the reasons including financial constraints, labor migrants usually live in crowded, low-quality lodgings in poor communities (Jaakkola & Heinonen 1995; Roberts 1997; Chen et al. 2001; Meng & Zhang 2001; Wang et al. 2002; Shen & Huang 2003; Liang & Xiang 2004; An et al. 2006; Fang et al. 2007; Wang et al. 2007; et al.). And also they are more likely to work in labor-intensive positions, work for extended hours, and to expose to heightened occupational health hazards (Roberts 1997; Tan 2003; Jiang 2006; et al.). 5) Despite the socioeconomic contributions they are making, labor migrants usually enjoy *lower social welfare, subsidies/benefits, and public services* in the hosting cities (Wang & Zuo 1999; Chen et al. 2006a, 2006b; Li et al. 2006a, 2006b; Liu et al. 2006; Gao, Qiao, et al. 2008; et al.). In a certain sense, labor migrants are largely *ømarginalizedø* in the hosting cities at least until recently.

Yet, to date, limited attention has been paid to situate the labor migrants' health dynamics into the environmental factors, net of other socioeconomic determinants in particular (Huang et al. 2001; Dai et al. 2005; Wang et al. 2006; Wen et al. 2006; Gao, Tan, et al. 2008; Liao et al. 2008; Zhao et al. 2008; Zhu et al. 2008, Wen & Wang 2009). And we know little about the environment and health conditions of labor migrants in the major migrant-hosting cities such as Shenzhen. This is incompatible with the great importance of both environmental and socioeconomic factors in influencing individuals' health. While migrants, especially the rural-urban labor migrants, are more likely to expose to detrimental environmental settings compared with their counterparts, it is vital to evaluate the related health effect of this subpopulation, especially in view of the potential changes along with policy evolution in the cities such as Shenzhen. This is especially the case in view of the emerging shortage of labor migrants in the traditional migrant-receiving cities and the requirements of a sustainable development of economy and society.

RESEARCH FRAMEWORK

In this study, we will examine the detrimental environment impacts on the migrants' health, both physical and psychological. As discovered in previous studies, the factors such as individuals' demographic and socioeconomic characteristics, health behaviors, migration experiences, health related knowledge, attitudes and practices (KAP), and others features alike are likely to have independent impacts on their health outcome (as outlined in the following display). As a result, it is important to control for these factors, when examining the net effect of environmental factors.

Display 1: Theoretical framework



The environmental factors we are interested in here include the tangible living and working conditions, such as sanitation, safety and quality of the food and water, crowdedness, safety in the community and working station, and so on. These environmental aspects are focused on particularly because they are most distinguished for labor migrants and local residents, and potentially they make great differences in the health outcomes of these subpopulations. By controlling for the individuals' demographic and socioeconomic characteristics, health behaviors, migration experiences and health related KAP, this study examines the environment-health relationship as defined above.

SURVEY DESIGN

Many rural-urban migrants are highly mobile and not registered officially in the hosting city, and as a result, there is no good sample frame of migrants readily available. In addition, as rural-urban labor migrants are less likely to be covered in the

local welfare system or to have formal working contract, their working location and everyday life are less tractable to the outers. As such, we employ a multistage stratified purposive sample design to select labor migrants from a range of industries and communities in accordance with the distribution of migrants as shown from the census.

First, we select three out of six districts in Shenzhen— Futian, Baoan, and Longgang. These three districts are selected because they are largest districts and also host greatest amounts of labor migrants in Shenzhen, and in addition, they vary significantly in the economic structure, public infrastructure, and environment. According to the 2005 mini census, around 81% working-age population in Futian district were from other provinces, the corresponding figures in Baoan and Longgang districts were 95% and 91% respectively. While Futian is the district where the municipal government locates and the center of the Shenzhen Special Economic Zone, the other two districts are out of the Special Economic Zone and are suburbs of Shenzhen.

Second, in each of the three districts, we select a few streets based on the related neighborhood environment conditions and SES. In order to include the collectively-boarded labor migrants who do not live in the residential communities, we also contact a few enterprises from various industries (including manufacture, construction, hotel/restaurant and others). As a result, four streets in Futian, two in Baoan and one in Longgang are selected, in addition to five enterprises in Baoan and seven in Longgang are included in the sample.

Third, in the selected streets and enterprises, we sample labor migrants purposively to maximize the variation of the migrants' socio-demographic characteristics (such as age, sex, and marital status) as well as the environmental conditions they work or live in.

The survey was conducted from May to June 2010. In total, 1025 labor migrants were selected and interviewed with a structured questionnaire. The data collected from the survey include: 1) **socio-demographic information**, 2) **physical, psychological health conditions**, 3) **health behaviors**, 4) **health care** (including health service & insurance coverage) & **health needs** (including the unmet health needs and related barriers), 5) **neighborhood environment**, and 6) **living & working conditions**.

In line with the theoretical framework, we measure the individuals' demographic and socioeconomic features with individuals' age, gender, marital status, education,

annual income, and occupation. Health behaviors include routine exercises, drinking and smoking behaviors, eating habits, and so on. Migration experience is operationalized in this study as migration duration, and details of the previous moves (up to three). Health related KAP includes the knowledge from the basics such as adults' normal body temperature to the more advanced such as usage of antibiotics and ways to protect from contagious diseases, the attitudes towards things such as expired food, and practices including handwashing habits and so on. Living and working conditions refer to the environmental settings of the lodging, community and working station, such as safety, air quality, noise level, walkability, and other neighborhood socio-physical features. Social network support involves a series of questions regarding accessibility of helpers or companions at various occasions. Finally, health outcome is operationalized with self-rated general health, physical illnesses experienced during the past 12 months, psychological problems and pressures experienced during the last month.

In addition, we also conduct some focus-group interviews with selected labor migrants and informants who have intensive contacts with the migrants either in the working station or in the community to collect the relevant contextual data.

PROFILES OF SURVEY RESPONDENTS

Table 1 displays the main demographic and socioeconomic characteristics of the sampled respondents. In total, 1025 respondents (including 265 in Futian, 245 in Baoan and 515 in Longgang) are contacted and interviewed successfully. From Table 1, it is clear that most labor migrants are young adults. The majority of the respondents are in their twenties (47.7%), and those aged below 20, in their thirties and forties account for 8.6%, 25.9% and 17.8% respectively. This is very close to the age distribution of labor migrants in Shenzhen. Male respondents account for around 56.8% in the sample, which is a little higher than the corresponding proportion of the migrant population (around 50% in 2005) in Shenzhen. Similar to the education distribution of the migrant population in Shenzhen, the majority of the respondents have a junior middle school or senior middle school education (or equivalent), accounting for 41.1% and 26.6% (with an additional 15.4% achieved occupational school education) respectively. While a relatively smaller number of respondents have a higher educational attainment (college or above, 11.3%), even fewer have a lower education (primary school education or less, 5.6%).

Table 1: Demographic and Socioeconomic Composition of the Sample

Characteristics	%	Characteristics	%
<i>N.</i>	1025	Type of birth place	
Age group		city	4.8
<20	8.6	county seat	7.2
20-24	27.3	town	15.8
25-29	20.4	village	72.3
30-34	13.6	Marital Status	
35-39	12.3	single	39.6
40-44	11.2	married, living with spouse	38.0
45+	6.6	married, not living with spouse	16.5
Sex		cohabiting before marriage	2.4
male	56.8	widowed/divorced/separated	3.5
female	43.2	Current living arrangement	
Educational attainment		living with children	16.5
primary school or less	5.6	living with siblings	5.2
junior middle school	41.1	living with parents	3.3
senior middle school	26.6		
occupational school	15.4	<i>Mean years migrated (SD)</i>	7.6(5.4)
college or above	11.3	<i>Mean years stayed in Shenzhen (SD)</i>	5.9(4.9)

Most labor migrants in Shenzhen are from rural areas. The respondents from villages account for around 72.3% of the sample, and those from towns and county seats account for 15.8% and 7.2% of the sample respectively, which leaves merely less than 5% of the respondents coming from cities. The original sending areas of the sampled labor migrants amount to about 24 provinces, with the top five sending provinces being Guangzhou (accounting for 23.9%, not shown in Table 1), Hunan (14.6%), Sichuan (11.9%), Hubei (10%), and Jiangxi (7.6%). "Earning more money" (57.4%) and "learning more knowledge" (43.7%) are among the major motivations driving the respondents' migration originally. On average, the respondents have been away from their home county for around 7.6 years all together, and have stayed in Shenzhen for about 6 years.

Because of their young age composition and high mobility, a substantial amount of the respondents are not married. The respondents remaining single at the time of survey account for 39.6%, in addition to a proportion of 2.4% in the sample cohabiting with partner before marriage. Around 38.0% of the respondents are married and currently living with spouse, 16.5% are married but not living with spouse at the time of survey, and 3.5% are separated, divorced or widowed. As

discovered in recent studies, labor migrants are starting to migrate with families (Cai, 2001 et al.). In the current sample, around 40% of the respondents currently live with spouse or partner, and 16.5% of the respondent live with (at least some) children, 5.2% live with siblings and 3.3% live with parents at the time of survey.

UNIVARIATE ANALYSIS RESULTS

Working and Living Situation

Table 2 displays the major working and living characteristics of the sampled labor migrants. In accordance with the rapid development of industries such as manufacturing and service in Shenzhen, many labor migrants in Shenzhen work in manufacturing or service industries. In the current sample, around 40.4% of the respondents work in manufacturing industries, 25% work in resident service and other service, and 9.6% in hotel and catering services. The remaining respondents work in construction (8.0%), wholesale or retail trade (6.4%), transportation (5.6%), or other industries (4.9%). The respondents' employment organizations range from public institution/agency (4.8%) to enterprises of various types and sizes. In addition to those working in private enterprises (38.3%), substantial proportions of respondents work in joint ventures with Hong Kong, Taiwan or Macao (22.1%) and state-owned enterprises (15.7%). Those work in collectively owned enterprises account for 6.1% and the rest (4.5%) work in foreign-owned enterprises. The corresponding enterprise sizes range from fewer than 7 persons to more than 500 persons, with a substantial variation observed.

On average, labor migrants have relatively limited skill levels. Around 71% of the sampled labor migrants do not have any special working skill. Those having low-level and middle-level skills account for 12.6% and 14.6% respectively, and the remaining 1.7% of the respondents have high-level skills. These labor migrants mainly work as servicer (36.5%), industrial worker (31.6%) or professional/technologist (12.6%). As with their working characteristics, most labor migrants have a moderate income. Around 46.4% of the respondents report their personal annual income in 2009 between 10 to 30 thousand Yuan, around 14% report a higher annual income, and the remaining (around 40%) report a lower annual income (no more than 10 thousand Yuan). For a decent income, labor migrants have routinely worked for extended hours. On average, the respondents work for around 58 hours per week, about 45% longer than the eight-hour daily working schedule³.

³ The mean hours worked weekly in the current sample is close to the figure calculated for migrants from the CGSS2009, conducted by CASS.

Table 2: Working and living conditions of the respondents

Working & Living Characteristics	%	Working & Living Characteristics	%
Industry		Occupation	
manufacturing	40.4	manager of enterprise/ institution/agency	1.2
construction	8.0	professional/technologist	12.6
transportation, storage and post	5.6	staff	6.8
wholesale and retail trade	6.4	servicer	36.5
hotel and catering services	9.6	industrial worker	31.6
Resident service and other service	25.0	others	11.3
others	4.9	Personal income in 2009	
Nature of organization		<=10 thousand	39.7
public institutions/agencies	4.8	10-30 thousand	46.4
state-owned enterprise	15.7	30-50 thousand	10.0
collective enterprise	6.1	>50 thousand	3.9
private enterprise	38.3	Mean hours worked weekly (SD)	58.1(14.2)
joint ventures with HK, Macao,TW.	22.1		
foreign-owned enterprise	4.5	Type of Current lodging	
others	8.4	storied building	86.2
Size of enterprise		single-story lodging	7.1
<=7	9.4	basement	0.2
8-49	15.5	construction shed	4.4
50-99	8.1	others	2.2
100-499	26.7		
>=500	19.2	Ownership of Current Lodging	
Not Known	21.1	leased	45.9
Skill level		employer'	43.2
none	71.0	own	6.0
low	12.6	parents'	3.5
middle	14.6	relatives'	0.9
high	1.7	others'	0.6

The figures above roughly picture the working situation of labor migrants in Shenzhen. In addition to the considerable variation in the working situation, the sampled migrants also vary substantially in their living conditions. While most respondents live in standard or non-standard storied buildings (86.2%) in Shenzhen, there are some respondents live in single-story lodging (7.1%), basement (0.2%), construction shed (4.4%) or other types of lodging (2.2%). Among all the sampled migrants, around 45.9% rent the lodging by themselves, and another 43.2% lived in the lodging provided by the employers. In spite of the low proportions, there are some respondents living in their own house (6.0%) or their parents' house (3.5%). And

around 0.9% of the respondents living in their relatives' house. These add more variation in labor migrants' SES, social network and social integration.

Environment in the Living and Working Settings

With regard to the environmental features, Shenzhen has made great progress in improving its environment recently (such as the interim procedures to protect workers from higher temperature⁴, city plan and *ōChaiweiō*⁵), and this has benefited all the residents including labor migrants in Shenzhen. Nevertheless, there is still much room to work on in order to improve the microenvironment that labor migrants have in particular. For instance, while in-door facilities such as private toilet, tap water and bath facility are important amenities characterizing the living condition, only 57.6% of the respondents in the sample have private toilet in their current lodging. Around 11% (=100%-89%) of the respondents do not have access to tap water in their lodging, and 43.4(=100-56.6)% of the respondents do not have bath facility in the house.

Table 3: Features of living and working environments

Living environment	%	Working environment	%
Facility in the house		Features of the working environment	
private toilet	57.6	very cold	1.9
tap water	89.0	very hot	34.1
bath facility	56.6	very humid	16.9
Facility in the neighborhood		very dirty	15.0
laboratory, printworks, ironworks	27.3	very noisy	32.6
park, sports ground	54.0	very crowded	21.9
library	21.3	very dangerous	12.1
cinema	14.3	likely to touch harmful solids/dust	31.9
gym	21.8	likely to touch toxic liquid/gas	22.3
free exercise facility	36.9	need to be seated for long time	27.2
bus or subway stop	76.6	need to stand for long time	21.8
restaurant/bar	66.2	need to walk from time to time	32.1
primary school	62.6	cannot change position freely	15.4
middle school	47.5	need to carry very extra weight	10.8
Perceived safeness in the neighborhood		Likelihood of getting injured	
always	36.9	very likely	5.8
most of the time	39.5	somewhat likely	8.1
sometimes	18.6	so so	26.3
never	5.0	less likely	19.2
		very unlikely	39.9

⁴ <http://news.sina.com.cn/c/2010-08-05/013117914112s.shtml>

⁵ *ōChaiweiō* refers to the actions removing the non-standard buildings (inc. the kissing buildings), which has been initiated since 2009.

With regard to the neighborhood⁶ environment, around 27.3% of the respondents live in the community having laboratory, printworks or ironworks nearby. Around 54% of the respondents live in the community having parks or sports ground in the neighborhood, and less than a quarter of the respondents report having library, cinema, or gym nearby. Although free exercise facilities mushroom in many communities of big cities such as Shenzhen, only around a third of the respondents (36.9%) report such amenities in their neighborhood. Around 76.6% of the respondents report having bus or subway stop nearby, and those having restaurant or bar in the neighborhood account for a lower proportion (66.2%). The respondents living in a community with a primary school nearby account for around 62.6%, and around half of the respondents live in a community with a middle school nearby (47.5%).

Figure 1 illustrates other social environmental features of the neighborhood as perceived by the labor migrants. In total, around half (46.6%) of the respondents report that most of the residents in their neighborhood know each other, 50% agree that the residents in their neighborhood are willing to help, and 60% agree that the residents in their neighborhood are nice to each other. Although only about 38% of the respondents report that the residents in their neighborhood can be trusted, around 35% of the respondents are unclear whether it is the case. Roughly 14% of the respondents report that the residents in their neighborhood dare not going out at night, and around 60% disagree with this. Above all, 76.4% (=36.9%+39.5%) of the respondents think their neighborhood is safe at least most of the time (as shown in the bottom left of Table 3). An additional 18.6% of the respondents think their neighborhood is safe sometimes, and the remaining 5% regard their neighborhood unsafe.

⁶ Here, we define neighborhood as the community within a 15-minute-walk distance, which signifies the central environmental factors (air quality, convenience, safeness, walkability) influencing individuals' life.

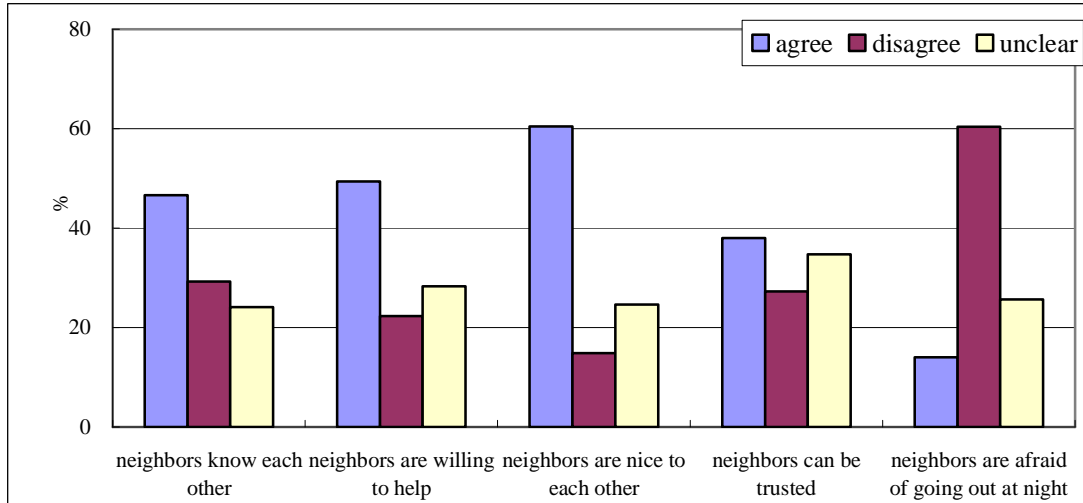


Figure 1: Features of the social environment in the neighborhood

In addition to the social environmental features, Figure 2 displays the migrants' self-perceived air quality and noise level in their current residence. While around 17% of the respondents think that both in-door and outside air quality are good, and around 13% think they are poor, majority of the respondents think the air quality in their residence is fair (with a 70% answering 'so so'). Similarly, around 17% of the respondents think the noise level in their community is low, and 56.4% think the noise level is moderate. The remaining 26.6% of the respondents regard the noise level in their community is high.

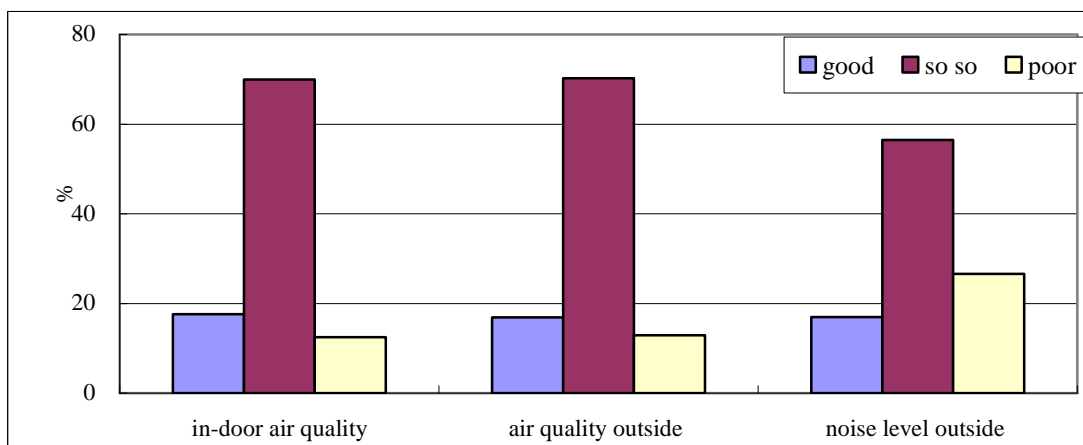


Figure 2: Features of the natural environment in the neighborhood

In addition to the main features of the living environment, Table 3 also displays the major environmental characteristics in the labor migrants' current working stations (as shown in the right panel of the table). Although only a very small amount

of the respondents report a very cold working condition (1.9%), labor migrants in Shenzhen encounter other extreme working conditions to much higher extents. There are 34.1% of the respondents reporting a very hot working condition, 16.9% reporting a very humid working condition, 15% reporting a very dirty working condition, 32.6% reporting a very noisy condition, and 21.9% reporting a very crowded working condition. In addition, some labor migrants are exposed to potential or real hazards. Around 12.1% of the respondents report that their working environment is very dangerous and much higher proportions of respondents report the likelihood of touching harmful solids, dust or toxic liquid and gas (31.9% and 22.3% respectively).

Besides the natural environmental conditions, the ergonomic aspects also arouse concerns for safeness and comfort of the labor migrants' working environment. Around 27.2% of the respondents report that they need to sit for long time in the working station, 21.8% report the requirement of long-time standing, 32.1% report the requirement of incessant walking, 15.4% report the requirement of keeping the same position, and 10.8% report the requirement of carrying extra weight in the current working position. Taken all together, about 14% of the respondents regard their current work is likely (very likely or somewhat likely) to get injured, and the majority think the opposite (59.1% thinking less likely or very unlikely).

Health Status and Health Care Practices

Labor migrants are young and selectively healthier in general. Table 4 displays the respondents' self-perceived general health, chronic conditions and other frequently experienced health problems. Above all, more than 60% of the respondents think their general health good, very good or excellent, and those perceiving their health status fair account for an additional 35.5%. Only about 2.7% of the respondents think their health poor. This is very similar to the health condition of migrants in Shanghai as reported from the 2008 Shanghai Health and Migration Study (Wen 2009). Telling from the chronic conditions as informed by doctors, around 66.8% of the respondents have not been informed of any chronic conditions. Although the rest of the respondents report some sort of chronic conditions, gastrointestinal diseases and anemia are the only two conditions affecting more than 3% of the respondents (10.3% and 13.6% respectively). In addition, conditions such as arthritis, bronchitis, high blood pressure and others alike also influence the health of 2-3% of the sampled labor migrants.

Table 4: Health status and frequently experienced health problems of the sampled labor migrants (N=1025)

Health Conditions	%	Health Conditions	%
Self-perceived general health		Frequent unwell feeling during last 12 months	
excellent	7.6	insomnia	11.1
very good	31.1	neck, shoulder, or back pain	10.5
good	23.0	eye pressure	8.5
fair	35.5	derma itchiness	7.7
poor	2.7	memory impairment	7.6
Known chronic conditions		difficulty to focus	7.5
none	66.8	stomach discomfort	6.4
bronchitis/pneumonia/asthma	2.5	mental sluggishness	6.0
high blood pressure/heart disease	2.2	cough/sore throat	5.9
diabetes	0.2	cold/flu	5.2
gastrointestinal diseases	10.3	headache/dizziness	5.2
nephritis	1.0	low fever or chills	5.2
hypertitis A & B	1.6	leg heaviness	4.8
anemia	13.6	lose appetite	4.0
arthritis	2.8	joint or muscle stiffness	3.0
stroke	0.5	chest pressure or short of breath when rested	2.6
Injured while working		tinnitus	2.4
yes	18.3	racing or irregular heart beat	1.2
no	64.7	Frequently experienced pressure last month	
missing	17.0	feel anxious about unexpected things	9.6
Faint while working		feel unable to control important things in life	8.8
yes	3.1	feel nervous and pressure	11.7
no	78.8	cannot complete all that should be completed	22.4
missing	18.0	feel angry because many things are out of control	19.1
Frequent psychological problems last month		always reflect that sth. need to do in person	53.5
anxiety/fret	10.7	feel so many difficulties out of control	12.9
loneliness	7.9	<i>can handle troubles successfully</i>	41.3
nervous	6.7	<i>can deal with life changes efficiently</i>	38.7
depressed/nth to cheer up	6.5	<i>confident in handling personal issues</i>	50.1
worthless	5.9	<i>feel satisfied with things</i>	32.8
feel everything was an effort	4.3	<i>feel capable to handle boring things in life</i>	40.7
despair/hopeless	2.4	<i>feel capable to control personal life</i>	48.4
		<i>capable to control time use schedule</i>	54.6

Although labor migrants are relatively healthy, they do experience some unwell feelings, psychological problems or pressures frequently, which are detrimental to their overall wellbeing. During the last 12 months, more than 10% of the respondents always had insomnia or neck/shoulder/back pain (11.7% and 10.5% respectively).

Around 7-9% of the respondents always had eye pressure (8.5%), derma itchinness (7.7%), memory impairment (7.6%), or difficulty to focus (7.5%). In addition, 5-7% of the respondents always had stomach discomfort (6.4%), mental sluggishness (6%), cough/sore throat (5.9%), cold/flu (5.2%), headache/dizziness (5.2%), or low fever or chills (5.2%). And smaller proportions of the respondents had other unwell feelings frequently, including leg heaviness, losing appetite, joint or muscle stiffness and so on. In total, around 18.3% of the respondents explicitly report experiences of injury due to work and 3% report experiences of getting faint while working.

Similarly, there are respondents experiencing some sort of psychological problems or pressures frequently during the last month. For instance, around 10.7% of the respondents always felt anxiety or fret during the last month. Those always feeling nervous, lonely, depressed, or worthless account for 6% or more. In addition, there are some respondents felt everything was an effort (4.3%) or hopeless (2.4%) frequently last month. Frequent pressure perception is another important aspect affecting the labor migrants' overall wellbeing. Around 10-20% of the respondents always feel nervous, anxious, unable to control, or even angry about important, difficult or unexpected things in life. The respondents always feeling confident to deal with troubles, boring things, personal time schedule, or life changes account for around 40-55%. Only around 32.8% of the sampled labor migrants feel satisfied with things most of the time.

Table 5 displays the insurance, health care usage and related features of the respondents. In total, more than a third (36.4%) of the sample labor migrants have no medical insurance whatsoever. The top three insurance types that labor migrants have are basic medical insurance for workers (32.2%), integrated medical insurance (17.4%), and hospitalization insurance (8.3%). All other insurance types, including the new rural cooperative medical care, cover less than 3% of the sampled labor migrants. Although the new rural cooperative medical system has developed rapidly in recent years, labor migrants have hardly benefited from it for the reasons including the complex reimburse procedure and long distance involved.

Although both pre-employment and on-job health checks are recommended, more than a quarter (26.4%) of the labor migrants did not have health check upon the time starting the current job, and more than 40% (41.8%) of them did not have any health check during the current employment. Fewer than a third of the respondents had such checks as required and also paid by their employers.

Taken altogether, around 63.8% of the respondents had a routine health check

during the past year. Those having no routine health checks for at least one year, two years, and five years amount to 18.3%, 5.9%, and 3.1% respectively. And the rest 9% of the sampled labor migrants never had any routine health check in their life.

Although labor migrants in Shenzhen are selectively healthy, it is necessary for them to seek health caring services in the event of encountering real health problems. During the last 12 months, around 71% of the respondents report having experience of seeing a doctor. The health reasons driving them to visit a doctor include cold (fever /throat pain /cough /running nose) (64.3%), headache/vertigo (11.8%), teeth pain (10.2%), diarrhea /stomachache (9.7%) and other unwell feelings. Among those who saw a doctor during the past 12 months, less than two thirds (62.1%) of them visited standard hospitals, 23% visited community health centers, and around 15% chose to seek services in private clinics. Comparatively, other health providers, including unit infirmary, play very limited role in service/care providing for the labor migrants.

. In the event of sickness, the labor migrants will not necessarily seek help from doctors. In our survey, the respondents were asked "During the last 12 months, what was the main reason(s) preventing you from seeing a doctor when you felt sick?" Around 15% of the respondents chose "not applicable/saw a doctor whenever feeling sick" (the "NA" category as shown in the right bottom of Table 5). The remaining 85% of the respondents report experiences of not seeing a doctor when feeling sick.

When the detailed reasons or perceived barriers are concerned, around 18% of the respondents consider it "too expensive", 13% state "too busy to see a doctor", and 8% think it might be not good for their job position. Other reasons include "the health condition was not too bad"(55.7%), "being afraid of finding out other health problems"(2%), "being afraid of known by others"(0.5%), "took medicine by self"(10%) and so on. This situation suggests that among other factors, medical cost, spare time and job position/opportunity are distinguished "barriers" preventing migrants from seeing a doctor when needed.

This is consistent with the evidence discussed above. On the one hand, the medical insurance coverage is low for labor migrants. In total, fewer than two thirds of the respondents have a medical insurance, be it commercial or social, covered in Shenzhen or in the hometown. In addition, even those who have medical insurance, the existing insurance coverage have limited effects in relieving them from heavy burdens of medical costs. Considering the percentage of medical expenses that covered by medical insurances during the past year, only around a quarter of the respondents who saw a doctor during the past 12 months report a proportion of 50%

or higher. More than half of the respondents report a zero percent of medical expenses covered by medical insurances. On the other hand, many migrants work for extended hours on a regular basis. More than half of them work for 56 hours or more each week, around three quarters of the respondents enjoy no more than one day off each week on average, and 10% of them work everyday and do not take off at all. As such, the extensive working schedule and low insurance coverage become salient factors preventing the labor migrants from using health caring services sometimes.

Table 5: Insurance, health care usage & realated features of the respondents (N=1025)

Insurance and Health Care Usage	%	Health Care Usage	%
Medical insurance		Reason seeing a doctor in the last 12 months	
commercial medical insurance	2.5	fever/throat pain/cough/running nose	64.3
integrated medical insurance	17.4	diarrhea/stomachache	9.7
hospitalization insurance	8.3	headache/vertigo	11.8
basic medical insurance for workers	32.2	arthritis/muscle pain	4.6
maternity medical insurance	0.5	tetter/dermatitis	5.3
new rural cooperative medical system	1.6	eye/ear diseases	2.5
NK	0.7	heart disease/peratodynia	0.6
none	36.4	trauma	4.8
		teeth pain	10.2
Pre-employment health check		other acute infection/disease	2.4
yes, required and paid by the employer	26.4	other chronic disease	6.5
yes, required but not paid by the employer	47.3	Hospital visited	
no	26.4	standard hospital	62.1
On-job health check		private clinic	14.9
yes, required and paid by the employer	30.1	community health center	23.0
yes, required but not paid by the employer	28.0	unit infirmary	1.8
no	41.8	others	1.5
Time of Last routine health check		Reason not seeing a doctor when needed	
within 1yr	63.8	health condition was not severe	55.7
1-2yrs	18.3	be afraid of finding other problems	2.0
2-5yrs	5.9	be afraid of known by others	0.5
5yrs ago	3.1	for concerns related to the job position	8.1
never	9.0	too busy, and have no time	13.1
		too expensive	18.2
Ever see a doctor during the last 12 months		distrust doctors	2.5
yes	70.9	took medicine/treated by self	10.1
no	29.1	others	1.9
		NA	14.8

MULTIVARIATE ANALYSIS: ENVIRONMENT-HEALTH RELATIONSHIP

Analysis Strategy

In order to build up the relationship between environmental factors and migrants' health, we use a few sets of variables to measure different dimensions of health and environmental features. The health dimensions include self-perceived general health, chronic conditions, physical health, psychological wellbeing and pressure. And the environment dimensions range from living condition (such as amenities both in the house and in the neighborhood) to working setting (such as extreme working conditions or requirements). These variables are analyzed first with scaling construction method (e.g., Optimal Scaling) to generate factors or scales. Then we use these factors and scales in multivariate regression analysis to examine the relationship between health and environment, net of other social and demographic factors.

The research hypotheses underlying the multivariate analyses include: 1) labor migrants are selectively healthy, and as a result, any potential degenerative effect (such as through aging or other processes) are expected to be lower for them; 2) environmental factors in the living and working settings have independent effects on migrants' health over and above the demographic and socioeconomic factors, given that migrants are likely to be "marginalized" in the hosting city as discovered in many other studies; 3) family members' (e.g., spouse's) company and social supports have important boosting effects on labor migrants' wellbeing (psychological), as these factors are potential to complement for the disconnections experienced in their original social network; and 4) health-related behaviors and life styles (such as smoking, physical exercises, eating habits) are expected to have independent impacts on migrants' health. These factors might be highly relevant for those who have intensive working schedules to maintain health, in the short supply of other health resources.

Data Preparation: Constructing Factors and Scales

Optimal Scaling is a technique to quantify categorical variables, which therefore allow "standard" analysis techniques to be used for the quantified variables. It uses *alternating least squares* iterative method, and is equivalent to the standard principal component analysis when all variables are measured at the numerical level. We use Optimal Scaling procedure to quantify the sets of variables measuring individuals' physical health, psychological wellbeing and pressure. In addition, we also use it to

create scales for the variables on individual's social support.

Physical health is constructed based on responses to the 18 questions "How often during the past 12 months did you have í (insomnia/ neck, shoulder or back pain/ eye pressure/ derma itchiness/ memory impairment/ difficulty to focus/ stomach discomfort/ mental sluggishness/ cough or sore throat/ cold or flu/ headache or dizziness/ low fever or chills/ leg heaviness/ lose appetite/ joint or muscle stiffness/ chest pressure or short of breath when rested/ tinnitus/ racing or irregular heart beat)?" The original response categories include "never" (1), "rarely" (2), "sometimes" (3) and "frequently/always" (4). The factor "physical" is constructed with Optimal Scaling procedure with a Cronbach's α (i.e., reliability measure) equaling to 0.926 (see Appendix Table 1 for distribution details of this factor).

Similarly, factors for psychological health and pressure are constructed separately based on the responses to the following two sets of questions:

1) "How often during the last 30 days did you have í (anxiety or fret/ loneliness/ nervous/ depressed and nth to cheer up/ worthless/ feel everything was an effort/ hopeless)?" and

2) "How often during the last 30 days did you í (feel anxious about unexpected things/ feel unable to control important things in life/ feel nervous and pressure/ can handle troubles successfully/ can deal with life changes efficiently/ be confident in handling personal issues/ feel satisfied with things/ cannot complete all that should be completed/ feel capable to handle boring things in life/ feel capable to control personal life/ feel angry because many things are out of control/ always reflect that something need to do in person/ capable to control time use schedule/ feel so many difficulties out of control)?"

The response categories for the former include "never" (1), "rarely" (2), "sometimes" (3) and "frequently/always" (4) , and those for the latter include "never" (1), "rarely" (2), "sometimes" (3), "frequently" (4), and "always/all the time" (5). Using Optimal Scaling procedure, the Cronbach's α equals to 0.867 for "psycho" and 0.897 for "pressure" (see Appendix Table 1 for the details of these factors).

One additional factor on individual's social support is constructed with Optimal Scaling procedure based on responses to the statements including: 1) "If I decided to have a one-day trip some day, I could easily find someone to go with me", 2) "I feel that I have nobody to share with my private worries and fears", 3) "If I felt sick, I could easily find someone to help me with my daily chores", 4) "If I decided one afternoon to go to the cinema/have other recreation that evening, I could easily find

someone to go with me, 5) I know someone that I can seek help for suggestions on very personal issues, 6) Rarely am I invited to shopping, having dinner together, watching movie or other non-work-related activities, 7) I can easily find someone to have lunch with me, 8) There is someone I could call to help me if I had troubles at a place 15 kilometers away from home, 9) If I need to move to another place, I could easily call someone to help me. The response categories include agree (1), disagree (2), unclear (9). The resulted factor, *support*, has a Cronbach's α of 0.746.

In addition to the factors generated with Optimal Scaling, five scales are constructed using counts of individual's positive responses to a series of questions about chronic conditions, house amenity, neighborhood amenity, extreme working conditions, and health knowledge. For instance, *chronic*⁷ is constructed as the number of chronic conditions, based on the positive responses to the questions "Have a doctor ever told you that you have (bronchitis, pneumonia, asthma/ high blood pressure, high cholesterol, heart disease/ diabetes/ gastrointestinal diseases/ nephritis/ hypertitis A & B/ anemia/ arthritis/ stroke)". The scale *n1_amenity* is constructed as the total number of house amenities (including private toilet, tap water, bath facility, kitchen, gas supply, land telephone, television, and computer). And *n2_amenity* captures the total number of neighborhood amenities (including library, cinema, gym, free exercise facility, bus or subway stop, restaurant or bar, primary school, middle school, college or university). Similarly, the scale *extreme* captures the total number of extreme working conditions, based on the positive responses to the question "Is any of the following description true for your current working station: (very cold/ very hot/ very humid/ very dirty/ very noisy/ very crowded/ very dangerous/ likely to touch solid toxic/ likely to touch liquid or gas toxic/ need to be seated for long time/ need to stand for long time/ need to walk from time to time/ cannot change position freely/ need to carry very extra weight)". Finally, a scale *knowledge* is constructed based on the correct responses to the health knowledge questions (ranging from adults' normal body temperature, necessary daily sleeping hours to proper use of antibiotics, emergency number for medical help, efficient way to deal with in-door air pollution, protect from contagious diseases, logo for high voltage/ biosafety/ radiation/ explosive hazard/ flammability/ toxic, and the occupation diseases protection law). See appendix Table 1 for the details of these

⁷ Although we used Optimal Scaling procedure to construct a factor on chronic conditions, the resulted reliability statistics is relatively low ($\alpha = 0.56$). So, we use the total number of chronic conditions (*chronic*) in the following analysis instead.

factors and scales.

Health Relevance of Working/Living Environment

To examine the health impacts of environmental factors, we use four variables/factors as dependent variables, namely *self-rated general health* (SRH for an abbreviation hereafter), *physical*, *psycho* and *pressure*. And we build a set of nested regression models for each of these four dependent variables as to test the net additional effects of the focal environmental variables, and potential mitigating effects from social network.

The SRH is treated as a dichotomous variable (1=fair/poor, 0=good/very good/excellent), and modeled with logistic regression procedure. And the other three variables are numerical, and modeled simultaneously with SUR (Seemingly Unrelated Regression) to count for potential correlation between these factors⁸. As a result, the corresponding coefficients indicates the variables' effects on different measures (the logit of SRH, versus *physical*, *psycho* and *pressure*), thus should be read accordingly.

In Table 6, we display the regression results of health outcomes on demographic and socioeconomic variables. We use these model results as the baseline to compare with in the following analysis, as to infer the health relevance of environmental factors. From Table 6, we see that age has significant effects only on psychological *pressure*. Those aged 35 and above tend to report significantly lower pressure. Given the dimensions covered by this factor, this is possibly because the migrants aged 35 and above have more life experience and better social support from various sources (as evident from Table 8). The neutralness of age group on the other three health outcomes, namely self-rated general health, physical health and psychological health, is consistent with what we expected at the beginning. This suggests that migrants are a selected group and only those healthier individuals retained in this group.

Females are more likely to report poorer health, in terms of self-rated health, physical health, and pressure. This is consistent with many other health research, including those in the general population. And possible explanations could be both physiological and behavioral (Hatch & Moline 1997). Marital status has only significant effects on individuals' psychological health (*psycho*) over and above other demographic and socioeconomic factors. Compared with those married and living

⁸ SUR is used because these three variables are generated separately with Optimal Scaling procedure, and they are related to each other. To check the sensitivity of the model results, we also build standard linear regression models separately for these three variables, and the coefficients and related Standard Errors are virtually the same as in the SUR models.

with spouse⁹, those remaining single are more likely to report psychological problems. And those married but currently not living with spouse also report poor psychological health despite that the effect is only marginally significant at 0.10 level. This signifies the importance of family environment to migrants' psychological wellbeing. In contrast, the migrants widowed/divorced/separated do not differ significantly from those married and living with spouse. Together with the neutralness of marital status on other health outcomes, again, this suggests that migrants are selectively healthier regardless of their differences in marital status.

Higher education has some buffering effect on migrants' self-rated general health. This is consistent to the education effect on general population as discovered in other studies. Yet, education is also positively related with migrants' psychological pressure (*pressure*) in spite of its marginal statistical significance. This is possibly because more educated individuals tend to have better expectations and they are more sensible to the difference between the reality and the expectation. To the contrast, income does not show consistent impacts on individuals' health. Although those having lower middle income (10-30 thousand yuan in 2009) report better psychological health, those having a higher income (30-50 thousand yuan in 2009) report significantly poorer physical health and more pressure. In effect, we find from our in-depth interviews that, because many labor migrants have relatively low human capital (as seen in the educational attainment and skill level shown in Table 1 and Table 2), they always feel uncertain about their expected income and the future. Besides, many enterprises in which labor migrants work are not stable or long-lived. This adds additional uncertainty to migrants' lives. As a result, the labor migrants are less likely to invest in personal health or living condition, and tend to sacrifice personal activities or wellbeing sometimes.

After controlling for other socio-demographic factors in the model, the years of migration have no significant effect on migrants' health. Again, this could be interpreted as an evidence of health selectivity of migrants. Extended weekly working hours exhibit significant detrimental effects on labor migrants' health, be it self-rated general health, or physical or psychological wellbeing. In addition, compared with those working in manufacturing industries, those working in transportation/ storage/ post, wholesale/retail trade, and resident/other services report significantly better physical health, and the latter two groups also report substantially better psychological

⁹ Preliminary analysis shows that cohabiting individuals have very similar health outcomes with those married and living with spouse. In this sample, only about 2% individuals are cohabiting, so this category is collapsed with the category "married and living with spouse".

health. The labor migrants working in resident/other services and other industries also report better self-rated general health. Taken together, these figures show a picture that labor migrants working in manufacturing and constructure industries report poorest health statuses even after controlling for other socioeconomic factors.

Table 6 Regression results of health outcomes on demographic and socioeconomic variables (N=1009)

	SRH [®]	Physical	Psycho	Pressure
Constant	-1.50***	-0.60**	-0.39*	-0.11
Age group(ref=up to 24)				
25-34	0.20	0.15	0.00	0.09
35+	0.16	0.02	-0.19	-0.24*
Female	0.50**	0.21**	0.04	0.21**
Marital status(ref=married and live with spouse/cohabit)				
married but not live with spouse	-0.26	-0.15 ^{\$}	0.17 ^{\$}	0.01
single	-0.18	-0.01	0.21*	0.10
widowed/divorced/separated	-0.78 ^{\$}	-0.15	0.06	0.13
Education(ref=junior middle or less)				
senior middle	-0.17	0.03	0.02	0.08
occupation school/college+	-0.44*	-0.02	-0.03	0.15 ^{\$}
Annual personal income in 2009(ref:<=10thousand)				
10-30thousand	-0.19	0.00	-0.17*	0.00
30-50thousand	-0.15	0.28*	0.06	0.24*
>50thousand	0.12	-0.02	-0.32 ^{\$}	0.13
Years migrated	0.02	0.00	0.00	0.00
Hours worked weekly	0.01*	0.01**	0.005*	0.00
Industry(ref=manufacturing)				
construction	0.50	0.02	0.05	-0.06
transportation/storage/post	-0.11	-0.32*	-0.13	-0.10
wholesale and retail trade	-0.33	-0.46***	-0.30*	-0.12
hotel and catering services	-0.34	-0.06	-0.18	0.01
resident service and other service	-0.56**	-0.24**	-0.19*	-0.09
others	-0.80*	-0.22	-0.16	0.01
District(ref=longgang)				
futian	0.19	0.13	0.16 ^{\$}	-0.01
baoan	-0.04	0.02	0.07	-0.09
n_chronic	0.95***	0.54***	0.38***	0.19***
R-square	---	0.18	0.11	0.07

[®] logistic regression is used for this DV, and the coefficients in this column should be interpreted accordingly as the effects on logit of SRH. ^{\$} p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Net of other demographic and socioeconomic factors, number of chronic conditions casts additional difference in other dimensions of migrants' current health status. The more chronic conditions an individual has, the poorer his/her health will be. This reflects the cumulative impacts of individuals' health over life span¹⁰.

Table 6 also presents the model R-square for the three numerical DVs, namely, physical, psycho and pressure. Above all, the social and demographic factors in the model account for 18% of variance for physical, 11% for psycho, and 7% for pressure. There is much unexplained variation to explore.

Table 7 displays the model results after adding the major environmental factors measured in the survey, including the amenities both in door and outside in the neighborhood, extreme working conditions, and in-door air quality. Compared with the baseline models including only social and demographic variables (as shown in Table 6), the models in Table 7 have improved substantially in model fit as telling from the statistics of overall model test (not shown) and the changes in R-squares for the latter three models. So, as we expected, the living and working environments in the hosting city have great relevance to migrants' health. Besides, the coefficients of social and demographic variables change only to a limited extent—slight increase or decline in absolute terms, as compared with those in the baseline models. This provides further evidence about the salient and independent effects of both sociodemographic and environmental factors as outlined in the theoretical framework. To save space, we will not repeat the discussions hereinafter.

Over and above the social and demographic factors, the extreme working conditions have significant detrimental effects on migrants' health. As expected, the more unfavorable working conditions, the poorer an individual's health will be on average, be it physical, psychological, or pressure. Therefore, favorable physical conditions in working stations are necessary not only to maintain good physical health, but also to relieve the workers from psychological problems and pressures.

In addition, the in-door air quality shows substantial impacts on individuals' health. Compared with those reporting good in-door air quality, those reporting fair or poor air quality have significantly poorer health in all dimensions. In our fieldwork, we find that the labor migrants usually live in non-standard storied buildings in

¹⁰ The number of chronic conditions is controlled in the models to eliminate the potential confounding effects from cumulative health conditions. We also examined the relationship between *n_chronic* and other socio-demographic variables in this study (the results are not shown). We found that most of the variables examined in Table 6 have no significant relationship with *n_chronic*. Only females tend to report higher numbers of chronic conditions, and those widowed/ divorced/ separated tend to report higher numbers of chronic conditions. Other variables such as number of years migrated, and hours worked weekly do not show significant impacts on *n_chronic*.

Shenzhen. The crowded constructions (including the kissing building) and the dense living condition restrict sufficient air ventilation, and the in-door air quality is affected negatively. This has virtually put the labor migrants' health at risks.

Table 7 Regression results of health outcomes on environmental, socioeconomic and demographic variables (N=1001)

	SRH [®]	Physical	Psycho	Pressure
Constant	-1.71***	-0.89***	-0.65**	-0.26
Age group(ref=up to 24)				
25-34	0.20	0.15 ^{\$}	0.00	0.08
35+	0.20	0.03	-0.19 ^{\$}	-0.25*
Female	0.47**	0.21**	0.04	0.23***
Marital status(ref=married and live with spouse/cohabit)				
married but not live with spouse	-0.23	-0.16 ^{\$}	0.15 ^{\$}	-0.02
single	-0.11	0.03	0.23*	0.08
widowed/divorced/separated	-0.74 ^{\$}	-0.13	0.07	0.11
Education(ref=junior middle or less)				
senior middle	-0.18	0.02	0.02	0.09
occupation school/college+	-0.50*	-0.03	-0.04	0.17*
Annual personal income in 2009(ref:<=10thousand)				
10-30thousand	-0.21	0.00	-0.16*	0.02
30-50thousand	-0.21	0.28*	0.10	0.30*
>50thousand	0.16	0.12	-0.12	0.30
Years migrated	0.02	0.00	0.01	0.01
Hours worked weekly	0.01 ^{\$}	0.00 ^{\$}	0.00	0.00
Industry(ref=manufacturing)				
construction	0.61*	0.03	0.10	-0.07
transportation/storage/post	-0.11	-0.33*	-0.11	-0.09
wholesale and retail trade	-0.35	-0.42***	-0.22 ^{\$}	-0.05
hotel and catering services	-0.31	-0.02	-0.11	0.05
resident service and other service	-0.51*	-0.18*	-0.09	-0.04
others	-0.76*	-0.14	-0.06	0.06
District(ref=longgang)				
futian	0.24	0.08	0.12	-0.06
baoan	-0.01	0.04	0.10	-0.07
n_chronic	0.94***	0.49***	0.33***	0.17***
n1_amenity	0.05	0.01	0.00	-0.02
n2_amenity	-0.06	0.00	-0.02	0.01
n_extreme	-0.01	0.05***	0.04**	0.03*
In-door air quality (ref=good)				
fair	0.27	0.19*	0.30***	0.16 ^{\$}
poor	0.83**	0.56***	0.77***	0.26*
R-square	---	0.22	0.18	0.08

[®] logistic regression is used for this DV, and the coefficients in this column should be interpreted accordingly as the effects on logit of SRH. [§] p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

Potential Buffering Effects of Health Knowledge, Behaviors and Social Support

While the environmental factors have salient effects on migrants' health, health-related knowledge, behaviors and social support also make important difference in migrants' health status and their capacity to cope with the related problems. Table 8 shows the regression results of the four health outcomes on health-related knowledge, behaviors, and social support, in addition to the factors examined in the previous models (as shown in Table 7). Again, the coefficients of the environmental, social and demographic variables changed no more than slightly in absolute terms, as compared with the previous models. Most of the environmental and socio-demographic variables remain robust. Therefore, even after taking the individuals' difference in health-related knowledge, behavior and social support into consideration, the detrimental environmental impacts persist for the migrants under study.

Net of other factors in the model, *knowledge* shows significant correlation with self-rated general health, physical health and psychological pressure, and is neutral to the psychological health measure (*psycho*). It seems that the migrants who have more knowledge are also more likely to have poorer general health, poorer physical health and more psychological pressure. While it is more likely that those having poorer health pursue more health-related knowledge as needed, it is impossible to test this from the cross-sectional data. And this will be left for further study.

As discovered in the general population from other studies, healthier behaviors are important buffering factors for individuals' health. To specify, non-smokers are significantly less likely to report physical illnesses. The migrants doing physical exercises on a regular basis are significantly less likely to report poor health (general, physical, or psychological). Those doing exercises at least once a week have most significant health boosting effects, and those doing exercises more frequently are comparably well off in health, after controlling other factors in the models.

Healthier eating styles/habits also have significant relevance to the migrants' physical and psychological health. Compared with those who do not have breakfast or miss breakfast frequently, the migrants always having breakfast are significantly less likely to encounter psychological problems. Compared with the migrants who never eat expired food, those eating expired food (either after cooking, or when it looks alright) are more likely to have physical and psychological illnesses.

Finally, social support is an important protecting factor for migrants' general health. On average, the more social support, the better one's self-rated general health will be. This is consistent with the findings in many previous studies (Cohen 1983; Kawachi and Berkman 2000).

Table 8 Regression results of health outcomes on environmental, behavioral, socioeconomic, and demographic factors (N=973)

	SRH [®]	Physical	Psycho	Pressure
Constant	-1.80**	-0.84**	-0.37	-0.58*
Age group(ref=up to 24)				
25-34	0.33	0.14	0.05	0.11
35+	0.38	0.03	-0.14	-0.21 ^{\$}
Female	0.59**	0.35***	0.08	0.25**
Marital status(ref=married and live with spouse/cohabit)				
married but not live with spouse	-0.24	-0.16 ^{\$}	0.14	0.00
single	-0.03	0.02	0.23*	0.11
widowed/divorced/separated	-0.66	-0.10	0.10	0.16
Education(ref=junior middle or less)				
senior middle	-0.17	0.05	0.05	0.10
occupation school/college+	-0.57**	-0.01	-0.02	0.13
Annual personal income in 2009(<=10thousand)				
10-30thousand	-0.27	-0.03	-0.17*	-0.02 ^{\$}
30-50thousand	-0.35	0.21 ^{\$}	0.02	0.22
>50thousand	0.15	0.10	-0.19	0.27
Years migrated	0.02	0.00	0.00	0.00
Hours worked weekly	0.01	0.00	0.00	0.00
Industry(ref=manufacturing)				
construction	0.65*	0.02	0.09	-0.04
transportation/storage/post	-0.20	-0.37**	-0.22	-0.08
wholesale and retail trade	-0.35	-0.37**	-0.26*	-0.04
hotel and catering services	-0.37	-0.02	-0.14	0.02
resident service and other service	-0.55*	-0.17*	-0.12	-0.06
others	-0.68 ^{\$}	-0.10	-0.03	0.02
District(longgang)				
futian	0.14	0.07	0.09	-0.04
baoan	-0.07	0.03	0.07	-0.08
n_chronic	0.98***	0.49***	0.34***	0.16***
n1_amenity	0.07 ^{\$}	0.01	0.01	-0.02
n2_amenity	-0.04	0.00	-0.02	0.01
n_extreme	-0.01	0.05***	0.03*	0.03*
In-door air quality (ref=good)				
fair	0.21	0.18*	0.29***	0.19*
poor	0.73*	0.54***	0.73***	0.29*

knowledge	0.07*	0.04**	0.01	0.04**
Ever smoked 100 cigar(ref=yes)				
no	-0.04	-0.09	-0.05	-0.05
non-smoker	-0.24	-0.24**	-0.10	-0.06
Frequency doing exercises(ref=never)				
< once per week	-0.20	-0.12	-0.06	0.01
once per week	-0.86***	-0.28***	-0.27**	-0.18 ^{\$}
> once per week	-0.71**	-0.25**	-0.24**	-0.16 ^{\$}
Always having breakfast(ref=sometimes/rarely/never)	-0.02	-0.05	-0.25***	0.09
Eating expired food(ref=no)	0.10	0.29**	0.22*	0.07
Support	-0.19*	0.02	0.00	0.03
R-square	---	0.25	0.21	0.11

[®] logistic regression is used for this DV, and the coefficients in this column should be interpreted accordingly as the effects on logit of SRH. ^{\$} p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

CONCLUSION AND POLICY IMPLICATIONS

In this project, we conducted a sample survey on the labor migrants in Shenzhen. Based on the data collected through sample survey and the in-depth interview, we examined the labor migrants' health status in various dimensions, the environmental characteristics of their living and working settings, and further we explored health relevance of the living and working environment and other important factors shaping/affecting (mitigating or strengthening) this relationship.

We found that the labor migrants are relatively healthy. More than two thirds of the respondents in our sample report no chronic conditions. And the most distinguished chronic conditions are anemia and gastrointestinal diseases, which make up for 13.6% and 10.3% of the respondents respectively. Around one tenth or fewer of the respondents experienced some unwell physical feelings frequently during the past 12 months. And the five most outstanding health problems include insomnia, neck/shoulder or back pain, eye pressure, derma itchiness and memory impairment. Despite the relatively good physical health condition, the labor migrants in Shenzhen do experience some psychological problems or pressures frequently, such as anxiety or fret, loneliness, nervous and depression. Merely half or fewer of the respondents feel confident or capable to deal with personal things and troubles.

Above all, the multivariate analyses also suggest that labor migrants in Shenzhen are selectively healthier. This is the case because labor migrants are relatively young in age composition, and they have quite high mobility. As a result, the degenerative effect of health through aging, which has been observed repeatedly

in the general population, seems not salient among the labor migrants. Moreover, the potential negative effects of marital dissolution (for the divorced, widowed, or separated) on health seem not salient for the labor migrants either. This provides further evidence to the health selectivity of labor migrants in Shenzhen.

As expected, the environmental factors in the living and working conditions have salient effects on migrants' health. Those living in non-standard storied buildings tend to report poorer health, so do the migrants working in the stations with more unfavorable/extreme working conditions. Working for extended hours regularly also exhibits detrimental effects on migrants' health. To the contrary, a good neighborhood environment (for instance, more neighborhood amenities) is potential to contribute positively to migrants' health.

Net of other effects, living with spouse or partner, and having good social support both contribute positively to migrants' health. Being away from hometown, migrants usually experience important disconnections of their original social network and encounter barriers in social and economic integration. As a result, having family members around or other social support is especially important for the labor migrants' health.

Similarly, personal health behaviors and life styles show significant effects on migrants' health. For instance, doing physical exercises on a regular basis (at least once a week) contributes significantly to improve migrants' health. And healthy eating style, such as having breakfast regularly and not eating expired food, also have significant impacts on migrants' health.

In addition to the individuals' health-related behaviors and social support, there are other important factors that potentially shape/affect the environment-health relationship in Shenzhen. These factors include health caring services, insurance and other welfare, and the overall social and economic developmental strategy in the hosting city. From our questionnaire survey and in-depth interviews, we find that most of the labor migrants in Shenzhen work intensively on a regular basis, they have limited medical insurance on average, and that they face great uncertainty regarding their life and employment. As such, the high medical costs practically prevent them from using health care services when needed.

It is evident that at policy level, some of the regulations have not been executed properly. For instance, although the labor law states that the weekly working hours should not exceed 40 or 44 hours in enterprises, and the overtime working hours should not exceed 36 hours monthly. This has not been executed accordingly in

practice. For the reasons of pursuing a relatively decent income or keeping the job opportunity, many labor migrants have to work every day and work over time.

In addition, there are some limitations (or deficiencies) in the existing policies and regulations. These limitations have exerted prohibiting effects on labor migrants' utilization of insurance and other welfare. For instance, from the survey and in-depth interview, we notice that the current regulations on pension plan require both the labor migrants and their employer to pay into the system for 15 years successively in order to be able to benefit from it. However, in the event of the employer/enterprise breakup, which takes place more often than expected for many enterprises in which labor migrants work, the employees will have to give up even if they have paid for 13 or 14 years. The situation like this calls for a change in the prevalent informal employment of labor migrants and more comprehensive regulations and labor law.

Nevertheless, as a Special Economic Zone, Shenzhen has been taking the lead in developing/reforming policies and carrying out actions to improve the environment and welfare of workers (including labor migrants). For instance, Shenzhen published its detailed regulations on stand-down in extreme weathers as early as in 2005¹¹, as a response to the out-dated regulations and labor law. And it has proved to be more specific, practical and efficient in protecting workers' wellbeing as compared with the regulations published in other cities recently. In addition, the geographic location is also relevant in the broad environment-health relationship. Located at the north of Hong Kong, Shenzhen supplies more than 90% of the fresh water used in Hong Kong. And as a result, the industry composition in Shenzhen, especially in the streets like Shawan— one of the Riverhead Protection Area (*Shuiyuan Baohu Qu*) located in Longgang District of Shenzhen city, is strictly subjected to the low-pollution or pollution-free requirement. And partly for the reason of riverhead protection action, the domestic sewerage is also standardized even in the non-standard storied buildings. Tap water is accessible almost in any building of this area. This has contributed to the city's overall environment, and will benefit its residents greatly.

Toward a Healthier and More Insured Status

The survey study in Shenzhen has demonstrated pros and cons in its environment and migrants' health. It is no denying that Shenzhen has been in the leading position in progressively improving the situation and has set up a model for

¹¹ For more details, see <http://www.southcn.com/news/dishi/shenzhen/tp/200507190247.htm> and <http://sz.bendibao.com/news/201077/219491.htm>

many other cities in China. Yet, to further the process and to relieve the detrimental health effects of environmental factors, there are still much to do for local governments, enterprises, service providers and others.

First, the policy-makers should speed up the process of policies and regulations improvement (such as the labor law, medical insurance and pension plan systems), and take into consideration the living and working realities of labor migrants.

Second, policies and regulations should be executed properly so as to facilitate the social and economic integration of labor migrants in the hosting cities.

Third, managers in enterprises and other employers should be trained with the ideology of sustainable and efficient use of workers, including labor migrants. Practices such as providing comfortable and friendly working (and living) surroundings for employees should be encouraged and modeled.

Fourth, organizations such as the labor union should play an active role in protecting the wellbeing of labor migrants, providing services and supports for labor migrants, and mitigating the potential difficulties and detrimental effects related to labor migrants' wellbeing.

Finally, labor migrants should be encouraged and facilitated to gain more knowledge and build up awareness for a sustainable personal development.

Appendix Table 1: Description of Factors/Scales on health and environment aspects (N=1025)

Variable	Median	Mean	S.D.	Min	Max
physical	-0.14	0.01	1.01	-1.54	3.33
psycho	-0.20	0.00	1.00	-1.27	2.99
pressure	0.33	0.00	1.00	-3.43	1.14
n_chronic	0	0.40	0.65	0	5
n1_amenity	4	4.03	2.13	0	8
n2_amenity	3	3.54	2.15	0	9
n_extreme	2	2.91	2.54	0	14
knowledge	9	8.55	2.31	0	13
support	0.34	0.00	1.01	-4.01	1.08

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