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Health of China's rural–urban migrants and their families: a review of literature from 2000 to 2012

Jin Mou[1], Sian M. Griffiths[2]*, Hildy Fong[2], and **Martin G. Dawes[1]**

[1]Department of Family Practice, Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada, and [2]Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong

Background: Socioeconomic transformation in China at the beginning of the twenty-first century has led to rapid urbanization and accelerated rural–urban migration. As a result, the concerns about public health problems triggered by increasing internal population mobility have been more widely studied in recent years.

Sources of data: Published data in Chinese and English on health of migrants and their families in mainland China from 2000 to 2012.

Areas of agreement: The shifting patterns of disease distribution due to rural–urban migration, health equity and health reform strategies that cater for this specific yet substantial subpopulation are outstanding concerns. Infectious diseases, mental health, occupational health and women's health are emerging public health priorities related to migration.

Areas of controversy: The high mobility and large numbers of Chinese rural–urban migrants pose challenges to research methods and the reliability of evidence gained.

Growing points: While the theme of working migrants is common in the literature, there have also been some studies of health of those left behind but who often remain unregistered. Migration within China is not a single entity and understanding the dynamics of new and emerging societies will need further study.

Areas timely for developing research: Social, economic, emotional, environmental and behavioural risk factors that impact on health of migrants and their families call for more attention from health policy-makers and researchers in contemporary China.

Keywords: rural–urban migration/China/health equity/public health

**Correspondence address. E-mail: siangriffiths@cuhk.edu.hk*

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Introduction

Internal migration of immense scale has made possible the rapid pace of social change, economic growth, environmental challenges and changing demographic patterns in the mainland of the People's Republic of China ('the mainland'). Workers have transitioned from agricultural fields in rural areas to industrial factories in the cities. In contemporary China, population movements have been eased as a result of more flexible policies in the market economy in response for the need for more labour, a need filled by migrants wishing for better work and lifestyle opportunities.

Unlike the downward trend of population mobility in most developed countries,[1] internal migration began accelerating in the 1980s when China's central government initiated its opening up strategy and economic reforms in 1978 and remains at a high level. In the first decade of the 21st century, an average of more than 15 million rural–urban migrants—also referred to as the 'mobile population', peasant workers, temporary migrants, rural migrants or migrant workers[2]—moved annually from their villages to cities.[3] Whilst in 1982, only 21.13% of the country lived in urban areas, by 2009 45.68% of China's population were living in cities.[4] In 2005, there were an estimated 147 million migrants,[5] and national statistics from 2012 suggest that 230 million people in the mainland were residing in a place other than their home town, of whom 80% were rural–urban migrants.[6]

China's rapid development has a range of health effects on the population, both in urban areas where migrants have relocated and in rural areas where families have been left behind. While rapid population movements have provided the human resources needed to meet the growing market demands in China's economy,[7] population health has not advanced at the same pace[8] and health services for migrant communities lag behind those of resident populations.

China's health challenges are similar to many other transitioning countries, facing the challenges of rural poverty in less well-developed parts of the country, the increasing burden of lifestyle related non-communicable diseases and emerging infectious diseases over its vast geographical area; this is compounded by an increasing elderly population. Understanding the health of its large migrant population is therefore an essential component of a successful health strategy, particularly for those who are currently in need of more proactive support.

This paper reviews the literature on health and internal migration in China. We describe the related public health priorities and consider the challenges this poses to the current healthcare sector reforms.

Source of data and selection methods used

The aim of this study is to provide stakeholders and researchers with perspectives on China's internal migrant health issues as experienced mainly by the Chinese rural–urban migrants and their families. We used a narrative synthesis of published empirical research and non-empirically based reports, incorporating 'grey literature' in both English and Chinese. The research question focus is placed on: (i) the prevalence of main disease/health problems pertaining to Chinese internal migrants and their families and (ii) health policy issues that might have impacted on migrants' health with specific interest on health insurance and services utilization. We define a 'migrant' as 'a person who has settled permanently or temporarily somewhere other than his/her hukou (household registration) place. A major searching effort has been put on 'rural–urban migrants', which is defined as person who holds rural hukou identity while migrating and living in urban areas. The long-existing Chinese rural–urban segregation and comparatively rigid hukou system make these definitions explicit and straightforward.

The search and selection strategies draw upon established systematic review methods and guidelines for the selection and appraisal, and review of grey literature. We retrieved both empirical and non-empirical published papers using major health databases such as Medline/OvidSP platform, EMBASE/OvidSP, CINAHL/EBSCO platform, ISI Web of Knowledge Social Sciences and ISI Web of Scicence/EBSCO platform, PsycINFO/EBSCO platform and China Knowledge Resource Integrated Database (中国知网, *Zhongguo Zhiwang*). For grey literature, we used database searches including ProQuest Dissertations and Theses Full Text, Google, Dissertations of China (DOC) (万方学位论文, *Wanfang Xuewei Lunwen*), Advanced Google and Google Scholar, unpublished conference proceedings (Papers First and Proceedings First), government publications (only Chinese, Advanced Google, site: gov.cn) and review of reference lists and extended manual search. We used China Data Online as a major source to search census and survey data on internal migrants; however, manual search was also used to find most recent demographic statistics and newsletters from China's statistics bureaus. Publication/written date was restricted within year 2000–12. Briefly, we used a bilingual search strategy which combined three search concept sets '[China OR Chinese] (for Chinese literature this part was omitted) and [Health OR Disease OR Utilization OR Utilisation OR Insurance OR Medic*] (健康/卫生/疾病/利用/保险/医疗) and [[Migra* OR Floating OR Rural–urban OR Rural-to-urban OR Transients and migrants OR Peasant worker] (流动*/暂住*/乡城/务工/劳务工/农民工) OR [Left-behind OR Left behind (留守)]]', with various synonyms for each of last two

concepts. All retrieved literature and documents were reviewed to evaluate the relevance to the topic of interest. Overlapped publications were compared and the one with more complete contents was kept.

Evolving disease distribution and increasing burdens of infectious diseases

The correlation between migration in China and increased risk of infectious diseases is well documented.[9–15] The vulnerability of rural–urban migrants to acquire infectious diseases seems to be associated with unfavourable working and living conditions, low awareness of disease prevention, lower immunization status[12,16,17] and lower economic status. Zheng and Lian[18] described how temporary rural–urban migrants are more at risk of contracting malaria, hepatitis, typhoid fever, respiratory infections and measles infections, all more prevalent in overcrowded, poorer and less hygienic conditions.

At a national level among the general Chinese population, the proliferation of infectious disease in the urban areas of China has been linked to an increase in rural–urban migration.[9] In a review on epidemiological transitions of infectious disease between 2002 and 2008 in Shenzhen, one of China's most populous migrant megacities, Zhang *et al.*[19] showed that type A and B notifiable infectious diseases more than doubled as the numbers of migrant workers in the city increased. Using modelling techniques for the transmission of infectious diseases, it has also been proposed that temporary migrant workers from rural areas should be identified as the top target group for control of communicable diseases, such as tuberculosis (TB).[10]

Tuberculosis

TB, especially multi-drug-resistant (MDR) and extensively drug-resistant-TB,[20] is a re-emerging major communicable and chronic disease, which has caused a high and persistent disease burden in China. Although a declining trend has been observed for TB since 1978.[21] the health gaps of epidemiological rates on TB in urban and rural areas and between western and eastern regions are growing rather than closing.[22] Significant links between socioeconomic status and the TB epidemic have also been found.[23] Rural–urban migration, the cause of an unsteady declining incidence of TB in big cities, has actually increased more harmful transmissions of MDR-TB in the urban areas—presumably due to migrants' poor knowledge, high mobility, financial constraints,[24] poor access to early diagnosis, inadequate referral to TB dispensaries and

lower adherence to TB treatment.[15,25] These deficiencies, however, have been somewhat offset by the expansion of health insurance coverage for TB treatment regardless of patients' migration status in some pioneer cities (such as Shanghai)[26] and the provision of community-based primary health care, nationally. However sustainable health resources are critical to sustaining long-term public health challenge.[27]

Sexually transmitted diseases

China's economic growth has also led to a growing commercial sex industry and a rise in unprotected sexual activity.[28,29] Sexually transmitted diseases.

(STIs) have thus become another communicable disease priority for Chinese health authorities. Higher prevalence among migrants has not yet been supported through cross-sectional studies,[30] but since migrants tend to be younger and unmarried, they have higher rates of risky behaviours such as unprotected sex and use of commercial sex.[31,32] National survey data indicate that migrant women, especially those who are unmarried, have the highest risk of STIs.[33,34] Other studies have also described 'female sex workers', who are at increased risk for getting and transmitting STIs due to occupation related risk and exposure.[35]

Few studies have explicitly explored the associations between STIs/HIV and migratory history, making it difficult to explain incidence, prevalence and health outcomes throughout the country. It has been found that rural–urban migrants are over-represented among high-risk populations and amongst people with STIs/HIV in certain regions,[36] while some studies have shown migrants to be at equal or lower risks for certain STIs in certain areas.[37,38] Established evidence is still too limited to conclude whether migratory status is a risk factor for increased HIV/STIs. Migrant cohort studies would allow study of the multi-dimensional factors that explain HIV/STIs infection.

Furthermore, addressing the challenge is difficult with no basis to describe complex interactions with socioeconomic status, infection vulnerability, environmental impacts or health policy.[39] Indirect effect on non-migrants is also a concern. For example, the literature on HIV/AIDS among migrants focuses mainly on behavioural risks of sex workers[31,32] or migrants who use commercial sex,[40] but few studies address migrants' spouses or partners who are often left behind in rural areas and at high risk of becoming infected.[41] STIs are also a concern because of mother-to-child transmission. Chen and colleagues reported a fast climbing incidence of congenital syphilis from 0.01 cases per 100 000 live births in 1991 to 19.68 cases per 100 000 live births in 2005, representing an annual increase average of 71.9%.[28,42]

More progressive cities like Shenzhen have initiated large-scale syphilis screening programmes,[43] which cover pregnant migrant women living in the city for more than 3 months, and prevention of mother-to-child HIV transmission has become a state public health strategy[44] with no or minimum discrimination on migratory status. However, free treatment of HIV/AIDS in the majority of urban areas is still restricted to local residents due to the high expenditures and financial burdens on local budgets. In reviewing HIV prevention and treatment strategies in China, Russia and India, Todrys and Amon[45] comment that internal migrants face a barrier of fully realizing their equal rights to HIV prevention and treatment. Negative stereotypes are also a factor in seeking treatment for HIV/STIs. Mason[46] suggests that stereotyping by public health professionals of floating populations that depicts them as having 'poor sanitary habits, poor immune systems, irresponsible risk behaviours, and to have failed to obtain vaccinations for themselves or their children' has denied migrants from getting health services needed to mitigate the spread of infectious disease. More efforts are needed to facilitate targeted prevention programmes by elimination of restrictive residence-based eligibility criteria for access to health services.

Vaccine preventable diseases

Apart from the existing observation on the links between rural–urban migration and rising risks of infections including STIs, respiratory (such as measles, influenza and meningitis) and gastrointestinal communicable diseases (such as cholera, typhoid fever and infectious diarrhoea) among adult migrants, protecting migrant children brought to cities from vaccine preventable infectious diseases has increasingly become a public health concern. Sun *et al.*[47] reported alarmingly low age-appropriate immunization coverage of migrant children for four types of vaccines in densely populated areas of Beijing. Methods including outreach immunization services/clinics have been shown to be efficient and effective[48] in migrant communities in China, but for rural–urban families with very high mobility and parents with very limited education, these services cannot be fully utilized. The variable quality of immunization services and record keeping in community clinics may also present barriers and challenges for migrant communities implying that further effort is needed for the immunization of migrant children. In addition, in childhood infections where there is no vaccine, such as hand foot mouth disease, targeted education and service provision is needed to stop spread among migrant children and facilitate early diagnosis and treatment.[49]

Preventing infectious disease in migrant communities in the mainland requires policy-makers to consider strategies for sub-populations and

their specific social demographic characters. Rising numbers of cases of measles and rubella often seen among young children remind public health professionals of the importance of active surveillance in certain communities. One study of the immunological status of female migrant factory workers in Shenzhen in 2008 found that the seroprevalence of antibodies to rubella was too low to provide herd immunity in the population. Rubella infection during pregnancy leads to congenital rubella syndrome and subsequent lifelong disability. Mass immunization programmes specifically designed for the prevention of rubella infection among adolescent girls or childbearing aged women do not exist in China, and the lack of immunity to rubella among childbearing age women with high mobility and high chance of getting pregnancy calls for urgent public health intervention.[16,17]

Mental health

Most of the literature on migration and mental health refers to those migrating between countries. Chinese migration is usually discussed within the context of internal country migration between rural and urban areas, with many migrants going back and forth between cities and their homes in rural areas. Studies on migrants' adaptation to city life have categorized adaptation into three levels: economic, social and psychological,[50] while others have proposed that migrant workers only adapt for their basic survival.[51] Factors which affect the psychological well-being of Chinese rural–urban migrants include stigmatization,[52] stress that comes from economic pressure, work load, family separation, expectation-reality discrepancy[53] and discrimination and difficulty in acculturation in their daily lives.[54–56] These factors are attributable to not only their current psychological states,[57,58] but also influence future trajectories of their mental health and well-being. Studies on the psychological outcomes in Chinese migrants and their families have found major depression, depressive symptoms[59,60] and insomnia[61] to be most common. This possibly contributes to high rates of suicides[62] and suicide attempts by migrants. The 13 young rural–urban workers' attempted or committed suicides at the Foxconn factories in southern China of 2010 are examples,[8,63] which highlight concerns about the impact of working lives on mental health among this new generation of Chinese workers,[64] Jiang and colleagues[65] found that the mental health level of Chongqing migrant workers was significantly worse than that of the Chinese norm. Similar results measured by Symptom Checklist 90 (SCL-90) were shown in Shenzhen migrants.[66] A study by Chen *et al.*[67] in Eastern China found that the mental ill health of unemployed migrant workers was a much

more serious and widespread problem during the economic crisis of 2008.

Children of migrating parents and the left-behind rural families also show signs of higher mental ill health.[68,69] Gao *et al*.[70] studied the left-behind adolescents in South China and their results revealed a higher level of internet addiction, suicide ideation and consideration of leaving home along with other social behavioural issues such as smoking and binge drinking.

Among migrant adolescents of Shanghai, there were significantly fewer social connections, lower self-esteem and higher levels of depression than their native peers.[71] Apart from depression, symptoms of separation anxiety and generalized anxiety disorder are also commonly seen.[68] Noticeably, rural children who were separated at an earlier age and especially from their mothers or both parents were at high risk of having symptoms of anxiety, depression,[72] as well as showing negative effects on the psychosocial well-being of both boys and girls.[73] The majority of evidence points to high psychological risks being incurred by rural–urban migration, but there is uncertainty regarding the degree and direction of such a link over time.[74] Further studies may be needed to address some of the methodological problems raised.

Workplace injury and occupational health

Compared with urban registered residents, migrant workers have a significantly higher incidence of injury in China. Injury prevention services among the migrant workers are urgently needed.[75] With many migrants working in mining, manufacturing and construction, work-related injuries and fatalities are rapidly increasing.[76] Adverse environmental hazards such as chemicals, toxic substances, noise, dusts and poor ventilation are major contributors to occupational damage including respiratory diseases, acute/chronic poisoning, cancer, injury, disability or even death. Statistics between the years 2000–05 showed that mining caused more than half of all industrial deaths in China. Common clinical outcomes of mine accidents include wound infections, hypothermia, decompression syndromes, organ damage and death.[77] Other occupation-related diseases that have been discussed in the literature include leukaemia caused by toxic benzene, silicosis, hearing disorders, occupational dermatoses, ionizing radiation-induced diseases, headache, stomach problems, dizziness and musculoskeletal disorders/chronic pain.[78–80]

In 2009, there were 14 495 new cases of pneumoconiosis diagnosed, a prevalent disease among mining, metal alloy, metallurgy, construction and jewellery industries, and it has been estimated that in 2010, the prevalence was ~1 million people in China with the majority being

migrant workers.[81] Pneumoconiosis is estimated to have cost China ¥25 billion, representing 0.4% of China's total gross domestic product.[80] The severity of such a disease epidemic, and findings that occupational disease rates are higher in migrant-receiving provinces,[78] have revealed the lack of occupational protection for migrants exposed to occupational environmental risks. In general, longer working hours and higher work intensity are common among rural–urban migrants, which increase the health risks from worksite hazard exposure. In addition to better health education strategies and safety training, enforcement of occupational protection laws (Occupational Diseases Prevention and Control Act, 2001), inspection, standardized monitoring of working conditions, early diagnosis and free treatment to avoid disability have been widely discussed as needed to guarantee migrant workers' right and reduce health threats at work places.[82]

Women's health

There is a growing body of research about the health inequities among migrant women in China, in particular maternal health outcomes and health service utilization. Evidence suggests migrant women are significantly less likely to receive prenatal care services,[83,84] antenatal care services[85] and regular gynaecology check-ups[86,87] than permanent female residents. There are also increased risks of unfavourable pregnancy outcomes correlated with being a migrant woman in big cities[88] and an unmet need for contraception.[89]

A study in Guangzhou investigated the self-reported symptoms of reproductive tract infections (RTIs) among migrant women and found a high prevalence of RTIs, but low knowledge levels. The study found that unmarried (younger) migrant women are more vulnerable compared with their married peers as they are sexually more active, and have significantly less access to women's health information and services.[90] Young female groups are also more likely to have induced abortions at later stages of pregnancy and poorer post-abortion care.[91] However, blaming the individuals' lack of knowledge,[92] or unmet needs for contraception services,[93] or poorer socioeconomic status of these women may be misleading. Working female migrants may have more difficulty taking time off from work, are paid less than males,[94] carry a greater burden of responsibility than male migrants and are more likely to be under or uninsured.[79]

Zheng and Liang[18] have articulated that it is time for the government to strengthen and enforce regulations to stop the violation of women's reproductive rights and benefits in the workplace, especially in private and

small enterprises. Zhan *et al.*[88] propose that the government needs to rethink and redesign maternal health delivery systems to provide opportunities for timely prenatal and obstetric care for the most vulnerable migrant women and to expand on community-provided services similar to recent efforts to improve immunization services at urban community health centres (CHCs or community medical centres). CHCs provide public health services at a 'grassroots level'[95,96] and ensure preventive medical services including maternal health care and immunization for children in the community.

Policy developments from central government have been comparatively successful in providing some financial support for public health packages, but the implementation of these health packages is influenced by local delivery arrangements. Demands for preventive services have higher out-of-pocket (OOP) payment price elasticity[97] and utilization inequities are mainly related to time stringency as well as unawareness of available care. Thus, a major policy focus needs to be placed on better financial accessibility and enforcement of related laws[98] for migrant women in concentrated enterprises to allow them sufficient time for health care (instead of working overtime). Also, physical access could be improved by increasing the supply of human resources in CHCs, greater flexibility in service provision as well as more maternal health education in their communities. New models of maternal health delivery are needed, such as an integrated midwifery model for childbirth,[99] to support the existing system within available resources. In addition, the higher prevalence of 'unauthorized' pregnancy[100] due to China's strict family planning policies[88] and service needs in pregnant migrants have been under-studied, making it a research gap to a full understanding of the whole picture.

Non-communicable chronic diseases and risk factors

The complex mechanisms and impacts of rural–urban migration on non-communicable chronic diseases (NCDs) are less documented than in other health domains, potentially because migrants are, for the most part, young and non-communicable diseases such as diabetes and hypertension tend to be more prevalent in older populations. In general, rural–urban migration, as part of urbanization, is considered a promoting factor for chronic diseases,[3] not only in the migrant-receiving cities, but also back in rural villages where migrants originate and eventually return. For example, evidence shows that urbanization is estimated to raise the age-standardized rate of coronary heart disease incidence by 73–81 per 100 000,[101] and migratory history increases the risks of rural residents having a higher age-related rise in blood pressure.[102] There are many

studies, which show increasing rates of obesity in westernizing populations,[103,104] and urban diet and physical inactivity are risk factors for higher rates of hypertension[105,106] as well as increasing obesity in children.[107–109] It is estimated that age-standardized coronary heart disease incidence in China will increase by 73–81 (from 164.4 to 237.0–244.9) per 100 000 and stroke incidence will rise from 790.1 to 801.1–830.9 per 100 000 from 2010 to 2030, with an assumption that risk factors and consequently cardiovascular risk change quickly in rural-to-urban migrants.[101]

Still, whether China's rural–urban migration itself, rather than urbanization as a whole, serves as an independent contributor to NCDs such as cancer, hypertension, diabetes or stroke is largely unknown.[3] Very few empirical studies have successfully tracked the progression of specific chronic disease trends in China in cohorts of rural–urban migrants. Heath behaviours and other established risk factors of chronic diseases related to urban living have been more widely studied. For example, higher smoking prevalence has been found among migrants post-migration compared with pre-migration. Conclusions of Yang *et al.*[110] has also pointed to the negative impacts of migratory lifestyles on smoking initiation. Of all potential factors, stress,[111] poorer mental health and time spent in the city[112] have been explored as risk factors for increased smoking. Some have alternatively shown that China's rural–urban migrants are not necessarily more likely to smoke compared with their peers in urban and rural locales.[112,113] Alcohol intoxication was reported to be elevated among migrants and was closely linked to occurrence of sexual risk behaviours.[114] International findings indicate that impacts are not uniform across different risk factors[115] and there are both positive and negative changes.[116]

It is still difficult to make an explicit causal inference between internal migration and chronic disease risks in China at this stage. As Hernández *et al.*[117] stated in their systematic review on cardiovascular disease and internal migration of low- and middle-income countries, even though gradients of certain cardiovascular risk factors exist between migrants and local residents, those gaps may not necessarily lead to the true differences in cardiovascular events. Many scholars in chronic disease prevention research in China have focused on ageing and its effects on incidence and prevalence of disease, whilst the comparatively young and physically healthy rural–urban movers have been neglected or, if studied, attention is often drawn to their psychological problems. Further efforts built on longitudinal follow-up design and appropriate data collection are warranted.

Health policy reforms related to China's rural–urban migration

Other factors that hold back China's public health progress include the failed transition of the healthcare sector in the 1980s at the time of marketization and the huge healthcare reform agenda which faces many difficulties in setting up universal insurance networks, essential drug systems, new management of hospitals in public sectors and a primary care-based health services mechanism.[96]

Access to health insurance

Although China has expanded its health insurance coverage[118] to address increased mobility throughout the country, financial protection remains insufficient for rural–urban migrants and their families. Skepticism regarding whether there is coverage readily available for migrants[119] in earlier studies has been replaced by concerns of whether the available plans and health services truly benefit the population with its high mobility and a special set of health risks. There is no comprehensive or universal medical coverage for migrants at the national level; even at a local level, individual urban health insurance systems seldom fully incorporate all rural–urban migrants without restrictions based on age, employment or *hukou* status. In the countryside, the former Cooperative Medical Scheme that financed health care for members of the agricultural commune has been reformed in the post-reform era.

Piloted in late 1990s and formally introduced in 2003, the New Rural Cooperative Medical Scheme (NRCMS, or NCMS, *Xin Nong He*) has been designed to cover rural residents on a household enrolment basis, and has been proved effective in preventing catastrophic health payment in rural China.[120] By March 2007, 685 million rural residents (79% of the rural population) were covered[121], and by 2011, this number has increased to 832 million.

Although NCMS has achieved astonishing coverage in rural China and is considered a true success in terms of the programme extension and substantial financial support from the government,[122–125] several concerns should be taken into account by stakeholders. Firstly, NCMS policies stipulate that people with rural hukou can only participate in the local NCMS. Reimbursement under NCMS for health services provided by undesignated urban providers is restricted and hard to achieve, posing barriers to migrants when they seek services in the health facilities of their destination cities. Even for the few NCMS plans that accept medical bills from urban facilities, the level of payment is extremely low and the procedures for reimbursement to individuals often are inconvenient and unpleasant.[126] Secondly, there is low utilization of the designated health

facilities in their original NCMS by migrants. Thirdly, there are conflicts between the western inland counties where many migrants come from, who have limited local financial resources of the NCMS, and the eastern/southern coastal cities where higher costs are incurred, causing payment problems for migrants when they are sick away from home. These issues are fundamental, serving as core difficulties for China to provide financial protection for rural–urban migrants who may be denied support when seeking health care using locality-based rural NCMS.

In migrants' urban destinations, medical insurance systems have also been evolving. New systems include the Medical Assistance Programme (MAP) for the poor and the Urban Resident Scheme or Urban Resident Basic Medical Insurance (URS),[127] which, since 2007, is supposed to benefit unemployed urban residents or working adults outside formal sectors.[17,128,129] Theoretically, URS should also cover unemployed migrants and their dependents (children <18 years and seniors), but detailed strategies on the management of the URS scheme such as registration procedures, financing patterns, premium contributions, reimbursement standards and, most importantly, whether to cover non-hukou residents are still under exploration at local levels and vary depending on the financial input from each city government. For example in the Guangdong Province, the province receiving the largest number of rural–urban migrant workers in China, current regulation does not compulsorily specify that migrants and their children should be enrolled into the URS, leaving detailed policies to be decided by city-level governments.[130] Shanghai, the largest migrant megacity of China, faces the same issue.[131] In fact, in most Chinese cities, URS is still a hukou-based system and is not open to adult rural–urban migrants who are unemployed, self-employed or who work for informal sectors.[132] Hesketh *et al.*[38] found that in the Zhejiang Province, the China's richest province, only 19% of migrant workers were covered whilst in 2009 in Beijing 94% of surveyed migrant workers did not have insurance.[133]

There are, however, novel health insurance options for working migrants under development, especially in affluent migrant-receiving cities, and successful insurance options have been implemented in several metropolitan areas where outdated health insurance framework schemes have been phased out and employment-based mechanisms introduced for employed non-hukou workers. China's earliest Special Economic Zone and most populous migratory city, Shenzhen, is an example of a city attempting to achieve universal coverage for its working migrants. Up to March 2011, the city's Medical Insurance System for Migrant Employees (MISM)[19] had quickly developed from a trial scheme in March 2005 to a programme covering more than 5.3 million migrant workers, representing an 8.9% annual increase, and includes more than

700 designated health facilities.[134] Following a State Council's Guideline document aiming to solving 'some critical peasant worker issues' in 2006, health insurance reforms were also initiated in other representative pioneer cities including Shanghai, Beijing and Chengdu[135] with varied regulations, rules, benefits and scales. Technically, the design of each city's system differs in premiums/co-payment, waiting periods, reimbursement levels, deductibles and ceilings, whether to link to occupational injury and/or retirement insurance, as well as the designation of health facilities to be used by the insured. All programmes are supplemented with Coordinative Severe Disease Reimbursement Networks (CSDRN, equal to MAP for locals),[17,128,136] which aims to avoid catastrophic results caused by severe health conditions for working migrants.

Shenzhen was also the first city to introduce a health insurance scheme open to children and juveniles (defined as under 18 years) independent of the child's registration status. The scheme ensures both inpatient care and outpatient care for severe diseases since 2008.[137] This innovative programme is supplementary to MISM and welcomed by migrant parents. However, lack of information among migrant parents, particularly those whose children do not go to publically funded schools, is limited and has hindered its effectiveness as had stipulations on what health care is covered.

To a certain degree, new health insurance schemes provide financial protection for migrants, but overall enrolment has been found to be skewed due to lack of knowledge and self-selection,[119] weak enforcement payment of subsidies' to employers by the government—all of which raise health equity problems.[79] There is also a gap of coverage for unemployed migrants, especially in the informal sector. In most urban areas where health insurance for working migrants is unavailable or very limited, migrant workers still depend on OOP payment, informal social assistance, if any, or limited funds from CSDRN (if qualified), to deal with catastrophic health outcomes of themselves or family members living with them.

In general, NCMS and migrant health insurance permit little flexibility for migrants to transfer their health insurance between rural and urban areas (or between different cities), because both are subsidized partly by local governments with variable capacity for support, despite national policies calling for less barriers to transferring medical insurance for migrants.[138] Institutional barriers that stop migrant workers transferring their insurance are mainly rooted in the differences in financial status between different areas, making it especially hard to navigate through health insurance systems when they move.[139]

Utilization of health services

Utilization of health services by Chinese rural–urban migrants is also problematic. Migrants have been found to ignore symptoms,[133] delay doctor visits[140] and decline referral for medical treatment (especially inpatient care) which results in suboptimal health utilization, late diagnosis and more severe disease progression. Health system reforms have so far failed to provide accessible and affordable services to migrants. The impact of the transformation in the 1990s changed China's health services into the world's most market-oriented health system, resulting in less health access, increased OOP expenditures (including catastrophic OOP expenses), widened rural–urban inequalities and a slowing in health improvements.[141] As providers' behaviour is driven mainly by profits and expensive high-tech medical equipment has been introduced, the most vulnerable migrants are paying a price.[121] In addition to high costs, factors reducing access to urban health facilities for migrants[38] include denial of sick pay, misconceptions of disease severity,[79] lack of information on healthcare facilities in their neighbourhoods,[142] exacting work schedules/limited spare time[143,144] and the long-existing self-medication tradition in the Chinese society.[133]

In general, evidence shows a package of obstacles to accessing appropriate and timely health care faced by rural–urban migrants. Having realized the urgency of solving considerable issues related to such massive population movement, current health reforms in China are trying to entitle working migrants the right to participate in medical insurance of their destinations and allowing a higher flexibility of scheme transferability. A guiding document jointly signed by the Ministry of Human Resources and Social Security, Ministry of Health and Ministry of Finance in December 2009 had proclaimed that health insurance transferability should not discriminate on the original type of insurance or hukou and that personal accounts can be transferred into the new account so that health insurance continuity can be guaranteed.[145] This guiding document, however, has yet to bring full national realization supported by specific measures for implementation at a local level.[146]

Development of the primary care system is another major determinant in health reform themes. The established urban community health services network has improved access for urban residents including rural–urban migrants. CHCs have delivered over 600 million visits in 2011 which represents an increase of 138% over 2008.[147] Binding migrants' health insurance and care with community health services has become a mainstream voice in megacities like Shanghai and Shenzhen. However, to further redesign the health systems so as to benefit migrant populations, factors such as financing migrant health insurance programmes,

appropriate delivery approaches, specific cultural beliefs of migrants and stricter supervision of employers all need to be rethought carefully.

Implications for future policy improvement and research directions

Despite many social and health policy advances in supporting rural–urban migrants and their families, China has a long way to go in terms of understanding the health status of this substantial sub-population, protecting their health at work sites, providing them with more accessible health services (physically and financially) and promoting health through meaningful initiatives and solutions. There is no doubt that public health policies should be matched closely with other supporting social policies and that migrants and their families are given fair treatment to seek health, which is the basic component of human rights and a positive factor to combat poverty and improve the productive forces of the whole country. By prioritizing existing barriers that stop China from achieving better targets in this field, we focus on two major issues that have been largely overlooked and should be remedied.

Strategies to redress health accessibility for migrants: transferability

The evolving health insurance schemes in China are fragmented and based on local financial inputs with very restricted transferability, creating inconvenience and low efficiency for rural movers. Further policy development is needed to tackle the lack of a national transfer mechanism, comparatively high deductibles, low reimbursement rates, undesirable coverage and exclusion of both the unemployed and employed in informal sectors. While current disputes about the significance of personal medical savings accounts are pending[135,148] and insurance transfer is currently rarely the case for migrant peasants under NCMS, stakeholders must consider major challenges that address not only the mobility of rural–urban migrant workers, but more so the complex patterns of their mobility,[149] the existence of a massive large pool of more invisible migrants (especially unemployed women, the elderly, small children), the drop-off of the schemes, instability, grey zones and catastrophic results in certain migrant communities.

Innovation and electronic records can play a role in addressing migrant health in China. Citizenship-based, nationwide universal health insurance systems could be developed but would require technically achievable national health insurance transferability. Some have suggested a unique identifier linked to personal insurance cards permitting better

administrative integration and independence between sites where migrants register and receive health care.[150,151] This overwhelming initiative faces technical barriers such as establishing a national-wide electronic medical records system[152] and linking it to existing insurance systems in different cities. Furthermore, administrative and institutional barriers dating back to unbalanced economic development, social situations (including whether it is a migrant-sending or migrant-receiving society), enforcement on employers' sponsorship, financial prosperity of each region and financial pressure to increase subsidies/benefits are challenges for China's long-term health insurance reform success.

Research priorities: the most vulnerable and a longitudinal design

Current migrant health research in China points to the need for better understanding of the social determinants of health for migrants, including returning migrants and left-behind populations. Rapid economic development has a huge effect on China's society, involving more than just migrant workers. Unemployed migrants, the elderly, the young out-of-school migrants, migrant sex workers and illegal child labourers are examples of vulnerable populations[153] who are impacted by migration. Compared with invisible urban migrants, those who are left behind may seem more visible but equally overlooked by the scholars. Persons above 60 years,[154] young children,[155,156] the chronically sick/less healthy (including the returned disabled workers) and females[157] are over-represented in many rural areas, given the scale of rural–urban migration,[38] however remain largely under-researched.

The significant public health impact of new demographic patterns and population dynamics also requires further study. Urgent health evaluation and development of implementable strategies for effective health and social policies are needed to protect migrants from disease and health deterioration. Technical barriers such as sampling and low response need to be fully addressed in any further studies on migrants. Given their transient lifestyle, systematic studies of unregistered migrants are difficult and challenging. International expertise in this field may shed a light on similar research initiatives in the future.[158]

To bring the research question forward, because of the lack of health administration data that many immigrant-receiving countries often use to observe the healthy migrant effect and time effect for migrants,[159,160] there is very little literature from China investigating trajectories of specific diseases among rural–urban migrants and their families. This missing evidence is fundamental to the understanding of disease (especially degenerative chronic diseases) aetiology of populations of Chinese ethnicity, as the environmental change of this population is intensive and recent. Tracking them along a longer time and recording cohort health outcomes will be critical for rigorous health planning of the country.

Conclusions

Rural–urban migration is an inalienable component of China's urbanization, modernization and social economic development in the 21st century. TB, STDs and vaccine preventable diseases are examples of most prevalent and concerning communicable diseases threatening this population, whilst work-related diseases, women's health, NCDs and behavioural risk factors are newly emerging health challenges, highly related to migrants' mobile status and living/working situations, and for the development of health systems. Although the evolving Chinese health insurance system has been largely improved to meet the medical needs of some migrants and their families, defective system design, insufficient coverage, unbalanced financial support as well as blurred implementation regulations all make it hard for migrants to navigate current systems. The health gradients between migrants and the locals are obvious. There are also serious health concerns for the most vulnerable left-behind children, women, elders, the returned sick and those unemployed individuals who might also be unregistered. Promoting the health and welfare of rural–urban migrants and their families through more equitable socioeconomic and health policies is urgently needed due to the sheer size of this mobile population and the observed health gaps. Public health research initiatives targeted to the most vulnerable groups in migrant communities with known health problems are warranted, and technical barriers inhibiting comprehensive understandings of migrant health needs and risks should be addressed, especially for migrants who are unregistered or highly mobile. Longitudinal studies to track different categories of migrants would provide more clarity in how to target policies and services for specific populations.

Now is the time for the policy-makers to seriously consider rural–urban migrants as a priority population for public health. They are a key group contributing to the economic success of China and also the key population who should be a priority in the national health reform plans, especially for health financing and service delivery. China's future research and policy responses to migrant health will provide valuable lessons for other countries where rapid economic development, societal change and transitioning health services pose challenges for health equity among vulnerable populations.

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