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Addressing the sustainable development goals “leave no one behind” promise: Migration and health

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Published in
Frontiers in Public Health

ISSN 1664-8714
ISBN 978-2-8325-2424-4
DOI 10.3389/978-2-8325-2424-4

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Addressing the sustainable development goals "leave no one behind" promise: Migration and health

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Citation

Chen, S., Law, C. K., Ming, W.-k., Orlando, S., eds. (2023). *Addressing the sustainable development goals "leave no one behind" promise: Migration and health*. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-8325-2424-4

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frontiers | Frontiers in Public Health

TYPE Editorial
PUBLISHED 02 May 2023
DOI 10.3389/fpubh.2023.1192454

OPEN ACCESS

EDITED AND REVIEWED BY
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RECEIVED 23 March 2023
ACCEPTED 07 April 2023
PUBLISHED 02 May 2023

CITATION
Chen S, Law CK, Ming W-k and Orlando S (2023) Editorial: Addressing the sustainable development goals "leave no one behind" promise: migration and health.
Front. Public Health 11:1192454.
doi: 10.3389/fpubh.2023.1192454

Editorial: Addressing the sustainable development goals "leave no one behind" promise: migration and health

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KEYWORDS

migration, urban-rural dual division system, people-centered integrated care, medical insurance, internal migrant men who have sex with men, rare diseases, migrant older adults following children

Editorial on the Research Topic
Addressing the sustainable development goals "leave no one behind" promise: migration and health

Introduction

Migration (including internal and international) and health are increasingly recognized as a global public health priority, given that in many countries, equitable access to health services is considered a goal only concerning citizens or local residents. A clear call to the United Nations' Sustainable Development Goals (SDGs) is to "leave no one behind," regardless of legal status, to achieve Universal Health Coverage (UHC) for all (1). The negative impact of absent or limited action on migration works not only on those who migrate, but also on sending, receiving, and "left-behind" communities. The present Research Topic is a response to the call from the SDGs with an especially focus on the health issues of migrants.

The current issue

The urban–rural dual division system has been a long-standing social issue and has been widely criticized in China (2). Xue and Li explored the impact of the integration of urban and rural medical insurance on migrant workers' overwork, based on panel data from 2016 and 2018. Xue and Li found that the integration of urban and rural medical insurance can significantly alleviate the excessive labor of migrant workers, and this alleviation especially affects work for migrant workers belonging to the older generation, from the central and western regions, working in the secondary industry and having a high level of education. They further explored the possible underlying mechanism and indicated that the integration of urban and rural medical insurance will improve the social

identity and health level of migrant workers, and then reduce the probability of migrant workers' overwork. Continuity is a crucial part of the health care of the internal migrant population under the aforementioned condition of dual urban-rural division (3). Zhang, Wu, et al. explored the potential mechanism of how people-centered integrated care (PCIC) in medical alliances promotes the continuity for migrants, from dimensions of continuity, accessibility, and comprehensiveness, and also explored the moderated mediating role of respect. Zhang, Wu, et al. found that coordination had a direct effect on continuity and had a mediating effect on continuity via comprehensiveness and accessibility. They also showed that respect has a positive moderating effect on the relationship between coordination and comprehensiveness.

The number of migrant older adults following children (MEFCs) has gradually increased along with the aging and urbanization of the population in recent decades in China. In this context, Di et al. investigated the mediating effect of family support on the relationship between acculturation and loneliness among MEFCs. Based on 656 MEFC, Di et al. found that acculturation of MEFC had a direct negative association with loneliness and a direct positive association with family support, while family support exerted a direct negative effect on loneliness. They further quantified that the mediating effect of family support accounted for 14.0% of the total association between acculturation and loneliness. Bao et al. qualitatively explored the factors affecting MEFC urban assimilation in China and presented the corresponding strategies to promote urban assimilation. Bao et al. concluded that the urban life of migrant older adults is mostly community-based and the fundamental institutional barrier is a significant factor that influences the ability of these migrant older adults to live a stable urban life. They emphasized that it is especially important for MEFC to reconstruct close neighborhood relationships and regain the humanity affection of the traditional acquaintance society, and suggested that the Chinese government needs to promote a nationwide unified pension and health insurance system, so that migrant older adults can enjoy the same benefits as local older adult residents in the "inflow" area.

Three articles focus on medical insurance or service. Yao et al. explored the pattern of health insurance use of 15,302 internal migrants in mainland China. They found that ∼71% of internal migrants were enroled in a social health insurance programme outside of their residential location and of those hospitalized, ∼73% were admitted to a hospital at their migration destination. They further indicated that internal migrants who had a local insurance fund aligned with residency [adjusted odds ratio (AOR) = 2.642, 95% CI = 2.108–3.310, $p < 0.001$] and were enroled in employment-based insurance (AOR = 1.761, 95% CI = 1.348–2.301, $p < 0.001$) were more likely to use insurance funds for hospital care and paid less out-of-pocket ($\beta = -0.183$ for local funds, $p = 0.017$; $\beta = -0.171$ for employment-based insurance, $p = 0.005$) than others. Meng et al. explored the association of medical services with population migration. They found that migrants with rural household registration or migrants not covered by the New Rural Cooperative Medical System were more prone to return to their hometowns for medical service reasons. They also showed that middle-aged and older people who migrated across provinces have the highest tendency to return to their hometowns due to medical services, and young people who migrated across and within provinces had the lowest propensity to return to their hometowns. Following the passage of the Affordable Care Act (ACA) and the subsequent 2012 Supreme Court decision, some states in the U.S. elected to offer Medicaid coverage to adults with incomes up to 138% of the Federal Poverty Level while others did not (4). Guo and Zou investigated whether post-ACA Medicaid coverage differences play a role in insurance coverage and interstate migration flow of low-educated non-citizens. They found that the 2014 Medicaid expansion was associated with statistically significant increases in insurance coverage rates among low-educated non-citizens, but there is little evidence supporting an increase in the in-migration rate or a decrease in out-migration rate in expansion states relative to that of non-expansion states.

Three papers put a special focus on minorities. Liu et al. established several prediction models to assess the risk of HIV infection among internal migrant men who have sex with men (IMMSM). Zhang, Chen, et al. assessed associations of migration with quality of life (QoL) among adults with rare diseases. Zhang, Chen, et al. found that among rural adults with rare diseases, migration had a positive direct effect on physical and environmental QoL, a positive indirect effect on physical and social QoL through increased individual income, and a negative indirect effect on environmental QoL via reduced tangible support. On the contrary, neither direct nor indirect associations of migration with quality of life were significant among the urban participants group. Asim et al. explored the maternity care experience of 120 Pakistani ethnic minorities, who had given birth in Hong Kong (HK). Asim et al. found that Pakistani women born in Hong Kong expressed relatively less satisfaction with care, especially during pregnancy and labor and delivery, compared to Pakistani women; women with fluent or conversational English-speaking ability also felt comparatively less satisfied particularly with intrapartum and postnatal care in hospital; and the level of education had a negative association with satisfaction with care during pregnancy.

Other topics include alcohol consumption and depression. Kurshed et al. investigated the alcohol consumption behaviors of the general and Roma populations of Hungary. They found that Roma people experienced more alcohol-related harm than non-Roma and that gender and marital status differences act more intensely among Roma than non-Roma when considering alcohol-related harm. Xiong and Hu investigated the mediating role of self-esteem and the moderating role of belief in a just world between relative deprivation and depressive symptoms among 1076 rural-to-urban migrant children. Xiong and Hu identified a significant positive association between relative deprivation and depressive symptoms, and self-esteem partially mediates this association. They also found that belief in a just world moderated the association between relative deprivation and self-esteem.

Finally, there is an article on an interesting topic. Based on 129,803 observations from China, Zheng et al. investigated the association between migration distance and happiness, examined the heterogeneity of this association between urban and rural areas, and explored the transmission mechanism of migration distance on happiness by mediating the role of social integration. The researchers found that the distance from internal migration in China has a significant negative association with happiness, and this

association is stronger among urban migrants. Social integration was also shown to be the potential mechanism through which migration distance works in happiness.

Conclusions

Timely, reliable, and impactful evidence on migration and health will help guide policymakers in devising evidence-based policies and action plans to tackle migration aspects of the SDGs. This Research Topic highlights recent literature on the institutional barrier (urban-rural dual division system), migrant older adults following children, medical insurance or service of migrants and migrant minorities, and the health risk behaviors and well-being accompanied by migration.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Funding

SC was supported by the PENDA, funded by the UK Foreign, Commonwealth and Development Office.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Wickramage K, Vearey J, Zwi AB, Robinson C, Knipper M. Migration and health: a global public health research priority. *BMC Public Health*. (2018) 18:987. doi: 10.1186/s12889-018-5932-5

2. Chen S, Chen Y, Feng Z, Chen X, Wang Z, Zhu J, et al. Dong, barriers of effective health insurance coverage for rural-to-urban migrant workers in China: a systematic review and policy gap analysis. *BMC Public Health*. (2020) 20:408. doi: 10.1186/s12889-020-8448-8

3. Brandenberger J, Tylleskar T, Sontag K, Peterhans B, Ritz N. A systematic literature review of reported challenges in health care delivery to migrants and refugees in high-income countries - the 3C model. *BMC Public Health*. (2019) 19:755. doi: 10.1186/s12889-019-7049-x

4. Stimpson JP, Kemmick Pintor J, McKenna RM, Park S, Wilson FA. Association of medicaid expansion with health insurance coverage among persons with a disability. *JAMA Netw Open*. (2019) 2:e197136. doi: 10.1001/jamanetworkopen.2019.7136

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ORIGINAL RESEARCH
published: 30 May 2022
doi: 10.3389/fpubh.2022.913553

Does Migration Distance Affect Happiness? Evidence From Internal Migrants in China

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Background: Happiness is a complex concept involving many subjects such as society, psychology, and ethics. How will migration distance affect migrants' happiness under the new trend of migration in China? The goal of this paper is to analyze the influence and transmission mechanism of migration distance on happiness of migrant individuals, and the heterogeneity of this effect on urban and rural migrants.

Methods: Employing data of 129,803 observations from the 2012 China Migrants Dynamic Survey, we first estimate the effects of migration distance on happiness by the ordinal logistic regression and propensity score matching (PSM) method. Second, we examine the heterogeneity of effect by splitting the sample into the urban and rural migrants. Finally, we analyze the transmission mechanism of migration distance on happiness by mediating effect model.

Results: The migration distance of internal migrants in China has a significant negative impact on happiness. Urban migrant individuals show a stronger response to migration distance compared to rural counterparts. Social integration is proved as the potential mechanism through which the effect of migration distance on happiness.

Conclusion: The results emphasize happiness of internal migrant and other mental health problems. Moreover, particular attention should be paid to social integration on happiness, such as strengthening the cultural exchange in different areas, narrowing the income gap between urban and rural areas, promoting rational migrant decision of individual, and enhancing the happiness of them.

Keywords: migration distance, happiness, social integration, mental health, Chinese internal migrants

OPEN ACCESS

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Specialty section:
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

Received: *05 April 2022*
Accepted: *09 May 2022*
Published: *30 May 2022*

Citation:
Zheng G, Yang D and Li J (2022) Does Migration Distance Affect Happiness? Evidence From Internal Migrants in China. Front. Public Health 10:913553. doi: 10.3389/fpubh.2022.913553

INTRODUCTION

Happiness is a complex concept involving many subjects, such as society, psychology, and ethics. For example, happiness is defined as positive and pleasurable emotions that come from heart (1); happiness is described as a beautiful experience of reaching a higher level of life by exerting one's potential (2); or emphasizing an individual's rational cognition of happiness, and judging happiness from the comparison between the preset happiness standard and the real life situation (3). In recent years, the pursuit of happiness in society has continued to heat up. Happiness is not only a comprehensive reflection of individual mental and physical health but also a universal goal and

expectation in human life all over the world. To this end, the 66th United Nations General Assembly proclaimed March 20 as the International Day of Happiness in 2012. The resolution is of practical importance to the well-being of all people.

With the rapid development of economy and society of China, internal migration of individuals presents a proximity trend. According to the data of China's seventh population census, the migrant population of China was 375,816,800 in 2020, accounting for 26.63% of the total population, among which the intra-province migrant population was 250,979,600, and the inter-provincial migrant population was 124.84 million, increasing respectively by 84.5 and 45.3% compared with 2010 (4). About two-third of the migrant population belongs to the intra-province migrant population.

Suppose high welfare is the ultimate goal of all human efforts (5). The purpose of migrant individual is to pursue higher happiness. In that case, it seems easy to explain why more and more Chinese migrants choose to move at short distances. Short-distance migration reflects the preference of destination of the migrants, as well as the spiritual belonging and social welfare that the destination can provide to the migrants (6). Fundamentally, it is likely that people choose to migrate in proximity out of comparison and acquisition of happiness. Therefore, one problem arises naturally, which is does migration distance affect happiness?

In addition to the length of geographic distance, migration distance represents the psychological distance between the individuals and their relatives in the hometown. This psychological distance includes language differences, climate differences, dietary customs, living habits, cultural education, etc. These are regional cultures with local characteristics formed over a long historical period (7). Regional cultures are mainly distributed across China in the form of provincial administrative regions (8). In the same province, people are influenced by physical geography and cultural environment. They share similarities in character, behavior, habit, thinking, and even personality. These factors significantly pull the psychological distance between people. The provincial-level proximity in China is conducive to people's rational adjustment to social environment or life pressure, forming good mental health, and thus maintaining a high sense of happiness (9–11).

On the one hand, under the influence of Confucian culture, Chinese society paid more attention to clan and family relationships. In the traditional concept of elderly support, "While parents are still living, it is better for child not to stay far away from home" and "Raise children to care for you when you get old." "Serving on the side" and other support modes are regarded as the criteria for filial piety to parents, which restricts the range of migration to a certain extent, leading people to choose short-distance migration.

On the other hand, in long-distance migration, the difference in cultural environment is an inevitable problem for the migrant population. Previous studies have found that the farther the dialect distance is, the weaker the migrant population's sense of identity and trust in the city, and the weaker their willingness to settle down and happiness (12, 13). Moreover, the sense of happiness reflects personal, economic, and spiritual levels, and the migrant population needs to make corresponding cognitive and emotional evaluations when the living environment changes and forms a subjective psychological response (14). The long-distance migration process lacks the support and care of relatives and friends, which can easily lead to the disintegration of the family and the loss of traditional values, reduce the individual's psychological sense of belonging and social integration willingness to the destination, and happiness naturally declines (15, 16). Based on the above analysis, we propose Hypothesis 1.

> Hypothesis 1. Migration distance has a significant negative effect on happiness.

China's population distribution presents a clear urban-rural dual structure. Due to China's preference for urban policies and resources, there are considerable differences in social welfare and public security between urban and rural population based on the household registration system. The income level of urban residents has long been at an advantage compared to the rural ones. According to the "happiness paradox" proposed by Easterlin (17), income and happiness have no apparent positive correlation. Some existing empirical studies showed that individuals with high-income levels were more likely to face disappointment in income expectations and the decline in happiness caused by the disappointment of expectations (18–22). Hence, Hypothesis 2 arises.

> Hypothesis 2. Urban individuals show a stronger response to migration distance compared to rural counterparts.

For some long-distance migrants, the unhappiness brought by the difficulty of integrating into the place of migration may be more prominent (23). Due to the persistent forms of discrimination that migrants experience, which leads to the marginalization and exclusion of migrant individuals, they continue to fall victims of being left behind. For example, in allocating public resources such as medical education and other public resources, the local residents and the foreign residents are treated differently. Zheng (24) found that migrating to a new region creates a sense of alienation and stress, which puts the migrating individuals at an extremely high risk of mental illnesses such as depressive symptoms. Happiness is a complete manifestation of mental health. If migrants have a good mental health state, such as optimism and positivity, they will remain happy. In contrast, if mental health problems such as worry and distress increase, it will undoubtedly reduce the experience of happiness (25). Hence, Hypothesis 3 is proposed.

> Hypothesis 3. Migration distance can harm happiness through their effects on social integration.

The novelty of this paper is four-fold. First, to the best of our knowledge, this is the first paper to investigate the impact of migration distance on happiness for the case of a developing country: China. Previous studies focused on the impact of education and income on happiness (24, 26). Our research investigates the general impact of migration distance

as an external shock on happiness. Second, we address the impact by propensity score matching (PSM) method, which is important to identify the casual effect of migration distance on happiness. Third, compared with empirical research in the existing literature, we examine the heterogeneity of effects by splitting the sample into urban and rural areas. These results help us understand why urban individuals showing a stronger response to migration distance than rural counterparts. Finally, this paper reveals that migration distance could affect happiness through the influence of social integration. The causal effect of migration distance on happiness is verified.

In this paper, we examine the effect of migration distance on happiness. Employing 129,803 research individuals in the 2012 China Migrants Dynamic Survey, we test Hypotheses 1–3, respectively and found that migration distance has a significant negative impact on happiness. This negative impact is remarkably different between urban and rural migrant individuals. In addition, social integration is proved to be the potential mechanism through which the effect of migration distance on happiness.

DATA AND VARIABLES

Data

The data used in this paper are mainly from the 2012 China Migrants Dynamic Survey (CMDS), which was organized and implemented by the Migrant Population Service Center of the National Health Commission of China (formerly the National Population and Family Planning Commission). This data is the only national survey data on happiness released by government departments. Compared with other survey data in China, it is highly credible and authoritative. The data is based on the 2011 annual report data of all the migrant individuals of 31 provinces as the basic sampling frame and adopts the stratified, multi-stage, and scale-proportional PPS method for sampling. The survey respondents lived in the immigration area for more than 1 month and were 15–59 years old migrant individuals with no household registration in the district (county, city). The total sample size of the national survey is 159,000 people. The survey content involves information such as the migration direction, social integration, and happiness of the migrant individuals. According to the research purpose of the article, we eliminate outliers and invalid values in the sample and finally obtain 129,803 observations.

Variable Definitions

The dependent variable is happiness. As a subjective feeling of an individual, happiness is objectively immeasurable. For this problem, discrete numerical variables can well show individual wishes and be compared and analyzed (27). In the questionnaire: "Compared with your hometown (where you migration from), do you feel happy now?" The respondents' options include very happy, happy, so-so, unhappy, and very unhappy, and the corresponding values are as follows: 5, 4, 3, 2, and 1, with higher numbers indicating greater happiness. The number of people who answered very happy, happy, so-so, unhappy, and very unhappy in the sample was respectively 18,535 (14.28%), 61,637 (47.49%), 47,460 (36.56%), 1,930 (1.49%), 241 (0.19%).

The independent variable is migration distance. The migration distance refers to the range of individual's movement, which is the main factor for the migrant individuals to make migrant decisions (28). The information on the migration distance in the questionnaire is in the individual basic situation module, and the latest migration range is judged based on the household registration and current residence of the migrant individual. Dummy variables capture migration distance. If the migrant individual chooses Inter-provincial migration, it is 1; otherwise, it is 0. In the sample data, the number of people who chose intra-provincial and inter-provincial migration were 55,176 and 74,627, and the corresponding proportions were about 42.51 and 57.49%, respectively.

The mediating variable is the willingness to integrate into the destination. Intention to integration has been identified as a potential mediator between migration distance and happiness. Immigrants need to face spiritual costs such as being far away from home, family, relatives, and friends. Research suggests that the lower the spiritual cost, the higher the probability of migration. These unmeasured costs affect the decision-making of the labor force at a deeper level. More importantly, the social integration process of the migrant individuals in the area is also a psychological process of adapting to the new environment, overcoming conceptual differences, and narrowing social exclusion, which directly affects a person's sense of belonging and mental health. Mentally healthy individuals are more able to feel the existence and strength of happiness. In order to objectively measure the degree of social integration of the migrant individuals, we use the question, "I think the locals are willing to accept me as one of them," in the questionnaire to represent the degree of social integration of the migrant individuals. The corresponding answers options include completely disagree, disagree, basically agree, and fully agree. We divide it into two categories: agree and disagree.

Control variables are mainly reflected in individual heterogeneity. In China, where diplomas are the criteria for talent selection, for this reason, happiness is closely related to education. Education changes the cognitive abilities of individuals, and people with higher education are happier (29). We divide educational attainment into lower and higher education. Employment status and age may have an impact on the level of individual happiness and have 15 to 20% explanatory power for individual differences in happiness (30). Employment status refers to employees, employers, and self-employed workers. An increase in personal relative income significantly impacts happiness (31–34). Research has found that migrants can derive happiness from increased economic income and seem happier than those who stay in their country of origin (35, 36). We choose the logarithm of monthly income to represent the income level of the migrant individuals in the questionnaire, "how much was your income last month (or last employment)." In addition, Gender differences between men and women may also impact happiness (37). Research suggests that the more children need to raise, the more passion and energy need to live, and the less happiness.

TABLE 1 | Descriptive statistics of the key variables.

Variables	Definitions	Mean	SD	Min	Max
Happiness	1 = very unhappy, 2 = unhappy, 3 = so-so, 4 = happy, 5 = very happy	3.742	0.720	1	5
Migration distance	0 = Intra-province, 1 = Inter-province	0.575	0.494	0	1
Gender	1 = female, 0 = male	0.408	0.492	0	1
Age	Respondent's age	34.019	8.914	18	59
Household register	0 = rural, 1 = urban	0.159	0.365	0	1
Income	Individual's income (in log)	7.856	0.574	4.605	11.493
Education level	0 = low, 2 = high	0.315	0.464	0	1
Employment status	0 = employees,1 = employers,2 = self-employed	0.721	0.904	0	2
Number of children	Number of children owned by the respondent	1.379	0.715	0	7
Migration time	The length of the last visit to this city/district/county	4.423	4.637	0	51
Social integration	0 = Disagree, 1 = Agree	0.929	0.256	0	1

Descriptive Statistics

Table 1 describes the overall sample and generalized characteristics. It shows that the average happiness score of migrant individuals of China is 3.742, indicating that the happiness of them is generally high. From the age distribution of the migrant individuals, the average age is 34.019, indicating that the migrant individuals are primarily young people. The average time of the migrants is 4.423 years, indicating that most migrant individuals focus on medium and long-term migration rather than short-term migration. The above conclusions are only preliminary judgments and have not been obtained through rigorous hypothesis testing. However, these results reveal some interesting differences in the happiness characteristics of heterogeneous and mobile individuals.

MODELS AND METHODS

First, we use ordinal logistic regression to empirically analyze migration distance's effect on happiness. Ordinal logistic regression is a standard method for dealing with ordinal categorical dependent variables, and it is widely used in questionnaire research. According to the level of happiness questionnaire, the dependent variables are set to 1, 2, 3, 4, and 5, representing very unhappy, unhappy, so-so, happy, and very happy. The corresponding probabilities are defined as π_1, π_2, π_3 ,π_4 and π_5. We construct the cumulative logistic regression model as follows:

$$logit\frac{\pi_1}{1-\pi_1} = -\alpha_1 + \beta_1 x_1 + \ldots + \beta_p x_p \quad (1)$$

$$logit\frac{\pi_1+\pi_2}{1-(\pi_1+\pi_2)} = -\alpha_1 + \beta_1 x_1 + \ldots + \beta_p x_p \quad (2)$$

$$logit\frac{\pi_1+\pi_2+\pi_3}{1-(\pi_1+\pi_2+\pi_3)} = -\alpha_1 + \beta_1 x_1 + \ldots + \beta_p x_p \quad (3)$$

$$logit\frac{\pi_1+\pi_2+\pi_3+\pi_4}{1-(\pi_1+\pi_2+\pi_3+\pi_4)} = -\alpha_1 + \beta_1 x_1 + \ldots + \beta_p x_p \quad (4)$$

In contrast to binary logistic regression analysis, π_1,$\pi_1+\pi_2$,$\pi_1+\pi_2+\pi_3$,$\pi_1+\pi_2+\pi_3+\pi_4$ refer to the cumulative probability of orderly value levels of response variables. We assume that the coefficients of the respective variables remain constant, and the constant terms are variable.

Second, we use the propensity score matching (PSM) technique to address endogeneity problems. The migrants sample used in this case may have a problem of selection bias. Shamsuddin (28) accepts that happiness affect the individual's migration distance and expected staying time; people who live happily are often happy in the place they migrated. The core idea of PSM is to find the control group individuals (intra-provincial migrant individuals) with similar characteristics to the treatment group (inter-provincial migrant individuals) according to the propensity score. Using the observed results of the intra-provincial migrant individuals to estimate potential outcomes unobserved by the inter-provincial migrant individuals, the causal effect of migration distance on happiness was identified by comparing the observed and estimated results of the inter-provincial migrant individuals (38, 39). An essential assumption of PSM is that the experiment is completely randomized, and the randomized assignment of interventions does not introduce confounding bias.

Average treatment effect of the treated (ATT) refers to the average causal effect of treated ($D_i = 1$) on individuals in the treatment group, and its formula is:

$$\tau_{ATT} = E[Y_{1i} - Y_{0i}|D_i = 1] \quad (5)$$

Third, we drive a mediation effect test based on the mediating effect model (40, 41), analyze the conduction path of the influence of migration distance on happiness, and use social integration variables to analyze the mediation effect. The analysis framework is shown in **Figure 1**.

RESULTS

Baseline Regression Results

First of all, we use ordinal logistic regression to analyze the causal relationship between migration distance and happiness in **Table 2**. Column 1 controls the relevant influencing factors such as gender, age, income, education, and migration duration of the migrant individuals. The estimation results show that without

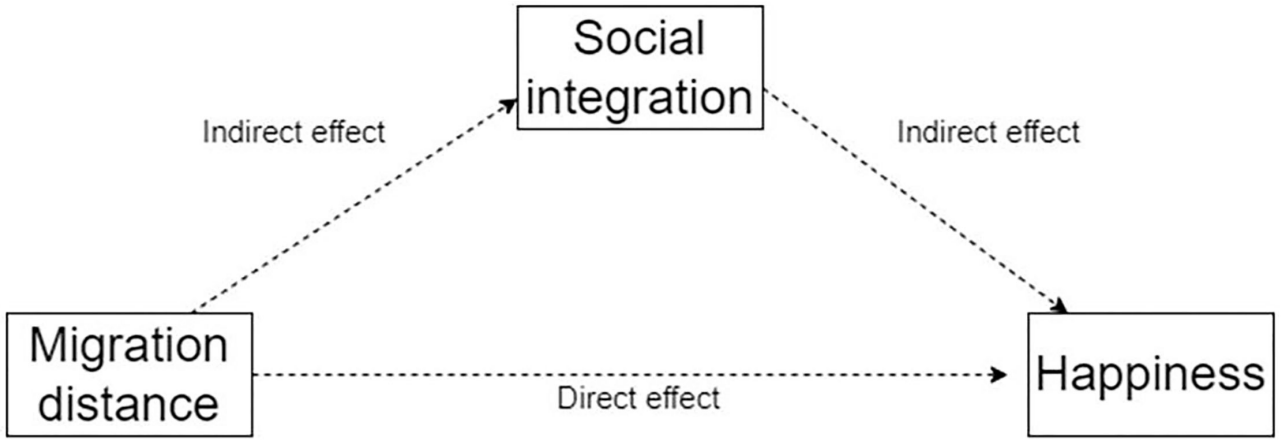

FIGURE 1 | Framework of mediation effect analysis.

TABLE 2 | The effect of migration distance on happiness.

Variables	Happiness	Margin effects				
		Very unhappy	Unhappy	So-so	Happy	Very happy
Range	−0.367***	0.001***	0.005***	0.077***	−0.036***	−0.047***
	(−29.80)	(11.50)	(23.30)	(30.16)	(−29.24)	(−29.46)
Gender	0.113***	−0.000***	−0.001***	−0.024***	0.011***	0.014***
	(8.98)	(−7.28)	(−8.73)	(−8.99)	(8.96)	(8.97)
Age	0.004***	−0.000***	−0.000***	−0.001***	0.000***	0.001***
	(4.89)	(−4.56)	(−4.85)	(−4.90)	(4.89)	(4.89)
Household register	0.083***	−0.000***	−0.001***	−0.018***	0.008***	0.011***
	(4.54)	(−4.26)	(−4.50)	(−4.54)	(4.53)	(4.53)
Education	0.070***	−0.000***	−0.001***	−0.015***	0.007***	0.009***
	(4.59)	(−4.31)	(−4.56)	(−4.60)	(4.59)	(4.59)
Income	0.157***	−0.000***	−0.002***	−0.033***	0.015***	0.020***
	(14.48)	(−9.45)	(−13.50)	(−14.52)	(14.40)	(14.45)
Employers	0.187***	−0.000***	−0.002***	−0.039***	0.017***	0.024***
	(9.62)	(−7.89)	(−9.82)	(−9.76)	(10.48)	(9.27)
Self-employed workers	0.102***	−0.000***	−0.001***	−0.021***	0.010***	0.013***
	(7.65)	(−6.57)	(−7.57)	(−7.66)	(7.70)	(7.61)
Children	−0.029***	0.000***	0.000***	0.006***	−0.003***	−0.004***
	(−3.08)	(2.99)	(3.07)	(3.08)	(−3.08)	(−3.08)
Time	0.036***	−0.000***	−0.000***	−0.008***	0.004***	0.005***
	(28.03)	(−11.39)	(−22.44)	(−28.29)	(27.41)	(27.81)
/cut 1	−0.346***					
	(−3.71)					
/cut 2	1.295***					
	(13.86)					
/cut 3	1.395***					
	(14.93)					
/cut 4	1.407***					
	(15.06)					
Observations	101,409	101,409	101,409	101,409	101,409	101,409

*t statistics in parentheses, ***p < 0.01.*

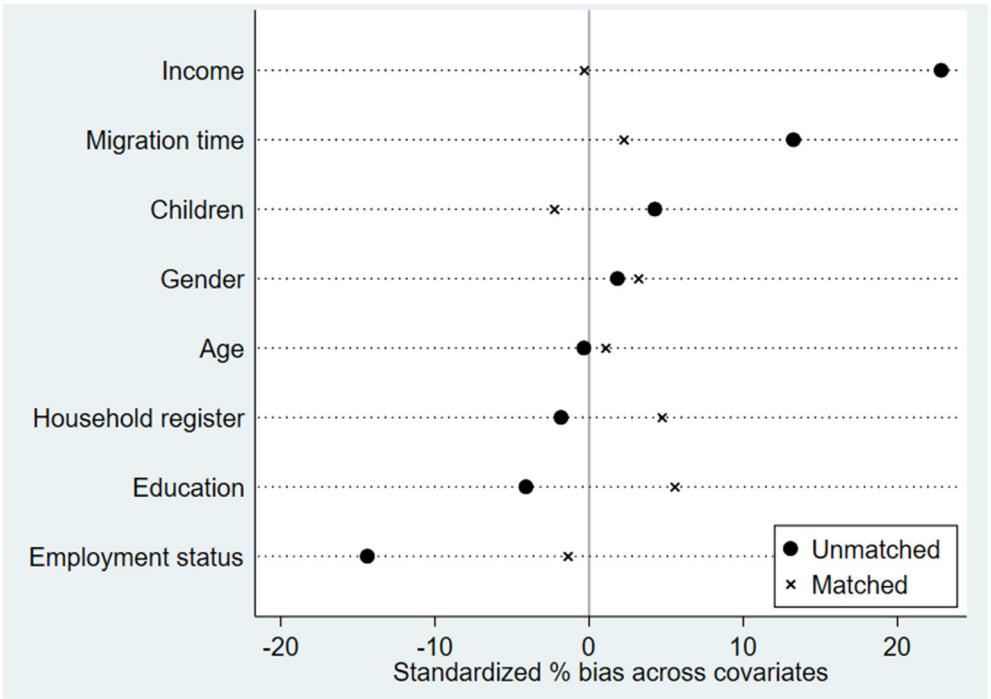

FIGURE 2 | Standardized bias before and after matching.

considering other influencing factors, the migration distance has a significant negative impact on happiness, which is −0.367.

To better understand the relationship between migration distance and happiness, we calculated the mean marginal effect of each explanatory variable to reveal that the unit change of the explanatory variable affects the probability of happiness taking each value. The estimation results in columns 2 to 6 show that when all explanatory variables are at the mean value. Compared with the intra-province migrant individuals, the probability of feeling very unhappy, unhappy, so-so, happy, and very happy will change by 0.001, 0.005, 0.077, −0.036 and −0.047 respectively at the significant level of 1% for the inter-province migrant individuals outside the province when the migration distance increases by one level. The probability of individuals feeling very happy is 0.011 lower than the probability of happiness. The results show that the farther the migrant individuals move, the lower the probability of happiness. That reflects that migration distance has a negative impact on happiness. Long-distance migration is not conducive to the happiness of the migrant individuals. On the contrary, short-distance migration is conducive to people's pursuit of happiness.

In addition, from other explanatory variables, the probability of an individual feeling very happy is 0.002 higher than the probability of happiness for each additional level of higher education compared with low education. When the individual's income is higher, the probability of obtaining happiness is higher. The happiness level of women is significantly higher than that of men. The happiness level of the non-agricultural migrants is significantly higher than that of agriculture. The probability, that an individual feels very happy, decreases by 0.004 with a new baby.

Endogeneity

In order to solve the estimation error of estimation results that may be caused by labor characteristics and selection bias, we consider the use of PSM to identify the causal relationship between migration distance and happiness. In this case, happiness is taken as the outcome variable, intra-provincial migrants are taken as the control group, and inter-provincial migrants are taken as the treatment group.

The condition for PSM requires that the covariates of the treatment and control groups are similar, meaning that the treatment and control groups have similar constructive characteristics. If the deviation of the covariates between the two groups is too large, the PSM cannot be directly used for estimation. Therefore, we need to test the balance of the covariates first (**Figure 2**). After matching, the *t*-test of covariates such as gender, number of children, and time in the treatment group and the control group rejected the null hypothesis of no systematic difference between the treatment group and the control group, indicating that some covariates were poorly balanced. Considering that the standardized mean difference of all covariates decreased significantly, the standardized deviation of most variables is $< 5\%$, which meets the requirement of a 10% balance, indicating the characteristics of the treatment group and the control group is very similar. The balance of the covariates could meet the requirements of randomized experiments.

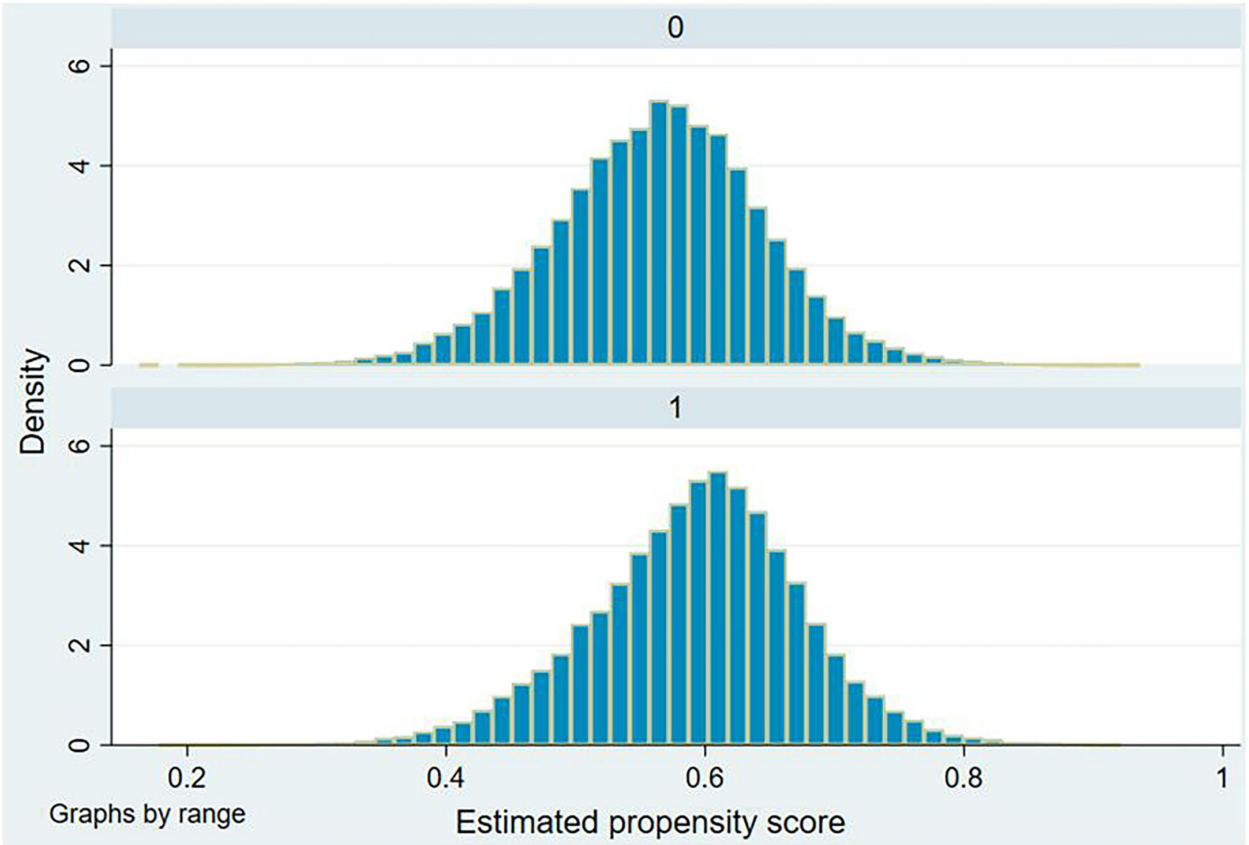

FIGURE 3 | Density distribution of the propensity score.

Another essential condition for implementing matching is to meet the common support assumption: the propensity score, $p\epsilon(0, 1)$. Therefore, when PSM is completed, we draw a histogram of the propensity score distribution of the treatment group and the control group to judge whether the results of the two groups meet the requirements of common support (**Figure 3**). The differences in the distribution of individual propensity scores between the control group and the treatment group are observed. The result shows that distributions of the two groups are similar, indicating that the covariates pass the balance test.

This paper presents different types of matching estimators to accurately identify the causal relationship between migration distance and happiness, including nearest neighbor matching ($k = 1$, $k = 4$), kernel matching, local linear regression matching, and mahalanobis matching. It is worth noting that the K-nearest neighbor matching method involves the selection of k, which is to determine the number of individuals most similar to the matching object, and nearest neighbor matching ($k = 4$) can obtain minimal mean square error (42). **Table 3** shows the estimated results of different matching strategies. ATT is significantly negative, indicating that the migration distance is negatively related to happiness.

Combined with the characteristics of the data in this paper, we use the pseudo treatment method to test for independence.

TABLE 3 | PSM analysis of the effects of migration distance on happiness.

ATT	Nearest Neighbor Matching ($k = 1$)	Nearest Neighbor Matching ($k = 4$)	Kernel matching	Local linear regression matching	Mahalanobis matching
Difference	−0.131***	−0.136***	−0.137***	−0.143***	−0.135***
S.E.	0.006	0.005	0.005	0.006	0.005
T-stat	−21.47	−26.08	−29.47	−23.31	−25.95

***$p < 0.01$.

The basic idea is to use the variables of the control group as pseudo-results to test and control covariates such as age, gender, education, and employment status of the migrants, and then use the pseudo-results to estimate whether the causal effect is zero. In particular, the original control group (intra-province migrant individuals) is randomly divided into two groups: one group is selected as the treatment group and the other group as the control group.

According to the nearest-neighbor matching ($k = 4$) results in **Table 4**, the estimated T-test result of ATT was 0.43, which failed the 1% significance test, indicating that there was no significant difference in the happiness of the migrant individuals

TABLE 4 | Conditional independence assumptions test results for pseudo treatment.

Nearest neighbor matching	Difference	S.E.	T-stat
$k = 1$	−0.002	0.009	−0.2
$k = 4$	0.003	0.008	0.43

For data with large samples and normal distribution, when 1.65<|t|<1.96, p <0. 10; when 1.96<|t|<2.58, p < 0.05; when |t|>2.58, p < 0.01.

TABLE 5 | Heterogeneous effects of migration distance by household register.

Variables	Rural		Urban	
	Coef	OR	Coef	OR
Range	−0.357***	0.699***	−0.425***	0.653***
	(0.013)	(0.009)	(0.032)	(0.021)
Control variables	Yes		Yes	
LR chi^2	1932.62		293.58	
Prob > chi^2	0.0000		0.0000	
Pseudo R^2	0.0105		0.0088	
Observations	86,122		15,287	

*Standard errors in parentheses, ***p < 0.01.*

in the "treatment group" and the "control group" of the pseudo-intervention. The pseudo treatment test can not completely confirm that the independence assumption is valid, but at least it does not show that the independence assumption is invalid, which indicates that the estimation result of nearest neighbor matching has certain credibility. The results verify Hypothesis 1.

Analysis of Urban and Rural Heterogeneity

To better understand the causal effect of migration distance on happiness, we divide the sample according to the migrant individual's household registration characteristics and gender characteristics and then estimate the impact of heterogeneity.

Table 5 shows the heterogeneous effects of migration distance on happiness for rural and urban migrant individuals. The key variable coefficients of the equation all pass the 1% significance test. Whether it is a rural or urban migrant individual, the impact of migration distance on happiness is always negative. However, the adverse effect of migration distance on the happiness of the urban migrant individuals is more robust than that of the rural ones, about 19.05% higher. Usually, the Chinese economy presents a clear urban-rural dual structure. The rural resident in China is poorer than the urban resident, which means that the pursuit of happiness is easier for the poor rural migrant individuals. These results in **Table 5** verify Hypothesis 2.

Analysis of Mediating Effect

The results of the mediating mechanism analysis of the impact of migration distance on happiness are shown in **Table 6**. The estimation results in column 2 indicate that the migration distance has a negative effect on social integration. Compared with intra-provincial migration, the effect of inter-provincial migration on social integration is −0.619, and both are significant

TABLE 6 | Mediating effect of social integration.

Variable	Happiness	Social integration	Happiness
	Order logit	Logit	Order logit
Range	−0.367***	−0.619***	−0.334***
	(0.012)	(0.028)	(0.012)
Social integration			1.088***
			(0.025)
Control variables	Yes	Yes	Yes
Constant		2.677***	
		(0.199)	
N	101,409	101,409	101,409

*Standard errors in parentheses, ***p < 0.01.*

at the 1% level. The social integration variable in column 3 is significant at the 1% level, with an estimated coefficient of 1.088, meaning that social integration has a significant positive effect on happiness.

From the above estimation results, it can be concluded that social integration plays a vital role in negative inhibition in the impact of migration distance on happiness. It means that the longer the migration distance, the weaker its social integration, resulting in a decline in the level of happiness. From the perspective of social integration, the migrant individuals who choose a close-range migration is more conducive to adapting to the new environment, overcoming differences in ideas, narrowing social exclusion, promoting healthy mental development, and continuously improving happiness. The results in **Table 6** verify Hypothesis 3.

DISCUSSION

Happiness is the most direct reflection of the migrant individual's pursuit of welfare. Under the proximity trend of the migration distance in China, there is a complex causal relationship between migration distance and happiness.

This paper investigates the effect of migration distance on happiness by using the 2012 China Migrant Dynamic Survey. One of the most important findings to emerge from this paper is that the migration distance has a negative impact on happiness. PSM conducts further analysis on the endogeneity problem of migration distance on happiness. ATT based on k-nearest neighbor matching, kernel matching, local linear regression matching, and mahalanobis matching are all significantly negative, indicating that migration distance has a negative causal relationship with happiness. From the perspective of happiness, this paper explains the law of migration proposed by Ravenstein (43), which holds that the total number of migrants decreases with the extension of migration distance.

Heterogeneity analysis is conducted from the perspective of urban and rural migrant individuals. Our study discovers that urban individuals show a stronger migration distance response than rural counterparts. China's economy presents a prominent

urban-rural dual structure, and the poor rural migrants' pursuit of happiness is easier to achieve.

In addition, our study also finds that social integration has a significant positive effect on happiness, which is consistent with previous findings on cultural integration on the happiness of the migrants (44–46). Social integration is shown to be the potential mechanism through which the effect of migration distance on happiness. This finding provides a valuable addition to the previous literature.

Our study comes with some limitations. Firstly, due to data constraints, we used the data from the 2012 China Migrants Dynamic Survey, which is a decade away from the present and may not reflect the happiness of the current migrant individuals. Secondly, the cross-sectional data used in this paper cannot reflect the effect of migration distance on happiness under temporal trends. Thirdly, this study only selected relevant control variables for personal characteristics. Existing studies have found that air pollution can not only affect happiness, but also affect individuals' migration decisions (47–50). Regretfully, due to the limitations of the questionnaire, the urban living environment, personal living conditions, and other real situations cannot be considered, which may cause deviations in the estimated results. Therefore, in future research, data and sample selection issues should be addressed to analyze better the causal effects of migration distance on happiness in a more realistic manner.

CONCLUSION

In this study, we found that the migration distance of the Chinese internal migrants has a significant negative impact on happiness. From the perspective of urban-rural heterogeneity, urban individuals show a stronger response to migration distance compared to rural counterparts. Furthermore, we also find that social integration is an essential mechanism by which migration distance affects happiness.

Our findings highlight mental health issues such as the happiness of the migrant individuals and provide some practical implications in a targeted manner. First, it is necessary to respect the law of the migration distance. The government and society need to take appropriate measures to reduce discrimination in household registration and discriminatory laws and policies, pay attention to the equality of the mental health, education, pension, and other migrant issues, which help the migrants enjoy the equal public services as the original residents. Second, particular attention should be paid to social integration for happiness, such as strengthening cultural exchanges between different regions, promoting the social integration of traditional, and helping the migrants better integrate into the city. Third, the government should also focus more on coordinating regional economic development, narrowing the income gap between urban and rural areas, implement the lagging areas and their causes, and propose effective measures for the root causes of the problems to ensure that "Leave No One Behind." Simultaneously, the government should promote rational migration of population and further improve relevant policies for the migrants.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

GZ completed the research design, data analysis, writing the paper, and handled the revision of the manuscript. DY helped in developing the research idea, contributed some intellectual contents to the draft, and responsible for all R&R works. JL edited the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

The authors acknowledge funding support from the Major Program Project of the National Social Science Fund of China (No: 21AJL006) and the Program Project Ministry of Education of China (No: 20JHQ079).

ACKNOWLEDGMENTS

The authors would like to express sincere gratitude to Sandy Dall'erba from University of Illinois at Urbana-Champaign, Randall Jackson from West Virginia University, and the peer reviewers, for their valuable suggestions. DY acknowledges a distinguished (visiting) professorship from the REAL and RRI.

REFERENCES

1. Layard R. *Rethinking Public Economics: The Implications of Rivalry and Habit*. Economies and Happiness: Framing the Analysis New York: Oxford University Press (2005). doi: 10.1093/0199286280.003.0006
2. Diener E. Subjective well-being. *Psychol Bull.* (1984) 95:542–75. doi: 10.1037/0033-2909.95.3.542
3. Veenhoven R. Happy life-expectancy, a comprehensive measure of quality of life in nations. *Soc Indic Res.* (1996) 39:1–58. doi: 10.1007/BF00300831
4. Central People's Government of the People's Republic of China. Bulletin of the Seventh National Population Census (2021). Available online at: http://www.gov.cn/guoqing/2021-05/13/content_5606149.htm (accessed March 31, 2022).
5. Kumar P. Happiness. *Int J of Psych Rehab.* (2020) 24:1513–8. doi: 10.37200/IJPR/V24I2/PR200454
6. Kratz F. On the way from misery to happiness? A longitudinal perspective on economic migration and well-being. *Migration Stud.* (2020) 8:307–55. doi: 10.1093/migration/mny040
7. Shi S, Huang K, Ye D, Yu L. Culture and regional economic development: evidence from China: culture and regional economic development in China. *Paper Reg Sci.* (2014) 93:281–99. doi: 10.1111/pirs.12114
8. Kwon J. Does China have more than one culture? exploring regional differences of work values in China. *Asia Pacific J of management.* (2012) 29:79–102. doi: 10.1007/s10490-010-9191-y
9. Keyes CLM. Social well-being. *Soc Psychol Q.* (1998) 61:121–40. doi: 10.2307/2787065
10. Ryff CD. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *J Pers Soc Psychol.* (1989) 57:1069–81. doi: 10.1037/0022-3514.57.6.1069

11. Huang Z, Huang S, Yang Y, Tang Z, Yang Y, Zhou Y. In pursuit of happiness: impact of the happiness level of a destination country on Chinese tourists' outbound travel choices. *Int J Tour Cities.* (2021) 23:713–25. doi: 10.1002/jtr.2421
12. Guiso L, Sapienza P, Zingales L. Cultural biases in economic exchange? *Q J Econ.* (2009) 124:1095–131. doi: 10.1162/qjec.2009.124.3.1095
13. Zhang P, Hong C, Yan J, Li Q, Guan H. The effects of dialect distance on the migrant population's settlement intentions: evidence from the China migrants dynamic survey. *Appl Econ Lett.* (2021) 28:1–9. doi: 10.1080/13504851.2021.2016579
14. Helliwell JF, Shiplett H, Bonikowska A. Migration as a test of the happiness set-point hypothesis: evidence from immigration to Canada and the United Kingdom. *Can J Econ.* (2020) 53:1618–41. doi: 10.1111/caje.12474
15. Bartram D. International migration, open borders debates, and happiness: international migration and happiness. *International studies review.* (2010) 12:339–61. doi: 10.1111/j.1468-2486.2010.00942.x
16. Jones RC. Migration and family happiness in Bolivia: does social disintegration negate economic well-being? *Int Migr.* (2014) 52:177–93. doi: 10.1111/imig.12007
17. Easterlin RA, McVey LA, Switek M, Sawangfa O, Zweig JS. The happiness—income paradox revisited. *PNAS.* (2010) 107:22463–8. doi: 10.1073/pnas.1015962107
18. Clark AE, Oswald AJ. Satisfaction and comparison income. *J Pub Econ.* (1996) 61:359–81. doi: 10.1016/0047-2727(95)01564-7
19. Wilson WR. Correlates of avowed happiness. *Psychol Bull.* (1967) 67:294–306. doi: 10.1037/h0024431
20. Jongbloed J. Higher education for happiness? investigating the impact of education on the hedonic and eudaimonic well-being of Europeans. *Euro Edu Res Jour.* (2018) 17:733–54. doi: 10.1177/1474904118770818
21. Ruiu G, Ruiu ML. The complex relationship between education and happiness: the case of highly educated individuals in Italy. *J Happiness Stud.* (2019) 20:2631–53. doi: 10.1007/s10902-018-0062-4
22. FitzRoy FR, Nolan MA. Education, income and happiness: panel evidence for the UK. *Empi Econ.* (2020) 58:2573–92. doi: 10.1007/s00181-018-1586-5
23. Heniks M, Burger M. Unsuccessful subjective well-being assimilation among immigrants: the role of faltering perceptions of the host society. *J Happiness Stud.* (2020) 21:1985–2006. doi: 10.1007/s10902-019-00164-0
24. Zheng X, Zhang Y, Chen Y, Fang X. Internal migration experience and depressive symptoms among middle-aged and older adults: Evidence from China. *Int J Environ Res Public Health.* (2022) 19:303–18. doi: 10.3390/ijerph19010303
25. Nowok B, van Ham M, Findlay AM, Gayle V. Does migration make you happy? A longitudinal study of internal migration and subjective well-being. *Environ Plan A.* (2013) 45:986–1002. doi: 10.1068/a45287
26. Yang J, Liu K, Zhang Y. Happiness inequality in China. *J Happiness Stud.* (2019) 20:2747–71. doi: 10.1007/s10902-018-0067-z
27. Lyubomirsky S, Lepper HS. A measure of subjective happiness: preliminary reliability and construct validation. *Soc Indic Res.* (1999) 46:137–55. doi: 10.1023/A:1006824100041
28. Shamsuddin M, Katsaiti M. Migration and happiness: evidence from Germany. *J Happiness Stud.* (2020) 21:2931–55. doi: 10.1007/s10902-019-00207-6
29. Roberts P. Happiness, despair and education. *Stud Philos Educ.* (2013) 32:463–75. doi: 10.1007/s11217-012-9325-4
30. Hammell KW. Opportunities for well-being: The right to occupational participation. *Can J Occup Ther.* (2017) 84:E1–14. doi: 10.1177/0008417417753374
31. Luttmer EFP. Neighbors as negatives: relative earnings and well-being. *Q J Econ.* (2005) 120:963–1002. doi: 10.1162/003355305774268255
32. Hayo B, Seifert W. Subjective economic well-being in Eastern Europe. *J Econ Psychol.* (2003) 24:329–48. doi: 10.1016/S0167-4870(02)00173-3
33. Stutzer A. The role of income aspirations in individual happiness. *J Econ Behav Organ.* (2004) 54:89–109. doi: 10.1016/j.jebo.2003.04.003
34. Dolan P, Peasgood T, White M. Do we really know what makes us happy? a review of the economic literature on the factors associated with subjective well-being. *J Econ Psychol.* (2008) 29:94–122. doi: 10.1016/j.joep.2007.09.001
35. Bartram D. Economic migration and happiness: comparing immigrants' and natives' happiness gains from income. *Soc Indic Res.* (2011) 103:57–76. doi: 10.1007/s11205-010-9696-2
36. Bartram D. Happiness and 'economic migration': a comparison of eastern European migrants and stayers. *Migration Studies.* (2013) 1:156–75. doi: 10.1093/migration/mnt006
37. Louis VV, Zhao S. Effects of family structure, family SES, and adulthood experiences on life satisfaction. *J Fam Issues.* (2002) 23:986–1005. doi: 10.1177/019251302237300
38. Rubin DB. Estimating causal effects of treatments in randomized and nonrandomized studies. *J Educ Psychol.* (1974) 66:688–701. doi: 10.1037/h0037350
39. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika.* (1983) 70:41–55. doi: 10.1093/biomet/70.1.41
40. Judd CM, Kenny DA. Process analysis: estimating mediation in treatment evaluations. *Eval Rev.* (1981) 5:602–19. doi: 10.1177/0193841X8100500502
41. Sobel ME. Direct and indirect effects in linear structural equation models. *Sociol Methods Res.* (1987) 16:155–76. doi: 10.1177/0049124187016001006
42. Abadie A, Drukker D, Herr JL, Imbens GW. Implementing matching estimators for average treatment effects in Stata. *Stata J.* (2004) 4:290–311. doi: 10.1177/1536867X0400400307
43. Ravenstein EG. The laws of migration. *J R Stat Soc.* (1889) 52:241–305. doi: 10.2307/2979333
44. Beier H, Kroneberg C. Language boundaries and the subjective well-being of immigrants in Europe. *J Ethn Migr Stud.* (2013) 39:1535–53. doi: 10.1080/1369183X.2013.833685
45. Angelini V, Casi L, Corazzini L. Life satisfaction of immigrants: does cultural assimilation matter? *J Popul Econ.* (2015) 28:817–44. doi: 10.1007/s00148-015-0552-1
46. Amit K. Determinants of life satisfaction among immigrants from western countries and from the FSU in Israel. *Soc Indic Res.* (2010) 96:515–34. doi: 10.1007/s11205-009-9490-1
47. Liu X, Dong X, Li S, Ding Y, Zhang M. Air pollution and high human capital population migration: An empirical study based on 35 major cities in China. *Sustain Prod Consum.* (2021) 27:643–52. doi: 10.1016/j.spc.2021.01.032
48. Song Y, Zhou A, Zhang M. Exploring the effect of subjective air pollution on happiness in China. *Environ Sci Pollut Res Int.* (2020) 27:43299–311. doi: 10.1007/s11356-020-10255-8
49. Guo S, Wang W, Zhang M. Exploring the impact of environmental regulations on happiness: new evidence from China. *Environ Sci Pollut Res Int.* (2020) 27:19484–501. doi: 10.1007/s11356-020-08508-7
50. Song Y, Guo S, Zhang M. Will environmental regulations affect subjective well-being? A cross-region analysis in China. *Environ Sci Pollut Res Int.* (2019) 26:29191–211. doi: 10.1007/s11356-019-06147-1

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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ORIGINAL RESEARCH
published: 01 July 2022
doi: 10.3389/fpubh.2022.934524

The Impact of the Integration of Urban and Rural Medical Insurance on Migrant Workers' Overwork: Evidence From China

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Edited by:
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Specialty section:
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

Received: *02 May 2022*
Accepted: *30 May 2022*
Published: *01 July 2022*

Citation:
Xue Z and Li B (2022) The Impact of the Integration of Urban and Rural Medical Insurance on Migrant Workers' Overwork: Evidence From China. Front. Public Health 10:934524. doi: 10.3389/fpubh.2022.934524

In recent years, the problem of migrant workers' excessive labor has attracted much attention. The implementation of the integration policy of urban and rural medical insurance has broken the urban-rural dual division system. While improving migrant workers' health and sense of social integration, can they effectively alleviate their overwork? Based on the panel data of China Labor Dynamics Survey (CLDS) in 2016 and 2018, this paper empirically analyzes the impact of the integration of urban and rural medical insurance on migrant workers' overwork by using the differential difference model (DID).The research shows that the integration of urban and rural medical insurance can significantly alleviate the excessive labor of migrant workers; Heterogeneity analysis shows that, comparing with the new generation, the eastern region, the tertiary industry and low education level migrant workers, it is more obviously that the integration of urban and rural medical insurance alleviates the overwork of the older generation, the central and the western regions, the secondary industry and high education level migrant workers. Path analysis shows that the integration of urban and rural medical insurance will improve the social identity and health level of migrant workers, and then reduce the probability of migrant workers' overwork.

Keywords: integration of urban and rural medical insurance, overwork, migrant workers, health rights, double difference method

INTRODUCTION

The rapid development of industrialization and urbanization in China has attracted a large number of surplus rural labors to transfer to cities and towns, forming a large number of migrant workers and becoming the backbone of China's urban labor market. According to the monitoring and survey report on migrant workers in 2019 issued by the National Bureau of statistics, compared with 2018, the total number of migrant workers in China increased by 0.8% to 290.77 million in 2019. However, due to the generally low level of educational human capital of migrant workers, they often engage in low-level physical labor, resulting in low time rate of return of their labor unit. In order to pursue higher income, they often pay the price of long-time excessive labor, which makes excessive labor become a common phenomenon. According to the data of the National Bureau of statistics, the average working hours of urban employees in China are 45.6 h, far exceeding the 44 h stipulated by the state, of which 42.4% are migrant workers who work more than 48 h a week (1).

Many studies have shown that long-term overwork will seriously damage the physical and mental health of migrant workers, and the incidence of cardiovascular and cerebrovascular diseases, mental disorders and other diseases will increase significantly with the increase of overwork time (2). Under this realistic background, how to alleviate migrant workers' excessive labor and protect their health rights and interests in cities is not only related to the realization of the goal of "Healthy China Strategy", but also an important policy tool to tap the potential of Chinese labor force and improve social welfare.

The classical theory of labor economics points out that the coverage of medical insurance has an important impact on workers' performance in the labor market (e.g., wage level, working time and employment status). Although, China fully implemented the new rural cooperative medical insurance (NCMS) in 2003, which aims to provide basic medical security for rural residents and improve their health status. However, affected by the long-term differentiated management of China's urban and rural social security system, China's NCMS can not provide timely medical security for migrant workers. Existing studies on the effect of NCMS on rural residents have found that NCMS with non-portability or discriminatory reimbursement policies are institutional factors that significantly hinder rural labor mobility (3). The NCMS require rural residents to participate in insurance only in the registered residence, and migrant workers can not be insured at any time with the change of the working place of migrant workers. Meanwhile, compared with local reimbursement, the reimbursement threshold of NCMS is higher and the reimbursement ratio is lower (4). There is no doubt that migrant workers engaged in non-agricultural employment in cities cannot enjoy the same medical rights and interests as urban residents even if they participate in the NCMS (5). In the absence of medical security, migrant workers can only increase their working hours in the form of preventive labor supply in order to prevent the risk of health deterioration (6).

In order to further narrow the gap between urban and rural areas and improve the treatment of medical services for rural residents, the Chinese government issued the document on integrating the basic medical insurance system for urban and rural residents in 2016. The urban and rural residents' basic medical insurance (URRBMI) will integrate the new rural cooperative medical insurance (NCMS) and urban residents' basic medical insurance (URBMI). From the perspective of policy setting, the URRBMI has increased the medical institutions that migrant workers can choose, improved the convenience of medical treatment, and solved the problem of migrant workers' medical treatment in other places. Secondly, the URRBMI insurance has significantly improved the medical insurance treatment of migrant workers, and the reimbursement proportion and reimbursement catalog have increased significantly. For example, after the implementation of the URRBMI in Beijing, the maximum reimbursement proportion of migrant workers' outpatient service has increased by 5 percentage points, the maximum reimbursement proportion of hospitalization has increased by 5–10 percentage points, and the reimbursement proportion of serious illness insurance has increased by 10 percentage points. Moreover, the types of drugs that can be reimbursed have also been expanded from the current 2,510 to more than 3,000, which will greatly reduce the medical burden of migrant workers (7). As an important factor affecting migrant workers' overwork, how will the transformation from NCMS to URRBMI affect migrant workers' overwork?

According to existing studies, there are relatively few empirical studies on the effect of URRBMI policy, especially for vulnerable migrant workers. Only a few scholars have evaluated the policy effect of URRBMI from the perspectives of improving health, improving the utilization rate of medical services, promoting social integration and social participation (8–11).However, there is no special study on the impact of URRBMI on migrant workers' overwork. Only some scholars analyze migrant workers' overwork from the perspective of medical insurance system. For example, Deng (6) from the perspective of the accessibility of migrant workers' health rights and interests, found that migrant workers participating in URBMI had 8.45% less weekly labor time than those not participating, and significantly reduced the incidence of overtime work of migrant workers. Guo (12) also finds that the overtime hours of migrant workers with medical insurance are significantly shortened. However, the above studies did not distinguish between URRBMI, urban workers' medical insurance and other forms of public medical treatment.

Based on this, with the help of the good quasi natural experiment of URRBMI, this paper attempts to explore the impact of URRBMI on migrant workers' excessive labor, in order to make a scientific evaluation on the reform effect of URRBMI in the new era, and more deeply understand the deep-seated institutional factors behind migrant workers' excessive labor behavior. The possible marginal contributions of this paper are as follows: (1) From the research perspective, this paper empirically analyzes the impact of medical insurance system arrangement on migrant workers' excessive labor with the help of the policy of URRBMI for the first time, so as to provide a more rigorous empirical basis for policy improvement. (2) From the perspective of research methods, based on the panel data of CLDS in 2016 and 2018, this paper uses the Differences-in-Differences (DID) model to better alleviate the endogenous problem caused by sample deviation, and further uses the Differential Propensity Score Matching Method (PSM-DID) to test the robustness, which greatly enhances the credibility of the conclusion. (3) From the perspective of impact mechanism, existing studies only focus on outcome variables and ignore the impact channels. This paper uses the mediating effect causal step method to identify the impact channels of URRBMI on migrant workers' overwork, so as to provide theoretical reference for alleviating the problem of migrant workers' overwork in the future.

THEORETICAL ANALYSIS:THE IMPACT OF THE URRBMI ON MIGRANT WORKERS' OVERWORK

The impact mechanism of URRBMI on migrant workers' overwork mainly has the following two aspects: On the one hand, URRBMI alleviates migrant workers' overwork to a certain extent by improving their social identity. On the other hand, URRBMI

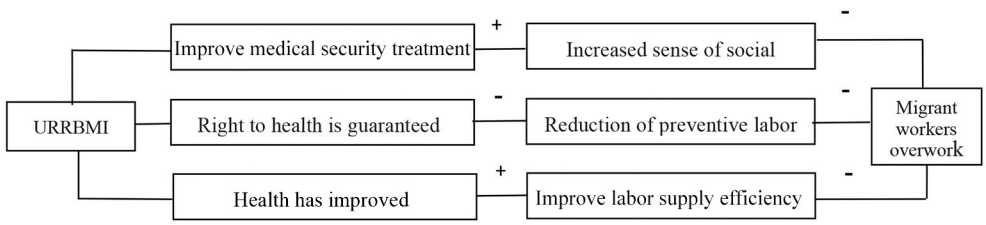

FIGURE 1 | Action path of urban-rural medical insurance integration on migrant workers' overwork.

can reduce excessive labor by improving the health level of migrant workers. Therefore, URRBMI has "identity effect" and "health effect" on migrant workers' excessive labor. The effect path of URRBMI on migrant workers' overwork is shown in the **Figure 1**.

Identity Effect

Social identity theory was first widely used in social psychology. Akerlof and Kranton (13) first introduced this theory into the field of economics. Social identity theory holds that people always belong to a specific social group. Affected by the behavior characteristics of the group where they locate, people will change their original behavior and obey the characteristics of the group (14). Under the theory of social identity, migrant workers in China may reduce their overwork time through the imitation effect of reference points. When migrant workers have a strong sense of social identity to the inflow place, migrant workers will have strong economic integration and behavior adaptation in the inflow place, imitate local urban residents in terms of clothing, food, housing and transportation, and have behavior characteristics similar to those of local people (15, 16). The URRBMI not only improves the medical service level of migrant workers, but also significantly improves the social participation and social integration level of migrant workers at the psychological level, making migrant workers have a strong sense of urban local identity (9, 10). Sun and Wang (17) used the dynamic monitoring survey data of the floating population conducted by the National Health Commission in 2017. The empirical test found that when the floating population has urban local identity, they tend to take the local people as the reference standard, because the working hours of urban residents are relatively small. The floating population with stronger urban local identity reduces its excessive labor time through imitation effect, so as to effectively alleviate the occurrence of excessive labor. Based on the above research, it can be expected that the URRBMI can effectively reduce the probability of migrant workers' overwork by improving their sense of social integration and reducing their overwork time.

Health Effects

The traditional labor-leisure intertemporal substitution theory holds that there is a substitution relationship between labor and time. When the wage level is high, migrant workers will increase labor supply and reduce leisure time, while when the wage level is low, migrant workers will reduce labor supply and increase leisure time. Low (18) put forward the preventive labor theory on this basis. If there is uncertainty in the future income of migrant workers, they will reduce the impact of future uncertainty by increasing the current labor time, then migrant workers will no longer allocate labor and leisure time according to the wage level. At this time, the labor-leisure intertemporal substitution theory will no longer be applicable. Based on the preventive labor theory, Chinese scholar Wang (19) made an empirical test using CHNS panel data from the perspective of health uncertainty and found that under the condition of health uncertainty, there is indeed a phenomenon of preventive labor supply for rural non-agricultural labors.

The preliminary theoretical analysis shows that the family assets of migrant workers are generally limited, and their income level is low, so they can only meet their living needs through labor income. Before the implementation of URRBMI, migrant workers could not enjoy the high-quality medical services in the inflow area. Due to the lack of necessary financial tools, it was difficult to realize the intertemporal substitution of labor force. At this time, the marginal effect of consumption tended to be infinite (6). In the case that they cannot survive without work, although the health of migrant workers is damaged by long-term and high-intensity labor, in order to meet the needs of survival, they have to increase their working hours in the form of preventive labor supply to prevent the impact of health risks. However, after the implementation of the policy of URRBMI, the health rights and interests of migrant workers have been protected, and their motivation of preventive labor supply has been weakened (20). Migrant workers allocate rest time across periods to ensure the equal marginal utility of consumption in different periods (19). From this perspective, the implementation of URRBMI provides a higher level of medical security for the health of migrant workers, and can help migrant workers optimize their intertemporal labor resource allocation and reduce labor intensity.

On the other hand, Grossman's theory holds that medical care is one of the important determinants affecting health. Consumers can increase their investment in health capital by buying medical services, while medical insurance can increase its investment in health capital by reducing the price of medical services (21). The implementation of URRBMI policy has further improved the reimbursement ratio and expanded the scope of medical treatment for migrant workers. That is, the change of the system makes the price of medical services for migrant workers drop more, so migrant workers increase spending on health, improve

TABLE 1 | Descriptive statistics of changes in migrant workers' overwork.

Year	Proportion of excessive labor (50 h)	Proportion of excessive labor (60 h)	Weekly working hours	Overwork time
2016	67.23%	48.28%	51.11 (hours)	14.43 (hours)
2018	48.28%	47.82%	51.08 (hours)	15.84 (hours)
Full sample	66.00%	48.04%	51.09 (hours)	15.144 (hours)

the medical service utilization, reduce the likelihood that migrant workers will not see a doctor if they fall ill, thus affecting health level and improve its labor yield per unit time, so that migrant workers do not need to increase their working hours to increase their economic income (22).

To sum up, the URRBMI can alleviate their overwork whether by improving the social identity of migrant workers or improving the health status of migrant workers. Based on this, we can draw the following inferences and assumptions:

Hypothesis 1: URRBMI can significantly alleviate the Overwork of migrant workers.
Hypothesis 2: URRBMI reduces the probability of migrant workers' overwork by improving their social identity and health level.

EMPIRICAL RESEARCH: THE IMPACT OF THE URRBMI ON MIGRANT WORKERS' OVERWORK

Data Sources

The data selected in this study are from China labor force dynamic survey (CLDS) in 2016 and 2018. The survey is a large-scale follow-up survey conducted by the social science survey center of Sun Yat-sen University, focusing on the current situation and changes of China's labor force. The sample covers 29 provinces and cities across the country (except Hong Kong, Macao, Taiwan, Tibet and Hainan). The survey covers multiple research topics such as education, work, economic activities and social participation. At the same time, the multi-stage and multi-level probability sampling method is adopted. This provides good data support for the research of this paper.

This paper focuses on the impact of URRBMI on migrant workers' overwork. Therefore, this paper first identifies the migrant workers. Refer to the research of Wu et al. (23). The sample with registered residence as agricultural and half a year away from the place of residence is retained. At the same time, the samples whose occupation type is "farming" are excluded, with 4,956 samples retained. Secondly, in order to improve the rigor of the study, samples with different types of insurance participation and household registration were deleted during data processing. Panel data were obtained for two years after screening, and a total of 3,715 eligible samples were selected. After excluding the missing values of important variables and invalid samples, a total of 3,087 valid samples were obtained.

Variable Selection and Descriptive Statistics

Explained Variable

Overwork refers to the overtime and over intensity labor behavior of workers in their work. Compared with the labor intensity and fatigue state of migrant workers, it is easier to obtain labor time. Therefore, this paper uses the commonly used indicator labor time in academic circles to measure whether migrant workers are overworked (24). Based on the limitation of labor time in the labor law of the people's Republic of China, this paper takes whether the weekly labor time exceeds 50 h and whether the weekly labor time exceeds 60 h as the identification criteria, and whether the weekly labor time exceeds 60 h is the core index of the later analysis (1).

According to the "Working hours in the past week" in CLDS personal questionnaire, this paper makes descriptive statistics on the Overwork status of migrant workers in 2016 and 2018, as shown in **Table 1**. In the whole sample, the average weekly working hours of migrant workers are 51.09 h, far more than the weekly working hours of workers stipulated in China's labor law shall not exceed 44 hours. At the same time, the phenomenon of migrant workers' overwork is relatively serious. Under the standard of 50 h of working time per week, the proportion of migrant workers' overwork is as high as 66.00%, while under the standard of 60 h of working time per week, 48.04% of migrant workers are overworked. The average overwork time per week is 15.43 h, indicating that the overworked migrant workers work overtime three times a week for at least 5 h each time. From different periods, the proportion of migrant workers in 2018 decreased compared with that in 2016, and the weekly average working hours decreased, but the excessive working hours increased slightly, indicating that the degree of excessive labor of migrant workers was deepened.

Explanatory Variables and Control Variables

According to the CLDS questionnaire, the investigator asked the respondents "Do you participate in urban and rural medical insurance?" to judge whether the area where migrant workers are located has implemented the URRBMI. If the respondent is insured for URRBMI, it is considered that the URRBMI has been implemented in the region, and the variable is assigned as 1. If the respondent is insured for NCMS, it is considered that the URRBMI has not been implemented in the region, and the variable is assigned as 0. **Figures 2**, **3**, respectively show the relationship between the URRBMI and the proportion of migrant workers' overwork under different overwork standards. As can be seen from the figure, under the 50 h standard, the proportion

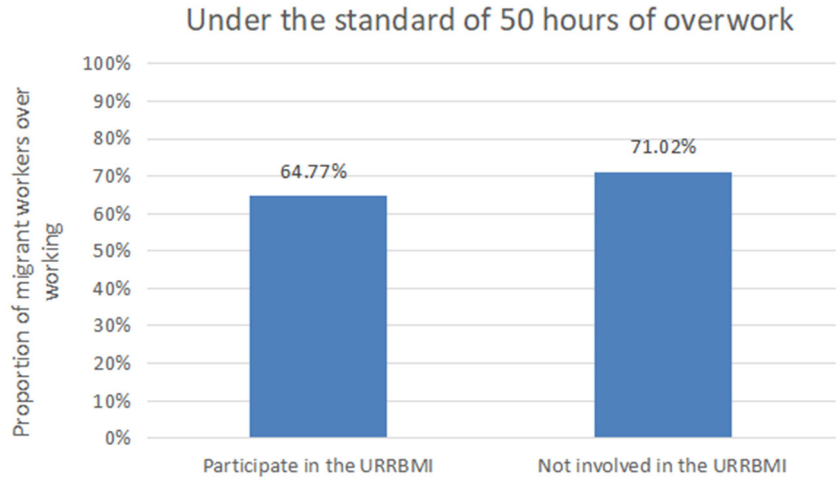

FIGURE 2 | Proportion of migrant workers' overwork under 50 h standard.

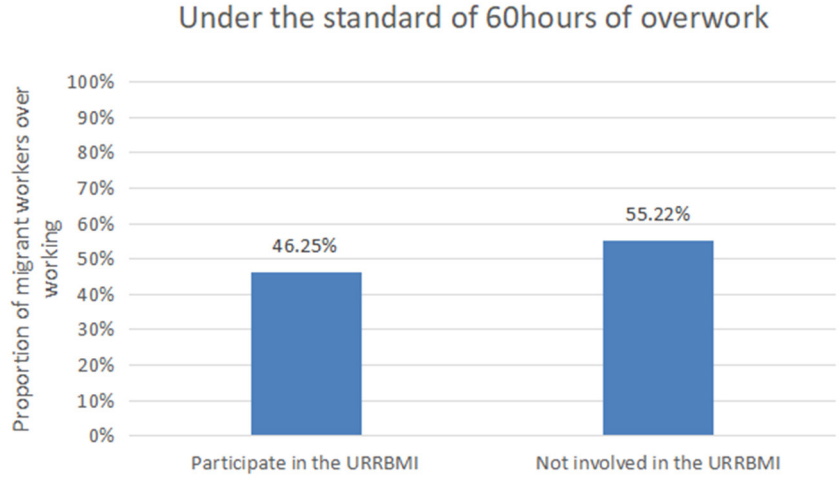

FIGURE 3 | Proportion of migrant workers' overwork under 60 h standard.

of migrant workers participating in URRBMI was 67.77%, while the proportion of migrant workers not participating in URRBMI increased significantly, reaching 71.02%. Similarly, under the 60 h standard, the proportion of migrant workers who did not participate in URRBMI was greater than that of migrant workers who participated in URRBMI, reaching 55.22%. It can be seen that the implementation of URRBMI has alleviated migrant workers' excessive labor to a certain extent. In addition, by combing the existing studies, this paper adds some control variables that may affect migrant workers' excessive labor, as shown in **Table 2**.

Model Selection

Benchmark Regression

When examining the impact of URRBMI on migrant workers' overwork, it will be affected by many unobservable factors. In order to eliminate the interference of other factors, this paper regards the implementation of the policy of URRBMI as a quasi natural experiment, and compares the differences of excessive labor changes between the groups impacted by the policy (treatment group) and the groups not impacted by the policy (control group), which is taken as the net effect of the policy. It is worth noting that URRBMI has obvious characteristics of pilot and gradual implementation, and there are differences in the time of URRBMI in different regions. Therefore, based on the study of Chang et al. (25), this paper judges whether URRBMI is implemented in this region according to the insurance type of the insured, that is, if the respondents participated in the medical insurance for urban and rural residents, the region was considered to have implemented URRBMI. Specifically, take the samples participating in NCMS in 2016 and 2108 as the control group, and the samples participating in NCMS in 2016 and

TABLE 2 | Definition and value of each variable.

Variable Name		Variable Definition	Mean	Std. Err.
Dependent variables	Overwork			
	Under 50 h standard	The weekly labor time exceeds 50 h = 1;Not exceeding = 0	0.660	0.474
	Under 60 h standard	The weekly labor time exceeds 60 h = 1;Not exceeding = 0	0.480	0.480
	Weekly working hours	Working hours in the past week	51.093	21.016
Independent variables	URRBMI	The sample area implements the URRBMI = 1;unenforced = 0	0.796	0.403
Control variables	Age	Age of respondents (years)	44.177	11.757
	Nation	Han nationality = 1;Other nationalities = 0	0.953	0.212
	Gender	Male = 1;female = 0	0.506	0.500
	Education level	0 = Never went to school;6 = primary school;9 = junior middle school;12 = High school / technical school / technical secondary school / vocational school;15 = junior college;16 = undergraduate;19 = master;23 = doctor	8.454	3.511
	level of health	1 = Very unhealthy;2 = Relatively unhealthy;3 = commonly;4 = Relatively healthy;5 = Very healthy	3.681	0.990
	Marital status			
	Unmarried	Unmarried = 1;other = 0	0.057	0.232
	Married	Married = 1;other = 0	0.913	0.286
	Divorced or widowed	Divorced or widowed = 1;other = 0	0.030	0.170
	Professional types	Private enterprise = 1;Individual business = 2 Enterprise of other nature = 3	1.604	0.901
	Monthly income	Natural logarithm of migrant workers' income in the past month	7.702	0.875
	Economic satisfaction	1 = Very dissatisfied;2 = Quite dissatisfied;3 = commonly;4 = Quite satisfied;5 = Very satisfied	3.207	1.029
	Family size	Number of family members living together	4.466	1.825
	Household consumption expenditure	Natural logarithm of total household consumption in the past year	10.513	0.867
	Toilet type	1 = Indoor;2 = Outdoor flushing toilet;3 = Outdoor non-flushing public toilet;4 = Outdoor non-flush toilet;5 = other	1.648	1.174
	Air pollution degree	1 = Very serious;2 = Relatively serious;3 = Not too serious;4 = It's not serious at all	3.016	0.873

URRBMI in 2018 as the experimental group, so as to establish a double difference model:

$$overwork_{ict} = \alpha_0 + \alpha_1 D_{ct} \times T_i + \alpha_2 N_{ict} + \omega_c + \delta_t + \varepsilon_{ict} \quad (1)$$

Among them, i, c and t respectively represent the surveyed migrant workers, the region where the sample is located and the visit time. The explained variable $overwork_{ict}$indicates whether migrant workers i in City c are overworked at t. If migrant workers are overworked, $overwork_{ict}$ =1, Otherwise $overwork_{ict}$ =0. The key explanatory variable$D_{ct}$of this paper indicates whether City c has implemented the URRBMI at t. If City c has implemented the URRBMI at t, then the pilot year t and subsequent years are assigned as 1, otherwise it is 0. $N_{ict}$is the vector set of a series of control variables,$\omega_c$representing regional fixed effect,$\delta_t$represents time fixed effect. The coefficient [[Inline Image]]of [[Inline Image]]is the double difference estimator concerned in this paper, which reflects the impact of URRBMI on migrant workers' overwork.

Path Analysis

In order to empirically test the impact path proposed on the theoretical basis above, the following intermediary effect model is constructed:

$$overwork_{ict} = \alpha_0 + \alpha_1 D_{ct} \times T_i + \alpha_2 N_{ict} + \omega_c + \delta_t + \varepsilon_{ict1} \quad (2)$$

$$M_{ict} = \lambda_0 + \lambda_1 D_{ct} \times T_i + \lambda_2 N_{ict} + \omega_c + \delta_t + \varepsilon_{ict2} \quad (3)$$

$$overwork_{ict} = \beta_0 + \beta_1 D_{ct} \times T_i + \beta_2 M_{ict} + \beta_3 N_{ict} + \omega_c + \delta_t + \varepsilon_{ict3} \quad (4)$$

The test ideas of mediation effect model are as follows: firstly, the model setting of equation (2) is consistent with that of equation (1), and equations (3) and (4) are further estimated based on the significant coefficient $\alpha_1$of variable $D_{ct} \times T_i$. $M_{ict}$is the intermediary variable of this paper. If the coefficient $\lambda_1$of equation (3) and the coefficient $\beta_2$of equation (4) are significant, it shows that the URRBMI has a significant impact on migrant workers' overwork through the intermediary variable. The above equation and the benchmark equation also use double difference to estimate relevant parameters. If the coefficient $\beta_1$of equation (4) is significant, it indicates that it belongs to partial intermediary. If the coefficient $\beta_1$of equation (4) is not significant, it is complete intermediary.

TABLE 3 | Benchmark regression.

Variable	Overwork (50 h)	Overwork (60 h)	Working hours	Overwork (50 h)	Overwork (60 h)	Working hours
URRBMI	−0.070**	−0.073**	−2.575*			
	(0.032)	(0.030)	(1.383)			
URRBMI × year				−0.127**	−0.144***	−8.901***
				(0.050)	(0.044)	(2.047)
Education level	−0.032***	−0.022***	−0.817***	−0.032***	−0.021***	−0.789***
	(0.003)	(0.003)	(0.134)	(0.003)	(0.003)	(0.134)
Age	−0.004***	−0.005***	−0.180***	−0.003***	−0.005***	0.176***
	(0.001)	(0.001)	(0.043)	(0.001)	(0.001)	(0.043)
Healthy	−0.004	−0.028**	−0.415	−0.003	−0.027**	−0.466
	(0.011)	(0.010)	(0.475)	(0.011)	(0.010)	(0.472)
Monthly income logarithm	0.045***	0.019*	2.384***	0.049***	0.020*	2.380***
	(0.012)	(0.011)	(0.508)	(0.012)	(0.011)	(0.505)
Toilet type	0.005	0.004	−0.980**	0.001	0.004	−1.027**
	(0.011)	(0.010)	(0.461)	(0.011)	(0.010)	(0.460)
Economic satisfaction	−0.017*	−0.010	−0.652*	−0.019**	−0.011	−0.638
	(0.009)	(0.009)	(0.395)	(0.009)	(0.009)	(0.393)
Air pollution degree	−0.001	−0.006	−0.552	−0.001	−0.006	−0.484
	(0.011)	(0.010)	(0.462)	(0.011)	(0.010)	(0.460)
Household consumption expenditure	−0.029 **	−0.010	−0.670	−0.028**	−0.010	−0.627
	(0.012)	(0.011)	(0.499)	(0.012)	(0.011)	(0.498)
Nation	−0.051	−0.037	−3.868*	−0.050	−0.037	−3.871*
	(0.049)	(0.045)	(2.037)	(0.049)	(0.045)	(2.035)
Married	−0.017	0.010	−0.778	−0.023	0.012	−0.704
	(0.039)	(0.037)	(1.699)	(0.039)	(0.037)	(1.689)
Divorced or widowed	−0.042	0.005	0.320	−0.034	0.013	0.376
	(0.074)	(0.071)	(3.204)	(0.075)	(0.072)	(1.690)
Gender	0.065***	0.028	0.960	0.062***	0.026	0.776
	(0.019)	(0.018)	(0.823)	(0.019)	(0.018)	(0.820)
Family size	0.011**	−0.000	0.173	0.010*	−0.006	0.110
	(0.005)	(0.000)	(0.231)	(0.005)	(0.005)	(0.230)
Professional types	0.010	0.034***	−0.042	0.112	0.041***	0.153
	(0.010)	(0.009)	(0.438)	(0.010)	(0.009)	(0.153)
Control variables	controlled	controlled	controlled	controlled	controlled	controlled
Pseudo R^2/R^2	0.0582	0.0448	0.0522	0.0568	0.0444	0.0539
Sample size	3087	3087	3087	3087	3087	3087

*Standard errors are in parentheses; *, ** and *** means passing the test at the significance levels of 10%, 5%, and 1%, respectively. Except for labor time, all other reports are probit marginal effect.*

RESULTS

Benchmark Regression

Firstly, this paper uses the binary choice model probit to estimate the impact of URRBMI on migrant workers' overwork. Considering that the regression results are only statistically significant in significance and impact direction, **Table 3** reports the average marginal effect of each variable on the impact of migrant workers' overwork. It can be seen from **Table 3** that whether the weekly working hours of migrant workers exceed the 50 h standard or the 60 h standard, the URRBMI can significantly alleviate the phenomenon of migrant workers' overwork, especially under the 60 h standard, the mitigation effect of URRBMI on migrant workers' overwork is more significant. Specifically, under the 50 h standard, the impact of URRBMI on migrant workers' overwork is significantly negative at the level of 5%, indicating that participating in URRBMI reduces the probability of migrant workers' overwork by 7%. Under the 60 h standard, URRBMI can also significantly reduce the probability of migrant workers' overwork. In addition to the analysis of whether overwork is used as the explained variable, this paper further takes the labor time of migrant workers as the explained variable, and uses the fixed effect empirical test to test the impact of the URRBMI on the labor time of migrant workers. **Table 3** shows that the URRBMI can reduce the weekly working hours of migrant workers

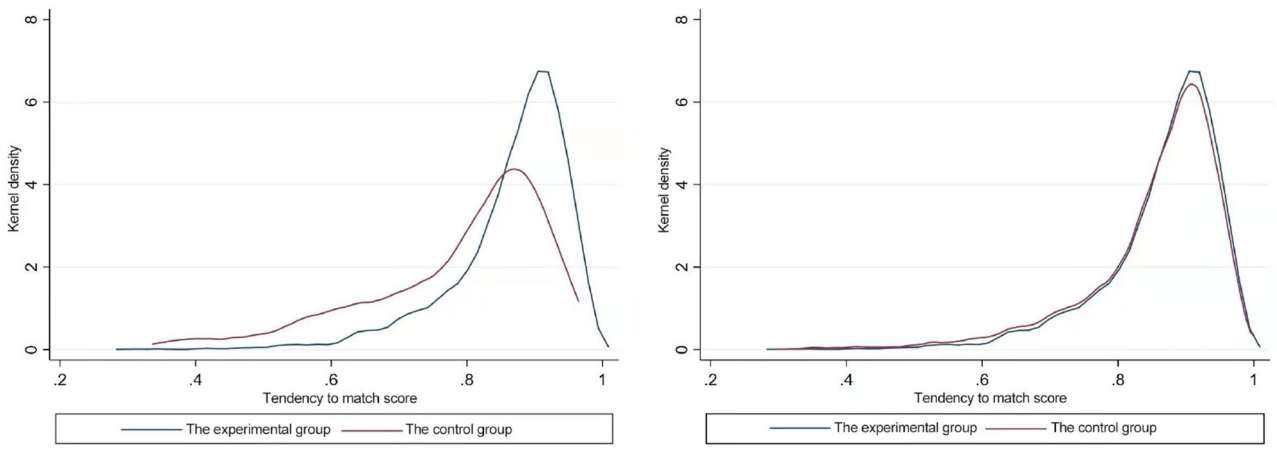

FIGURE 4 | Kernel density function before and after propensity score matching of urban-rural medical insurance integration.

by 2.575 h, which is significant at the level of 10%. This is consistent with the above estimation results, which shows that the URRBMI can not only significantly reduce the labor time of migrant workers, but also alleviate the excessive labor of migrant workers.

Secondly, according to the setting of the above double difference model, this paper uses the double difference model to further investigate the impact of URRBMI on migrant workers' overwork, which is also the core method of the empirical test. **Table 3** results show that taking the 60 h standard as an example, the impact of the cross term of URRBMI and year on migrant workers' overwork is significant at the level of 1%, with a coefficient of −0.144, indicating that participating in URRBMI will significantly reduce the probability of migrant workers' overwork. From the results of labor time regression equation, the coefficient of double difference is −8.901, which is significant at the level of 1%, indicating that participating in URRBMI will significantly reduce the labor time of migrant workers and reduce their weekly labor time by about 8.9 h. Compared with the previous probit regression results, the negative impact of URRBMI on migrant workers' overwork and working time is significantly increased. To sum up, the URRBMI has significantly reduced the labor time of migrant workers, reduced their probability of overwork, and improved the welfare of migrant workers.

Robustness Check

Based on the previous empirical analysis, it is found that the URRBMI can significantly alleviate migrant workers' overwork. In order to reduce the error and ensure the robustness of the results, this paper uses PSM-DID model to re estimate. The most important and key premise for the application of the double difference method: the control group and the control group must meet the common trend hypothesis, that is, if they are not affected by the URRBMI, there is no systematic difference over time in migrant workers' overwork. However, in view of the actual situation of migrant workers' excessive labor, there are still endogenous problems caused by sample selection errors, which is difficult to meet the common trend hypothesis. In this paper, the double differential propensity score matching method (PSM-DID) proposed by Heckman et al. (26) can effectively alleviate this problem. The basic idea is to match the individuals with similar propensity scores in the control group, remove the selective errors caused by non-randomness, so that the screened samples are only different in terms of excessive labor, and other characteristic variables are as similar as possible, so as to obtain the net effect of the URRBMI on the impact of excessive labor of migrant workers.

It should be noted that in order to ensure the effectiveness of propensity score matching, we first need to test the common support and balance hypothesis. **Figure 4** is a test result of the common support hypothesis using the kernel density function method. From the nuclear density function diagram before matching, it can be seen that there are obvious differences in the nuclear density function curves between the experimental group and the control group, and there are enough overlaps, indicating that they meet the common support hypothesis. The nuclear density function curves of the matched experimental group and the control group are in good agreement, indicating that the test of the balance hypothesis is satisfied after the propensity score matching. **Table 4** further proves that there is no significant difference in covariate characteristics between the two groups after matching, indicating that PSM model is reasonable.

Table 4 reports the balance test results of propensity score matching. It can be seen from **Table 4** that after propensity score matching, the distribution of covariates in the treatment group and the control group has been relatively balanced, and the difference is no longer significant. Specifically, the absolute value of covariate standardization deviation in the matched treatment group and control group is <10%. The results of *t*-test also show that there is no significant difference between the two groups. Therefore, it can be considered that the sample data in this paper are suitable for estimation by PSM-DID method, and the conclusion is reliable.

TABLE 4 | Balance test results.

Variable	Sample	Mean		Standardization deviation		T statistic
		Control group	Treatment group	Standardization deviation	Bias%	
Education level	Before matching	8.648	9.079	14.0	96.9	2.63
	After matching	8.958	9.079	−0.4		−0.16
Age	Before matching	42.28	42.168	−1.1	−400.5	−0.20
	After matching	41.59	42.168	5.4		1.97
Healthy	Before matching	3.812	3.838	3.0	−51.4	0.59
	After matching	3.878	3.838	−4.5		−1.66
Monthly income logarithm	Before matching	7.488	7.752	29.7	93.8	6.02
	After matching	7.736	7.752	1.8		0.70
Toilet type	Before matching	2.062	1.493	−46.3	96.1	−10.15
	After matching	1.471	1.493	1.8		0.77
Economic satisfaction	Before matching	3.201	3.207	0.5	−32.9	0.10
	After matching	3.200	3.207	0.7		0.25
Air pollution degree	Before matching	3.181	2.920	−30.7	97.8	−5.93
	After matching	2.926	2.920	−0.7		−0.24
Household consumption expenditure	Before matching	10.4	10.586	23.9	74.8	4.46
	After matching	10.539	10.586	6.0		2.17
Nation	Before matching	0.905	0.962	23.3	73.6	5.42
	After matching	0.947	0.962	6.1		2.65
Married	Before matching	0.949	0.910	−15.4	49.9	−2.79
	After matching	0.890	0.910	7.7		2.39
Divorce or widowhood	Before matching	0.015	0.019	2.9	−76.9	0.56
	After matching	0.013	0.019	5.2		1.98
Gender	Before matching	0.613	0.571	−8.4	91.8	−1.65
	After matching	0.575	0.571	−0.7		−0.25
Professional types	Before matching	1.752	1.565	−20.5	71.6	−4.13
	After matching	1.617	1.565	−5.8		−2.17
Family size	Before matching	4.527	4.410	−6.6	−17.3	−1.26
	After matching	4.274	4.410	7.7		2.82
Year	Before matching	2017.1	2017	−5.3	9.0	−1.05
	After matching	2017	2017	4.9		1.76
Province	Before matching	2.000	1.600	16.6	77.9	3.16
	After matching	2.000	2.100	−3.7		−1.29

After the common support and balance hypothesis test, this paper makes a double difference on the matched samples. Results as shown in **Table 5**, the URRBMI can still significantly alleviate the excessive labor of migrant workers under either the 50 h standard or the 60 h standard, and its impact coefficient is slightly higher than the benchmark estimation results above. In terms of working hours, after migrant workers participate in the URRBMI, their weekly working hours are reduced by about 8.66 h. To sum up, the URRBMI can significantly reduce the working hours of migrant workers and alleviate their overwork.

Heterogeneity Analysis

Migrant Workers of Different Generations

Previous studies have shown that age is an important factor affecting migrant workers' overwork. There are significant differences between the old generation of migrant workers and the new generation of migrant workers in education level, cultural pursuit and economic pressure, which will directly affect whether they overwork. Therefore, according to the year of birth, this paper takes the samples born after 1980 as the new generation of migrant workers, and those born before 1980 are divided into the old generation of migrant workers, and then estimates the impact of URRBMI on the Overwork of migrant workers in the two sub samples. Results as shown in **Table 6**, the URRBMI has significantly reduced the Overwork probability of the older generation of migrant workers by 22.5 and 17.6%, and reduced their weekly working hours by about 9.03 h, both significantly at the level of 1%. The URRBMI has no significant impact on the overwork and working time of the new generation of migrant workers.

Migrant Workers in Different Regions

According to the respondents' region, this paper divides all samples into eastern, central and western regions to test the

TABLE 5 | Double differential propensity score matching (PSM-DID).

Variable	Overwork (50 h standard)	Overwork (60 h standard)	Working hours
URRBMI × Year	−0.145***	−0.151***	−8.658***
	(0.051)	(0.045)	(2.194)
Control variables	Controlled	Controlled	Controlled
Pseudo R^2/R^2	0.061	0.052	0.057
Sample size	3,012	3,012	3,012

*Standard errors are in parentheses; *, ** and *** means passing the test at the significance levels of 10%, 5%, and 1%, respectively. Except for labor time, all other reports are probit marginal effect.*

impact of URRBMI on migrant workers' overwork in different regions. Results as shown in **Table 6**, the URRBMI has a significant negative impact on the overwork and working time of migrant workers in the central and western regions. Taking the 60 h standard as an example, migrant workers in the central and western regions participated in URRBMI, which reduced the probability of overwork by 21% and the weekly working hours by 15.93 h, which was significant at the level of 1%. For migrant workers in the eastern region, the URRBMI can only reduce their weekly working hours by 7.88 h, which is significant at the level of 10%, but the impact on migrant workers' overwork in the eastern region is not significant.

Migrant Workers in Different Industries

According to the industry type of respondents, the sample of migrant workers engaged in mining, manufacturing and construction will be taken as the secondary industry, and the samples engaged in wholesale and retail trade, catering and other industries are divided into migrant workers engaged in the tertiary industry. Then this paper estimates the impact of URRBMI policy on the overwork of migrant workers in different industries. As shown in **Table 6**, URRBMI policies can significantly reduce the probability of overwork of migrant workers in different industries. Specifically, URRBMI policy significantly reduced the probability of overwork of migrant workers in the secondary industry by 18.2 and 54.0% respectively, and the weekly working hours were reduced by about 10.51 h, both significantly at the level of 5%. URRBMI policy also significantly reduced the probability of overwork of rural migrant workers in the tertiary industry by 15.0 and 23.0% respectively, and reduced the weekly working hours by about 8.29 h.

Migrant Workers With Different Levels of Education

Referring to Susanna et al. (27) research, this paper divides all migrant workers into samples with high education level and low education level according to whether they have received junior high school education or not, and tests the influence of URRBMI policy on overwork of migrant workers with different education levels. The results are shown in **Table 6**, URRBMI policy can significantly reduce the probability of overwork of migrant workers with high education levels by 20.9 and 15.5% respectively, and weekly working hours by about 13.12 h. For migrant workers with low education levels, the URRBMI policy also significantly reduced the probability of overwork by 13.1 and 14.2% respectively, and reduced weekly working hours by about 7.15 h.

IMPACT PATH ANALYSIS

According to the previous analysis of the impact mechanism, this paper expects that the URRBMI may affect the Overwork of migrant workers through the following two paths: First, the URRBMI can effectively reduce the probability of migrant workers' overwork by improving their sense of social integration. Identity is the degree to which people accept their status, roles, images and relationships with others in society (28). As a special group under the arrangement of the household registration system, migrant workers in China are subject to institutional discrimination due to their departure from their occupation and identity, which leads to the dilemma of their identity. Fair and reasonable design of political system and distribution of public rights have become important ways to improve the identity of migrant workers (29). Therefore, in this paper, the questionnaire "whether you participated in the last neighborhood committee vote" is used as the measurement index of social identity, no vote is assigned 0, and participation in voting is assigned 1. Second, the URRBMI will reduce the time of overwork by improving the health status of migrant workers. The health status variable is measured by "Have you had physical pain in the past month?" in the personal questionnaire. According to the model set above, this part tests the above influence paths step by step according to the mediation effect causal step method (30).

Table 7 shows the regression results of the intermediary effect model constructed with "identity" and "health level" as intermediary variables. Among them, the cross item of URRBMI and year represents the net effect of URRBMI on migrant workers' overwork. As can be seen from **Table 7**, the impact coefficient of the cross item of URRBMI and year on migrant workers' identity is significant at the level of 5%, indicating that URRBMI helps to improve migrant workers' identity. After adding the intermediary variable "identity" into the regression equation, the impact coefficient of URRBMI on migrant workers' overwork is smaller than that without controlling the intermediary variable, and the impact of identity on migrant workers' overwork is significant at the level of 1%. It shows that the mitigation effect of URRBMI on migrant workers' overwork is partly through improving their sense of identity, which is basically consistent with the previous mechanism analysis. From the perspective of the impact mechanism of "health level," the URRBMI plays a significant role in improving the health level of migrant workers at the 5% level. Similarly, after the intermediary variable "health level" is added to the regression equation, the impact of URRBMI and health level on migrant workers' overwork is significant at the 1% level, indicating that URRBMI alleviates migrant workers' overwork by improving migrant workers' health status. To sum up, the URRBMI reduces the probability of migrant workers' overwork by improving their social identity and health level.

TABLE 6 | Heterogeneity analysis.

Different generations	**Older generation of migrant workers**			**New generation of migrant workers**		
Variable	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**
URRBMI × year	−0.225***	−0.176***	−9.025***	0.097	0.006	−3.023
	(0.062)	(0.052)	(3.001)	(0.110)	(0.101)	(6.267)
Constant term			−23.515			165.142
			(71.655)			(102.246)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	2206	2206	2206	881	881	881
Pseudo R^2/R^2	0.058	0.049	0.074	0.104	0.094	0.181
Different regions	**Eastern region**			**Central and Western regions**		
Variable	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**
URRBMI × year	−0.091	−0.087	−7.884*	−0.193***	−0.210***	−15.928**
	(0.081)	(0.068)	(4.238)	(0.060)	(0.059)	(5.400)
Constant term			−14.055			219.672
			(37.446)			(162.790)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	2,074	2,074	2,074	1,013	1,013	1,013
Pseudo R^2/R^2	0.085	0.042	0.061	0.075	0.085	0.156
Different industries	**The second industry**			**The third industry**		
Variable	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**
URRBMI × year	−0.182**	−0.540**	−10.506**	−0.150**	−0.230***	−8.293**
	(0.076)	(0.224)	(4.758)	(0.068)	(0.078)	(3.140)
Constant term			76.654			61.846
			(108.162)			(14.901)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	2,037	2,037	2,037	1,050	1,050	1,050
Pseudo R^2/R^2	0.052	0.069	0.073	0.079	0.064	0.148
Different levels of education	**Junior high school the following**			**Junior high school above**		
Variable	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**	**Overwork (50 h)**	**Overwork (60 h)**	**Working hours**
URRBMI × year	−0.131**	−0.142***	−7.148**	−0.209**	−0.155*	−13.120**
	(0.062)	(0.053)	(3.487)	(0.100)	(0.087)	(6.481)
Constant term			3.096			−74.103
			(85.668)			(124.297)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	2,315	2,315	2,315	772	772	772
Pseudo R^2/R^2	0.078	0.059	0.108	0.070	0.074	0.235

*Standard errors are in parentheses; *, ** and *** means passing the test at the significance levels of 10%, 5%, and 1%, respectively. Except for labor time, all other reports are probit marginal effect.*

DISCUSSION

The implementation of URRBMI policy has narrowed the difference between urban and rural medical security and provided institutional guarantee for protecting the health rights and interests of migrant workers. Firstly, this paper theoretically expounds the relationship between the URRBMI and migrant workers' excessive labor. At the same time, using the survey data of China labor force dynamic survey (CLDS), this paper empirically tests the impact of URRBMI on migrant workers' overwork. The results show that the URRBMI can significantly reduce the labor time of migrant workers and reduce the probability of overwork. Although previous studies did not directly evaluate the impact of the URRBMI on the labor supply of migrant workers, some studies tested the impact of urban workers' medical insurance and other forms of public medical

TABLE 7 | Impact path of URRBMI on migrant workers' overwork.

	Overwork	Sense of identity	Level of health	Overwork
URRBMI × year	−0.729***	0.156**	0.454**	−0.145***
	(0.223)	(0.067)	(0.229)	(0.045)
Sense of identity				−0.071***
				(0.194)
Level of health				−0.039***
				(0.014)
Control variables	Controlled	Controlled	Controlled	Controlled
Sample size	2,730	2,730	2,730	2,730
Pseudo R^2/R^2	0.053	0.127	0.097	0.057

*Standard errors are in parentheses; *, ** and *** means passing the test at the significance levels of 10%, 5%, and 1%, respectively. Except for labor time, all other reports are probit marginal effect.*

care on migrant workers' excessive labor from the perspective of health rights and interests (6). The conclusion is consistent with the results of this paper. On the one hand, the URRBMI policy improves the sense of identity and social integration of migrant workers by eliminating the barriers to health rights and interests in urban and rural China, thus reducing their probability of overwork. On the other hand, the implementation of URRBMI policy enables migrant workers to enjoy the same medical services as urban residents, reduces their preventive labor supply, and improves their labor supply efficiency by improving their health conditions, so that migrant workers do not have to work overtime to increase their income.

Secondly, the heterogeneity analysis shows that the URRBMI can significantly alleviate the Overwork of the old generation of migrant workers, but has no significant impact on the new generation of migrant workers. Compared with the new generation of migrant workers, long-term high-intensity labor has seriously damaged the health of the older generation of migrant workers. Meanwhile, the physical function of the older generation of migrant workers is declining with the increase of age. The older generation of migrant workers are facing greater health risks, leading to the extension of working hours to obtain more income. The implementation of URRBMI policy can reduce the medical burden of the older generation of migrant workers, reduce the income fluctuation caused by health risks, and thus reduce their excessive working hours. Between different regions, Considering the obvious differences in the level of economic development, the proportion of medical insurance reimbursement and the acceptance of migrant population in different regions of China, the impact of URRBMI on migrant workers' overwork in different regions may be heterogeneous. The study found that the URRBMI can effectively alleviate the Overwork of migrant workers in the central and western regions, but it has no impact on the Overwork of migrant workers in the eastern region. The reason for this phenomenon is that the level of economic development in the eastern region is high, and the phenomenon of migrant workers working overtime is common in this region, resulting in the fact that the URRBMI does not significantly alleviate their excessive labor, but the labor intensity in the central and western regions is less than that in the eastern region, and there are fewer overtime in daily work, Therefore, when impacted by the policy of URRBMI, the probability of overwork decreases significantly (31).

In addition to the above heterogeneity, the impact of the URRBMI policy on the overwork of migrant workers will be heterogeneous due to the different industry types of migrant workers. It is found that the policy of URRBMI has a greater alleviating effect on migrant workers in the secondary industry than in the tertiary industry. The possible reason is that for migrant workers engaged in traditional secondary industries (such as construction and manufacturing), the relatively poor working environment and long-term heavy physical labor have seriously damaged their health status, making their health human capital far inferior to migrant workers engaged in the tertiary industry. At the same time, the education level of migrant workers in the secondary industry is generally not high, and the corresponding positions have strong substitution, which makes the vocational mobility of migrant workers in the tertiary industry greater, the wage level is generally low, and the lack of social security provided by employers, resulting in the phenomenon of excessive labor of migrant workers in the secondary industry more serious. Therefore, the URRBMI policy has significantly improved the medical accessibility and health status of migrant workers in the secondary industry, making the probability of overwork of migrant workers in the secondary industry more obvious. At the same time, this paper further tests the impact of the URRBMI policy on the overwork of migrant workers with different education levels. The results show that the URRBMI policies can significantly alleviate the overwork of migrant workers with different educational levels, and the effect on overwork of migrant workers with higher educational levels is more significant. The possible reason is that the higher the education level of migrant workers, the more they understand about the policy setting of URRBMI, and the better they can enjoy the welfare brought by the policy. Compared with migrant workers with low education level, they are not willing to spend more time and energy to participate in the URRBMI (32). Therefore, the URRBMI policy has a more significant effect on alleviating the overwork of migrant workers with high education level. Finally, there are few existing studies to explore the impact path of medical insurance on migrant workers' labor supply. Therefore, this paper further explores the impact of URRBMI on migrant workers' excessive labor from the perspectives of health level and identity. The results show that health level and identity play a partial intermediary role between the URRBMI and migrant workers' overwork.

CONCLUSION

It is worth noting that the econometric method used in this paper can only reflect the impact of URRBMI on migrant workers' excessive labor from the sample as a whole, and determine the causal relationship between URRBMI and migrant workers' excessive labor. It is impossible to deeply explore whether each sample can alleviate its excessive labor after participating in

URRBMI (33). In the future, we can further use the method of case analysis to analyze the individual differences of the impact of URRBMI on migrant workers' overwork. At the same time, due to the inconsistent implementation progress of the policy in various cities in China, there are differences in the integration mode, financing level and medical insurance treatment of the policy. However, limited by the survey data, it is difficult to carry out in-depth analysis from the details of the policy, and only the comprehensive impact of the overall planning policy can be analyzed. Therefore, the follow-up research can analyze the impact of URRBMI on migrant workers' labor supply from the perspective of different integration models, and reveal the deep-seated institutional factors behind it.

Most importantly, some policy implications can be derived from the empirical analysis. Migrant workers' long-term excessive labor behavior has seriously damaged their physical and mental health and reduced China's potential labor dividends. The implementation of URRBMI policy can significantly alleviate the excessive labor of migrant workers. Therefore, the government should accelerate the progress of medical insurance integration and expand the scope of medical insurance integration. At present Chinese health care has not been implemented nationwide transferring and carry, this is the main shackles of employment locking and work chains effect, only a completely dismantle free movement of Labor barriers and improve the efficiency of labor element configuration, to further promote the migrant workers' income, as much as possible to reduce the excessive labor possible. Second, improve the medical security system and strengthen the welfare protection of vulnerable groups. In particular, we should pay attention to coordinated regional development, give more preferential policies to regions with relatively backward economic development, and strengthen external financial support to narrow the gap between different regions. Finally, the popularization and publicity of public medical information should be strengthened to guide migrant workers to make reasonable diagnosis and treatment, so as to reduce migrant workers' blind dependence on medical treatment and the probability of unnecessary diagnosis and treatment, thus reducing migrant workers' medical expenses and improving their serious overwork situation.

DATA AVAILABILITY STATEMENT

The datasets China labor force dynamic survey (CLDS) presented in this article are not readily available because the ownership and copyright of the data belong to Sun Yat-sen University. The authors ZX and BL have applied to Sun Yat-sen University and have been approved. We have the right to use this database, but we have not obtained the ownership and copyright of the data, so we can't upload and publish this data. Requests to access the dataset should be directed to http://css.sysu.edu.cn. The data will be available after the application is approved.

AUTHOR CONTRIBUTIONS

ZX is responsible for research design, data processing, model design, and text writing. BL has made great contributions in the process of article conception and revision, including the improvement of analysis framework and the application of methods, and provided project support. Both authors contributed to the article and approved the submitted version.

FUNDING

This study was supported by the Zhejiang Provincial Social Science Foundation of China under Grant No. 20NDQN299YB, the Zhejiang Provincial Natural Science Foundation of China under Grant No. LQ20G030004, and the Fundamental Research Funds for the Provincial Universities of Zhejiang under the Grant No. 2020YQ012.

ACKNOWLEDGMENTS

The authors thank the social science investigation center of Sun Yat-sen University for providing the datasets and code book for data analysis of CLDS. Thanks to reviewers for their comments and suggestions which helped improve the manuscript.

REFERENCES

1. Sun ZW, Huang JW. Overtime dependence system: a further probe into the problem of excessive overtime of young migrant workers. *China Youth Study*. (2021) 8:5–13. doi: 10.19633/j.cnki.11-2579/d.2021.0123
2. Otsui, K, Yamamoto J, and Inoue N. Overwork accelerates thrombotic reaction: implications for the pathogenesis of Karoshi. *J Thromb Thrombolysis*. (2018) 45:222–4. doi: 10.1007/s11239-017-1605-y
3. Yi FJ, Gu HQ. The impact of discriminatory reimbursement rates of new cooperative medical scheme to rural labor mobility. *China Rural Survey*. (2015) 3:2–15.
4. Jia N, Ma JL. Lock-in effect of non-portable medical insurance on rural labor mobility. *Manage World*. (2015) 9:82–91.
5. Lai S, Shen C, Xu YJ, Yang XW, Si YF, Gao JM, et al. The distribution of benefits under China's new rural cooperative medical system: evidence from western rural China. *Int J Equity Health*. (2018) 17:137. doi: 10.1186/s12939-018-0852-7
6. Deng, R. The availability of health rights and labor supply of migrant workers: evidence from dynamic monitoring of migrant population. *China Rural Econ*. (2019) 4:92–110. Available online at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=ZNJJ201904007&DbName=CJFQ2019
7. Ma C, Zhao GC, and Gu H. The effect of urban-rural integrated medical insurance system on rural residents' health care behavior. *Stat Res*. (2016) 33:78–85. doi: 10.19343/j.cnki.11-1302/c.2016.04.011
8. Hong HQ, Ning MX. Does benefit portability of health insurance mitigate the job-lock effect on rural labor force?—quasi-natural experimental study on integrated medical insurance system. *J Agric Econ*. (2020) 11:83–95. doi: 10.13246/j.cnki.jae.2020.11.007
9. Qin LJ, Chen CP, Wang W, Chen H. How migrants get integrated in urban China-The impact of health insurance. *Soc Sci Med*. (2021) 272:113700. doi: 10.1016/j.socscimed.2021.113700
10. Kang X, Du M, Wang S, Du H. Exploring the Effect of Health on Migrants' Social Integration in China. *Int J Environ Res Public Health*. (2022) 19:4729. doi: 10.3390/ijerph19084729

11. Huang X, Wu B. Impact of urban-rural health insurance integration on health care: Evidence from rural China. *China Economic Rev.* (2020) 64:101543. doi: 10.1016/j.chieco.2020.101543
12. Guo FM. The changes of migrant workers'overwork and its influencing factors. *Popul J.* (2020) 42:98–112. doi: 10.16405/j.cnki.1004-129X.2020.05.008
13. Akerlof GA, Kranton RE. (2010). *Identity Economics*. Princeton: Princeton University Press.
14. Reed AII. Social identity as a useful perspective for self-concept–based consumer research. *Psychol Mark.* (2002) 19:235–66. doi: 10.1002/mar.10011
15. Mao D. Empowerment, interaction and identity: suburban farmers' urbanization under the perspective of role theory. *Sociol Studies.* (2009) 24:28–60. doi: 10.19934/j.cnki.shxyj.2009.04.002
16. Teresa C, Christian D. Immigrants' identity, economic outcomes and the transmission of identity across generations. *Econ J.* (2010) 120:31–51. doi: 10.1111/j.1468-0297.2009.02336.x
17. Sun WK, Wang GF. Social identity,overworkand urban-rural difference of migrant workers. *Econ Perspect.* (2020) 9:96–110. Available online at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=JJXD202009007&DbName=CJFQ2020
18. Low HW. Self-insurance in a life-cycle model of labour supply and savings. *Rev Econ Dyn.* (2005) 8:945–75. doi: 10.1016/j.red.2005.03.002
19. Wang YB. Health uncertainty and precautionary labor supply in rural areas of China. *J Financ Econ.* (2009) 35:96–106. doi: 10.16538/j.cnki.jfe.2009.04.004
20. Shen Z, Parker M, Brown D , Fang XM. Effects of public health insurance on labor supply in rural China. *China Agric Econ Rev*. (2017) 9:623–42. doi: 10.1108/CAER-12-2016-0194
21. Grossman EL. On the concept of health capital and the demand for health. *J Polit Econ*. (1972) 80:223–55. doi: 10.1086/259880
22. Nga L, Wim G, Sonila MT, Florian T. Effects of health insurance on labour supply: a systematic review. *Int J Manpow*. (2019) 40:717–67. doi: 10.1108/IJM-02-2018-0038
23. Wu WP, Yan JJ, Chen YH, Wang ZJ, Lin YR. Has environmental policy improved the job quality of migrant workers? A quasi-natural experiment on China's Clean Air Action. *J Clean Prod.* (2022) 347:131231. doi: 10.1016/j.jclepro.2022.131231
24. Wu WJ, Chen YY, Stephens M, Liu Y. Long working hours and self-rated health: Evidence from Beijing, China. *Cities.* (2019) 95:102401. doi: 10.1016/j.cities.2019.102401
25. Chang X, Su Q, Xie HR. The influence of urban and rural medical insurance system on the medical burden of residents—based on the difference in urban and rural areas. *J Guizhou University Finance Econ.* (2021) 2:80–90. Available online at: https://kns.cnki.net/kcms/detail/52.1156.F.20210322.1419.004.html
26. Heckman JJ, Ichimura H, Todd PE. Matching as an econometric evaluation estimator: evidence from evaluating a job training programme. *Rev Econ Stud.* (1997) 64:605–54. doi: 10.2307/2971733
27. Susanna M, Massimiliano M, Nora P, Giovanni P. Education, reputation or network? Evidence on migrant workers employability. *JSeD.* (2010) 39:64–71. doi: 10.1016/j.socec.2009.08.002
28. John H. In defence of associative political obligations: part two. *Polit Stud.* (2007) 55:10. doi: 10.1111/j.1467-9248.2007.00642.x
29. Brubaker, R, Cooper F. "Beyond 'Identity'". *Theory and Society*. (2000) 29:1–47. Available online at: http://www.jstor.org/stable/3108478
30. Wen ZL, Ye BJ. Analyses of mediating effects: the development of methods and models. *Adv Psychol Sci.* (2014) 22:731–45. doi: 10.3724/SP.J.1042.2014.00731
31. Wang YJ, Shi JL, Yao Y, Sun WK. The impact of health insurance on job location choice: Evidence from rural China. *J Comp Econ.* (2022) 50:569–83. doi: 10.1016/j.jce.2022.01.001
32. Li XF, Yang Ha, Wang H, Liu XJ. Effect of health education on healthcare-seeking behavior of migrant workers in China international. *J Environ Res Public Health.* (2020) 17:7–2344. doi: 10.3390/ijerph17072344
33. Li BW, Xu CY, Zhu Z, Kong FB. Does e-commerce drive rural households engaged in non-timber forest product operations to adopt green production behaviors? *J Clean Prod.* (2021) 320:128855. doi: 10.1016/j.jclepro.2021.128855

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 17 August 2022
DOI 10.3389/fpubh.2022.934237

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 02 May 2022
ACCEPTED 01 July 2022
PUBLISHED 17 August 2022

CITATION
Zong D, Lu Z, Shi X, Shan Y, Li S and Kong F (2022) Mediating effect of family support on the relationship between acculturation and loneliness among the migrant elderly following children in Jinan, China. *Front. Public Health* 10:934237. doi: 10.3389/fpubh.2022.934237

Mediating effect of family support on the relationship between acculturation and loneliness among the migrant elderly following children in Jinan, China

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The total number of migrant elderly following children (MEFC) has gradually increased along with population aging and urbanization in recent decades in China. The purpose of this study was to investigate the mediating effect of family support on the relationship between acculturation and loneliness among the MEFC in Jinan, China. A total of 656 MEFC were selected by multistage cluster random sampling. Loneliness was measured using the short-form UCLA Loneliness Scale (ULS-8), while acculturation and family support were assessed using a self-designed questionnaire. Descriptive analysis, univariate analysis, and the structural equation model (SEM) were conducted to illustrate the relationship between the above indicators and loneliness. The average ULS-8 score of the MEFC was 12.82 ± 4.05 in this study. Acculturation of the MEFC exerted a negatively direct effect on loneliness and a positively direct effect on family support simultaneously, while family support exerted a negatively direct effect on loneliness. Family support partially mediated the relationship between acculturation and loneliness [95% CI: −0.079 to 0.013, $p < 0.001$], while the mediating effect of family support accounted for 14.0% of the total effect. The average ULS-8 score of 12.82 ± 4.05 implied a low level of loneliness in the MEFC in Jinan, China. Acculturation was found to be correlated with loneliness, while the mediating role of family support between acculturation and loneliness was established. Policy recommendations were provided to reduce loneliness and improve the acculturation and family support of the MEFC according to the findings above.

KEYWORDS

loneliness, acculturation, family support, migrant elderly following children, mediating effect

Introduction

As the population has aged and urbanization has increased in recent decades, the number of migrant elderly has increased in China (1). According to the data of the Seventh National Population Census of China conducted in 2020, there were 375 million migrants, with a 70% increase seen over the past decade. Among them, 124 million were inter-provincial and 251 million were intra-provincial (2). Meanwhile, the proportion of the elderly among the migrant population in China continually increased from 4.9% in 2000 to 5.3% in 2015 (3). Among the significant number of the migrant elderly in China, those who migrated from their original residence following their children to another city in China in order to take care of the younger generation or to receive healthcare services were defined as the migrant elderly following children (MEFC) (4). The MEFC left their hometowns where they had lived for a long time and migrated to unfamiliar cities. The new living environment of the inflow cities may cause various problems for the MEFC, such as lifestyle changes, shrinkage of social networks, and unfamiliarity with local languages. These problems could also lead to physical discomfort, less social participation, lower acculturation, loneliness, and other mental health problems. The MEFC have thus become a vulnerable group in China's fast economic and social development and deserve more focus and research (5).

Peplau and Perlman suggest the following definition for loneliness: "loneliness is a painful feeling, usually a feeling that one's social needs are not met by the quantity or quality of one's social relationships, especially the quality (6, 7)." According to previous research, the level of loneliness increased with age among the elderly, especially those over 70 years old (8, 9). Tao's research revealed that the MEFC are more likely to feel loneliness in a new environment, which further affects their interpersonal relationships (10). Chinese immigrants in Canada were found to be lonely in Tam and Neysmith's study because their dependent children were unable to provide them with enough emotional support (11). In addition, a study on immigrants to Canada found that second-generation immigrants were lonelier than native-born Canadians (12).

Redfield defined the concept of acculturation as follows: "Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups" (13). Studies have shown that the MEFC would face acculturation problems, including language, diet, customs, values, religious beliefs, etc. (14), while low levels of acculturation could further lead to high levels of loneliness (15, 16). Research among elderly immigrants in New Zealand reported that the challenges of loneliness for older immigrants stemmed from problems with culture, language, etc. (17). One study among migrant children in China found that migrant children with low levels of acculturation and social acceptance might experience greater stress and loneliness (18). Although previous studies have explored the relationship between acculturation and loneliness among elderly immigrants and migrant children, there is no research that has examined this association among the MEFC.

The loneliness experienced by the elderly in China is mainly affected by family support from spouses or children, etc. (19). A review by Bai described how harmonious family relationships could enable the MEFC to obtain reliable emotional support and avoid loneliness (20). A further study found that the disabled elderly with high levels of family support had lower levels of loneliness in Tangshan, China (21). It was also found that good family support could lead to better care and could reduce the loneliness of the elderly in Shanghai, China (22). A survey of elderly people in rural Anhui Province, China found that there was a high degree of loneliness, and social and family support played an important role in the development process of loneliness (23). Family support was also confirmed to play an important role in alleviating loneliness among older adults in a study of elderly Malaysians (24). High levels of family support were observed to be capable of preventing the loneliness of patients with cancer in Turkey (25). Although there have been studies on the relationship between family support and loneliness, there are relatively few studies on the MEFC.

Concerning the relationship between acculturation and family support, the existing research has generally found that family support increased with acculturation. Jewell's study revealed that higher acculturation led to higher family support among Mexican American women (26). One study of Chinese American older adults showed that good family support and cohesion could promote their acculturation (27). In addition, previous studies revealed that higher acculturation of children would lead to lower family support of their parents (28). Perez-Brena's research found that it might be easier for young immigrants to integrate into the local area than their parents and they accordingly had a higher degree of acculturation which would lead to differences in cultural values between young immigrants and their parents resulting in lower family support for the migrant elderly (29). Relatively few studies have investigated the association between acculturation and family support and we are not aware of any studies that have examined this relationship among the MEFC.

No research could be found to clarify the relationship between acculturation, family support, and loneliness

Abbreviations: MEFC, Migrant elderly following children; ULS-8, the short-form UCLA Loneliness Scale (ULS-8) the short-form UCLA Loneliness Scale; SEM, structural equation model; χ^2, Chi-square; GFI, Goodness of Fit Index; AGFI, Adjusted Goodness of Fit Index; CFI, Comparative Fitness Index; RMSEA, Root-mean Square Error of Approximation; SE, standard errors; CI, confidence interval; LLCL, lower limits confidence interval; ULCL, upper limits confidence interval.

simultaneously, while more attention has been paid to the relationship between acculturation, family support, and mental health (30). In a study of high school students who migrated to Norway, the cultural impact on mental health was found to be mediated by family support (31). In addition, a study of Chinese American older adults found that acculturation could affect the mental health of older immigrants through family support (32).

In summary, some studies have explored the relationship between acculturation and loneliness, family support and loneliness, and acculturation and family support, yet no research has ever clarified the association between acculturation, family support, and loneliness simultaneously, nor mentioned the MEFC as the research subject. This study aimed to clarify the relationship between acculturation and loneliness, and further verify whether there was a mediating effect exerted by family support on this relationship among the MEFC in Jinan, China.

Methods

Study location and its population conditions

Shandong Province is located in the east of China and Jinan is its capital city. Its GDP in 2020 was about 1.01 trillion Yuan (about US $158 billion), an increase of 4.9% over the previous year. As of 1 July 2020, Jinan has jurisdiction over 10 districts, two counties, 132 streets, and 29 towns. By the end of 2020, Jinan had a permanent population of 9.2 million, with an average annual growth rate of 1.27%. Among the permanent residents, the population living in towns is 6.76 million, accounting for 73.46%, and the population living in the countryside is 2.44 million, accounting for 26.54% (33). The seventh census showed that Jinan had a migrant population of 1.83 million (2).

Data collection and research participants

The data were collected in Jinan, Shandong Province, China in August 2020. The subjects of the study were the elderly over 60 years old who followed their children to Jinan, China. This study adopted the method of multistage cluster sampling to select subjects. In the first stage of data collection, three regions were selected from a total of 10 regions as primary sampling units (PSU), considering the economic development and geographical location of Jinan, China. In the second stage, three zones were selected from each primary sampling unit (PSU) as secondary sampling units (SSU). In the third stage, three communities were selected from each SSU. Then, in these three communities, all elderly people over 60 who migrated with their children were taken as the total sample of this study.

In this survey, a total of 32 college students acted as investigators and received training on research background information, questionnaire content, and social survey skills. The investigators collected data in the form of face-to-face interviews with the subjects for about 20 min each. A total of 670 MEFC were selected and interviewed at first. However, 14 of them were excluded because there were obvious logical errors in their answers or their questionnaires were not completed. A total of 656 MEFC in Jinan, China were ultimately included in the study.

Culture shock theory

The theoretical basis is based on anthropologist Oberg's Culture Shock Theory. It refers to the sense of loss and accompanying anxiety in the process of cultural transformation. Oberg believes that culture shock is the result of an individual's contact with a different culture, such as tension and anxiety, and it is also the individual's sense of loss, confusion, and incompetence due to separation from the familiar culture and social symbols of the original culture. Studies have shown that culture shock generally goes through four stages, honeymoon stage, depression stage, adjustment stage, and adaptation stage. The change process of these four stages generally takes the form of a "U"-shaped curve. In the third stage, when immigrants gradually understand the difference between the original culture and the foreign culture, and gradually understand the local customs, they begin to adjust their emotions, gradually get out of the painful emotions, and gradually have their own social contact, with certain social support, which will lead to the gradual reduction of psychological loss and loneliness (34). Based on the culture shock theory, a structural equation model between the acculturation, family support, and loneliness of the MEFC was constructed in this study. When the MEFC gradually adapts to the local culture and customs, it will lead to lower loneliness. Meanwhile, acculturation will also result in a good family atmosphere and better family support, and finally, indirectly reduce the loneliness of MEFC.

Measurements

Loneliness

This study used the short-form UCLA Loneliness Scale (ULS-8) to assess the loneliness of the MEFC in Jinan, China. There are a total of eight items in the ULS-8, each item can score 1–4 points (never, rarely, sometimes, always), and the total score is between 8 and 32 points. The eight items were the following: "(1) I lack companionship; (2) There is no one I can turn to; (3) I feel left out; (4) I feel isolated from others; (5) I am unhappy being so withdrawn; (6) People are around me but not with me; (7) I am an outgoing people; (8) I can find companionship when I want it." The higher the score, the higher the degree of loneliness (35).

Acculturation

Four questions were used as the indicators of acculturation: "(1) understanding of local wedding customs; (2) understanding of local funeral customs; (3) understanding of local diet customs; and (4) understanding of local special food snacks." Two levels of answers were set for each question in the current research: "1. don't understand; 2. understand."

Family support

Family support in this study was measured by four aspects: "(1) children's support, (2) couple's support, (3) siblings' support, and (4) other family members' support." Two levels of answers were set for each question: "1. no support or low support; 2. high support."

Data analysis

A descriptive statistics, *t*-test, and analysis of variance (ANOVA) were employed to describe and determine the statistically significant differences between demographic characteristics, acculturation, and family support by adopting the SPSS 26.0. A *p*-value of <0.05 was considered to be statistically significant. The structural equation model (SEM) was used to explore the relationship between acculturation, family support, and loneliness among the MEFC in Jinan, China. In this study, maximum likelihood estimation was used to estimate the best fitting model. The SEM consisted of endogenous and exogenous variables, the former being loneliness and the latter being acculturation and family support. The AMOS (IBM, Armonk, New York, USA) statistical software package for Windows was conducted to run the SEM in order to obtain the maximum likelihood estimation of model parameters and to calculate the model fitness index. Finally, we performed bootstrap tests (the sampling process was repeated 1,000 times) to examine the total, indirect, and direct effects of the model. The indirect effect was regarded as statistically significant if the 95% confidence interval (CI) excluded zero (36).

Results

General characteristics of the subjects

Table 1 shows the demographic characteristics of the MEFC in this study. A total of 656 MEFC were included in the data analysis, with a mean age of 66.19 ± 4.53 years old. Among them, 30.1% were 63–65 years old. The average score of ULS-6 among the MEFC was 12.82 ± 4.05 in this study. For the sociodemographic information, most of the MEFC were female (63.7%), had a rural Hukou (87.5%), were currently married (88.9%), were unemployed (74.4%), and had a monthly income of 0–1,000 (64.3%). Concerning education, 18.9% of the MEFC had received a high school education or above. Statistically significant differences between education level and loneliness were found among the MEFC in this study.

TABLE 1 Demographic characteristics of the MEFC.

Variables	*N* (%)	Mean score of ULS-8 (SD)	*t*/*F* value	*p*
Total	656 (100)	12.82 (4.05)		
Sex			0.608[a]	0.436
Male	238 (36.3)	12.66 (4.14)		
Female	418 (63.7)	12.92 (4.00)		
Age (years)			1.160[b]	0.296
60–62	126 (19.2)	17.01 (2.63)		
63–65	197 (30.1)	17.05 (2.98)		
66–68	183 (27.9)	16.73 (3.08)		
69–	150 (22.9)	17.17 (3.07)		
Hukou			0.364[a]	0.716
Rural	574 (87.5)	12.84 (4.10)		
City	82 (12.5)	12.67 (3.74)		
Marital status			1.592[a]	0.112
Currently married	583 (88.9)	12.73 (4.03)		
Single	73 (11.2)	13.53 (4.16)		
Employment			2.416[b]	0.090
Employed	37 (5.6)	12.62 (4.29)		
Retired	131 (20.0)	12.15 (3.88)		
Unemployed	488 (74.4)	13.02 (4.07)		
Education level			1.765[a]	0.152
Illiteracy	196 (29.9)	13.36 (4.18)		
Primary school	144 (22.0)	12.75 (3.94)		
Junior high school	192 (29.3)	12.55 (4.04)		
High school and above	124 (18.9)	12.48 (3.97)		
Monthly income			0.849[b]	0.630
0–1,000	422 (64.3)	17.11 (3.06)		
1,001–2,000	78 (11.9)	16.17 (2.54)		
2,000 and above	156 (23.8)	16.72 (2.78)		

MEFC, migrant elderly following children.
[a]t-test.
[b]F-test.

Table 2 shows the acculturation, family support, and loneliness of the MEFC. In terms of acculturation, the percentage of the MEFC who knew about the wedding customs, funeral customs, diet customs, and special food snacks of the inflow city was 42.4, 40.1, 51.1, and 46.5%, respectively. Concerning family support, most of the MEFC were able to obtain high support from their children (89.5%) and spouse (83.5%), while the percentage of support from

10.3389/fpubh.2022.934237

TABLE 2 Acculturation and Family support of the MEFC.

Variables	*N* (%)	Mean score of ULS-8 (SD)	*t* value	*p*
Wedding customs		12.82 (4.05)	3.749	<0.01
Don't understand	378 (57.6)	17.34 (3.08)		
Understand	278 (42.4)	16.47 (2.72)		
Funeral customs			3.791	<0.01
Don't understand	393 (59.9)	17.33 (3.06)		
Understand	263 (40.1)	16.44 (2.74)		
Diet custom			4.737	<0.01
Don't understand	321 (48.9)	17.53 (3.11)		
Understand	335 (51.1)	16.45 (2.72)		
Special food snacks			4.936	<0.01
Don't understand	351 (53.5)	17.50 (3.05)		
Understand	305 (46.5)	16.37 (2.74)		
Children support			2.270	<0.05
None or low support	69 (10.5)	17.74 (3.09)		
High support	587 (89.5)	16.89 (2.94)		
Spouse support			0.762	0.121
None or low support	108 (16.5)	17.38 (3.14)		
High support	548 (83.5)	16.90 (2.92)		
Sibling support			3.830	<0.01
None or low support	303 (46.2)	17.45 (2.85)		
High support	353 (53.8)	16.57 (3.00)		
Other family support			5.140	<0.01
None or low support	417 (63.6)	17.42 (2.86)		
High support	239 (36.4)	16.21 (2.99)		

MEFC, migrant elderly following children.

siblings and other family members was 53.8 and 36.4%, respectively. Statistically significant differences were observed between loneliness and the four variables of assessing acculturation (wedding customs, funeral customs, diet customs, and special food snacks) separately in this study. Meanwhile, statistically significant differences between loneliness and the three variables of measuring family support (children support, sibling support, and other family support) were also found among the MEFC in the current study.

Structural equation modeling analysis

Model fitness indices

Table 3 displays the value of the model fit indicators of this study. As shown, the information of the model fitness indices was: CFI = 0.946 > 0.90; GFI = 0.938 > 0.90; AGFI = 0.915 > 0.90; RMSEA = 0.061 < 0.080. The chi-square value of the overall model was $p < 0.001$. All of the model fitness indices values indicated that the hypotheses model fits the empirical data very well in this study.

TABLE 3 The model fit index.

Index	*p*	CFI	GFI	AGFI	RMSEA
Change range	–	0–1	0–1	–	–
Reference standard	$p < 0.05$	>0.90	>0.90	>0.90	<0.080
Actual value	$p < 0.001$	0.946	0.938	0.915	0.061

CFI, Comparative Fitness Index; GFI, Goodness of Fit Index; AGFI, Adjusted Goodness of Fit Index; RMSEA, Root-mean Square Error of Approximation.

Relationship between acculturation, family support, and loneliness assessed by the SEM

The relationship between acculturation, family support, and loneliness of the MEFC is shown in Figure 1. In detail, there are two figures in Figure 1: the upper figure shows the relationship between acculturation and loneliness, while the lower figure illustrates the mediating effect of family support on the association between acculturation and loneliness. In addition, the SEM could be used not only to analyze empirical relationships between different variables in the model but also to analyze statistical associations between observed and unobserved variables simultaneously. In this study, there were three unobserved variables: acculturation, family support, and loneliness. Among them, acculturation and family support were both represented by four observation variables, and loneliness was represented by eight observation variables.

As illustrated in Figure 1 (upper figure), acculturation exerted a negative effect on loneliness (the standardized effect $= -0.25$, $p < 0.01$). Moreover, as shown in Figure 1 (lower figure), acculturation exerted a negative effect on loneliness (the standardized effect $= -0.22$, $p < 0.01$), family support also exerted a negative effect on loneliness (the standardized effect $= -0.31$, $p < 0.01$), and acculturation exerted a positive effect on family support (the standardized effect $= 0.12$, $p < 0.05$).

The mediating effect of family support on the association between acculturation and loneliness

Figure 1 also illustrated the mediation pathway model. The path coefficients showed that the total effect of acculturation on loneliness was −0.25 (upper figure in Figure 1). After adding family support (lower figure in Figure 1), the direct effect of acculturation on loneliness was −0.22.

Table 4 shows the standardized total effect, direct effect, indirect effects, as well as the results of the mediating effect. Specifically, the standardized indirect effect coefficient of acculturation on loneliness through family support was −0.037,

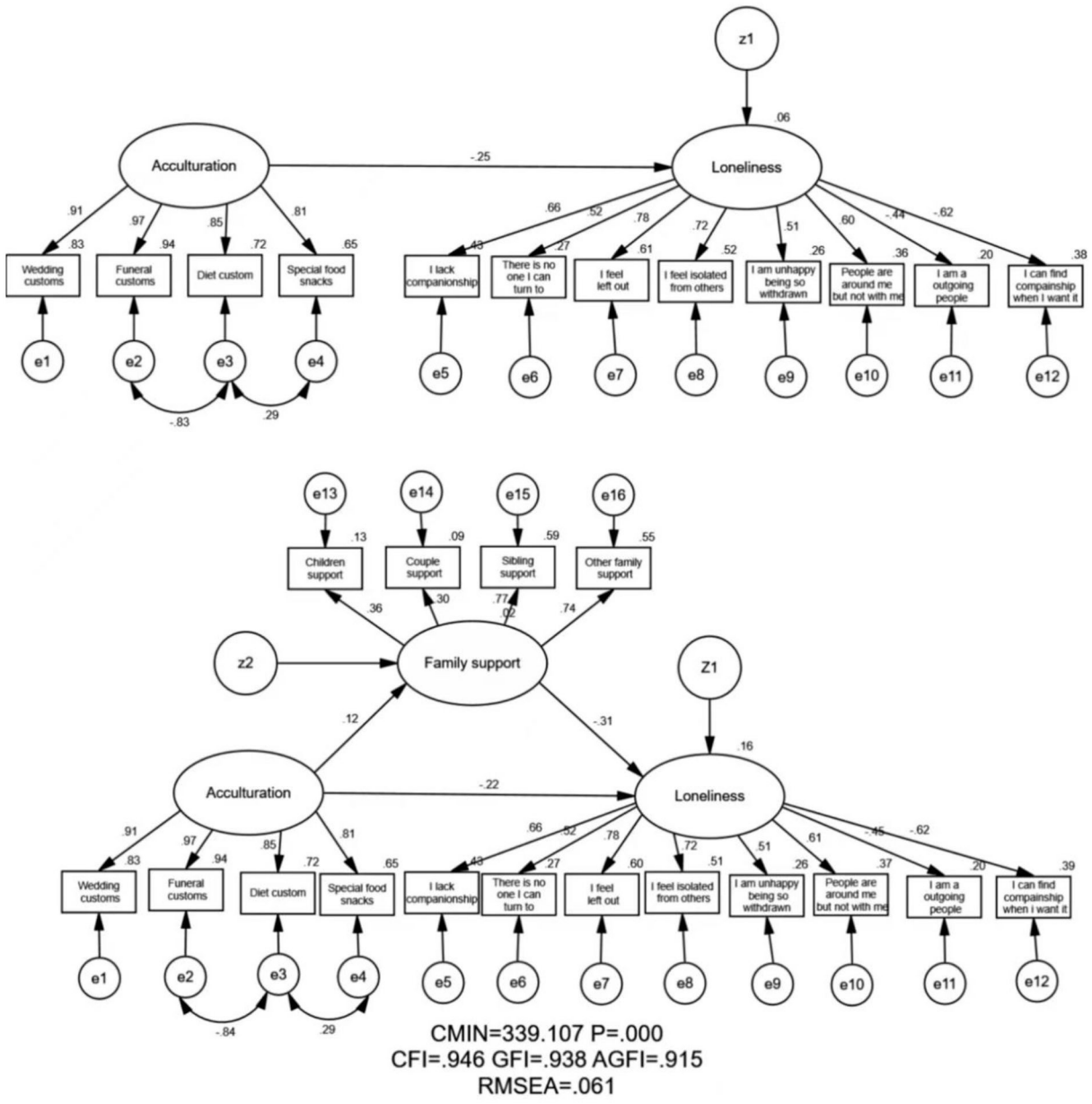

FIGURE 1
Path diagram of the association between acculturation and loneliness with family support as a mediator ($n = 656$). Employing the cross-sectional data, the relationship between acculturation and family support, and loneliness was analyzed. Arrows indicate the associations and directions between variables, and double curved arrows indicate the correlation between each factor. All parameter estimates were statistically significant ($p < 0.001$); χ^2 = Chi-square; GFI, Goodness of Fit Index; AGFI, Adjusted Goodness of Fit Index; CFI, Comparative Fitness Index; RMSEA, Root-mean Square Error of Approximation; MEFC, migrant elderly following children.

with a mediating effect of 14% [14% = 0.12 × (−0.31)/0.12 × (−0.31) +(−0.22)]. The bootstrap test suggested that the direct mediating effect *via* family support was −0.037 (95%CI: −0.079 to −0.013, $p < 0.001$). These effects were significant since the 95%CI excluded zero. Therefore, the association between acculturation and loneliness was achieved partly through family support.

Discussion

Principal findings and comparison with other studies

Employing the SEM, this study investigated the relationship between loneliness, acculturation, and family support among the

TABLE 4 The standardized total, direct, and indirect effects of acculturation on loneliness with family support as mediators ($N = 656$).

Path	Standardized effect value	SE	p	Percent (%)	95%CI	
					LLCL	ULCL
Direct effect	−0.22	0.041	<0.01	86	−0.298	−0.138
Acculturation→ Loneliness						
Indirect effect	−0.037	0.016	<0.01	14	−0.079	−0.013
Acculturation→ Family support						
Family support→ Loneliness						
Total effect	−0.25	0.041	<0.01	100	−0.341	−0.170

SE, standard errors; CI, confidence interval; LLCL, lower limits confidence interval; ULCL, upper limits confidence interval.

MEFC in Jinan, China. The results revealed that the loneliness of the MEFC was associated with their acculturation, while family support mediated the relationship between acculturation and loneliness.

Loneliness of the MEFC

The mean score of loneliness among the MEFC in this study was 12.82 ± 4.05, indicating that they had a low level of loneliness. This result is lower than a study of Italian elderly people (13.1 ± 6.9) (37), which might be because most of the MEFC come to the inflow city to take care of their children, so their bodies are relatively healthy, while physical frailty and disability are an important cause of loneliness (38). In addition, the loneliness level of this study was also lower compared to a Nigerian study of retired elderly people (20.31 ± 3.59) (39). It might be because most Nigerian elderly people are not accompanied by their children after retirement (40), and although most of the MEFC did not have a job, they were accompanied by their family members, so they had a lower level of loneliness. However, in a study on the elderly in rural China (11.09 ± 4.59) (41), it was found to have a lower level of loneliness than this study. The possible explanation for this difference was the MEFC were not used to the inflow cities and felt unfamiliar or the differences in socioeconomic status among sample cities.

Acculturation and loneliness

A negative relationship between acculturation and loneliness was found among the MEFC in this study, that is, the better the acculturation, the lower the loneliness. The negative effect of acculturation on loneliness in our study was similar to that in the study conducted among older immigrants in Sweden, where it was also found that the migrant elderly were not able to adapt to the culture which could lead to feelings of alienation and non-belonging that triggered experiences of loneliness (42). In previous studies, the immigrants who were able to share a similar language and culture had lower levels of loneliness, while those who did not had higher levels of loneliness (43). The relationship between acculturation and loneliness could also be partially explained by the concept of cultural belonging (44). Although it might be a resource for migrants experiencing two different cultures during their migration, there are also inner conflicts in migrants' sense of belonging. Therefore, in terms of cultural belonging, if cultural attachment and inclusion between two cultures could prevent loneliness, then acculturation stress and cultural conflict could also increase the loneliness of migrants (45). Specifically, for the MEFC in this study, most of them came from rural areas and migrated to cities following their children. The big differences between their hometown and inflow city might cause cultural conflicts for them, and further result in increased loneliness.

Family support and loneliness

The relationship between loneliness and family support in the MEFC was negative in this study, which was consistent with previous research that found that the level of family function and social support were important factors affecting the loneliness of the elderly (46, 47). Family relationship was an important part of the social network, and children were important sources of companionship, intimacy, and sharing (48). Spouse's company was also an important factor in reducing loneliness among older adults (49). In addition, sibling support could ease the loneliness of older adults (50). It is well-known that Asian populations are characterized by collectivism compared to the individualism of the West (51). Studies have shown that the loneliness of collectivist societies is higher than that of individual socialist societies (52) because the core of collectivism is interdependence which emphasizes the relationship between individuals (53). Srinivasan's research found that strong relationships were the norm in rural areas in India, while a lack of such social connections was akin to a departure from cultural norms and could be seen as painful which finally led to an increase in loneliness (54). In a study on Chinese American older adults, a supportive network was observed to reduce the effects of adverse stressors and to improve mental health

outcomes (32). Regarding the MEFC in the current study, their support from family members might help them to face unfamiliar environments, integrate into the inflow city, and reduce their loneliness.

Acculturation and family support

A positive relationship between acculturation and family support was observed in this study, implying that the improvement of acculturation would lead to higher levels of family support. This result was consistent with a study on Mexican Americans which also found that those who approved more of Mexican culture and customs would enjoy a higher level of family support (55). Moreover, it was found that second-generation Mexican Americans were more likely to have large family networks and receive family support than first-generation Mexican American women (56). However, a study on Latino-American adolescent boys showed that higher acculturation could lead to family conflicts. This might be due to the fact that the teenagers could more easily and actively integrate into the local culture and environment, while their parents would generally follow the original cultural values and customs. This gap in the acculturation of children and parents might lead to their differences in cultural values, and further cause conflicts among family members (57). For the MEFC, when they have better acculturation, they might become more cheerful, be more willing to communicate with their family members, and be more likely to have a higher level of family support.

The mediating effect of family support

This study found that the family support of the MEFC played a mediating role between acculturation and loneliness, and the mediating effect accounted for 14% of the total effect. This was similar to a previous study among Latino adults, which also found that family support had a mediating effect between acculturation and mental health (58). The reason may come from the fact that social support could reduce the stress caused by unfamiliar cultural environments during the intercultural transition of migrants and could further promote their physical and mental health (59). In detail, as an important resource for immigrants (60), social support has been shown to be associated with acculturation (61) and is helpful for the maintenance of the mental health of immigrants (62). Therefore, family support became a mediator between acculturation and loneliness. Compared with the young people who need to develop their careers in the inflow city, the MEFC might not have an urgent need to expand their network and comprehensively adapt to the local culture, since their main job is to take good care of their grandchildren. Moreover, taking care of their grandchildren consumed most of their time and energy, which also caused them to have limited time and energy for purposely enlarging their network and caring for their own health conditions. All of these factors made the MEFC more reliant on family support for adapting to life in the inflow city. In this sense, as a mediating variable, family support played an important role between acculturation and loneliness for the MEFC.

Implications

The following policy recommendations are provided based on the results of this study: First, the community could arrange certain programs and activities to help the MEFC to learn the culture of the inflow city, to better adapt to local life, and to enhance their sense of belonging. Second, the family members of the MEFC should pay attention to the mental health of the MEFC, provide them with a good living environment, and create a good family atmosphere. Third, community health centers are encouraged to pay attention to the mental health of the MEFC and conduct psychological counseling and health education.

Limitations

This study has the following limitations: First, cross-sectional data was used and so causality cannot be predicted (such as the association between acculturation and family support). Second, due to the lack of systematic scales of family support and cultural adaptation in the questionnaire, we only selected certain relevant indicators for evaluation, which are expected to be improved in follow-up research. Third, multi-stage cluster sampling was employed to select the participants, yet the survey weights were not applied and calculated. Fourth, more confounding variable effects (such as duration of migration) on the loneliness of MEFC are needed to be examined in future studies. Finally, due to the COVID-19 pandemic, this study only selected the MEFC in Jinan as the research subjects as more surveys in other cities in China could not be conducted. This means that the results cannot represent more MEFC populations in China.

Conclusion

The average ULS-8 score of 12.82±4.05 indicated a low level of loneliness among the MEFC in Jinan, China. Acculturation was found to be associated with loneliness, while family support was observed to play a partial mediating role between acculturation and family support among the MEFC in Jinan. Policy implications were provided to decrease loneliness and

improve the mental health status of the MEFC based on the findings of this study.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

DZ analyzed the data and drafted the manuscript. ZL and XS participated in the questionnaire survey and data processing. YS gave many valuable suggestions in response to the reviewer's comments. FK applied for funds to support this study, designed the study, completed the questionnaire design, supervised and participated in the data collection, instructed the writing, statistical analysis, data processing, and provided comments on the modification of the manuscript. SL gave many valuable comments on the draft and also polished it. All authors read and agreed to the published version of the final manuscript.

Funding

This study was supported and funded by the National Natural Science Foundation of China (No. 71804094), the China Postdoctoral Science Foundation (No. 2016M592161), the Natural Science Foundation of Shandong Province (No. ZR2016GB02), the Postdoctoral Science Foundation of Shandong Province (No. 201603021), and the Fundamental Research Funds of Shandong University (Nos. 2015HW002 and 2018JC055).

Acknowledgments

The research team greatly appreciates the funding support and the research participants for their cooperation and support.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Beier Z, Mingzhu Y, Xuewen Q, Xin S. Review of social adaptation research of migrant elderly. *Legal Syst Soc.* (2020) 8:128–30. doi: 10.19387/j.cnki.1009-0592.2020.03.179

2. Jinan Bureau of Statistics. *Announcement of the Seventh Census of Jinan*. (2021). Available online at: http://jntj.jinan.gov.cn/art/2021/6/16/art_18254_4742896.html (accessed May 21, 2022).

3. National Health Commission (NHC). *Report on China's Migrant Population Development in 2018*(2018). Available online at: http://www.nhc.gov.cn/wjw/xwdt/201812/a32a43b225a740c4bff8f2168b0e9688.shtml (accessed April 19, 2022).

4. Fanlei K, Mei K, Cheng L, Shixue L, Jun L, Research progress of the migrant elderly following children. *Chin J Gerontol.* (2020) 40:2443–7. doi: 10.3969/j.issn.1005-9202.2020.11.059

5. Chunlei Ji, Chang M. Study on the relationship between loneliness and social support of urban migrant elderly. *J Campus Life Mental Health.* (2020)18: 58–60. doi: 10.19521/j.cnki.1673-1662.2020.01.018

6. West DA, Kellner R, Moore-West M. The effects of loneliness: a review of the literature. *Compr Psychiatry*. (1986) 27:351–63. doi: 10.1016/0010-440X(86)90011-8

7. Peplau L, Perlman D. Perspectives on loneliness "being old and living alone". In: Peplau LA, Perlman D, editors. *Loneliness: A Sourcebook of Current Theory, Research and Therapy*. New York, NY: John Wiley (1982). p. 327–47. doi: 10.1093/geronj/38.4.492

8. Hawkley LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann Behav Med*. (2010) 40:218–27. doi: 10.1007/s12160-010-9210-8

9. Wolf TM, Scurria PL, Webster MG. A four-year study of anxiety, depression, loneliness, social support, and perceived mistreatment in medical students. *J Health Psychol.* (1998) 3:125–36. doi: 10.1177/135910539800300110

10. Weiwei T, Yue W, Yulin Z, Qianqian Y, Bo Z, Jie W, et al. The effects of self-acceptance and loneliness on the social adaptability of the migrant elderly. *Chin Nurs Manag.* (2018) 18:1051–6. doi: 10.3969/j.issn.1672-1756.2018.08.010

11. Tam S, Neysmith S. Disrespect and isolation: elder abuse in Chinese communities. *Can J Aging.* (2006) 25:141–51. doi: 10.1353/cja.2006.0043

12. Wu Z, Penning M. Immigration and loneliness in later life. *Ageing Soc.* (2013) 35:64–95. doi: 10.1017/S0144686X13000470

13. Redfield R, Linton R, Herskovits MJ. Memorandum for the study of acculturation. *Am Anthropol.* (1936) 38:149–52. doi: 10.1525/aa.1936.38.1.02a00330

14. Shangxin C. Effects of cultural adaptation on physical and mental health of migrant elderly. *Chin J Popul Sci.* (2021) 3:112–25.

15. Lin Y, Kingminghae W. Social support and loneliness of Chinese international students in Thailand. *J Popul Soc Stud.* (2014) 22:141–57. doi: 10.14456/jpss.2014.10

16. Garcia DL, Savundranayagam MY, Kloseck M, Fitzsimmons D. The role of cultural and family values on social connectedness and loneliness among ethnic minority elders. *Clin Gerontol.* (2019) 42:114–26. doi: 10.1080/07317115.2017.1395377

17. Park HJ, Morgan T, Wiles J, Gott M. Lonely ageing in a foreign land: social isolation and loneliness among older Asian migrants in New Zealand. *Health Soc Care Community*. (2019) 27:740–7. doi: 10.1111/hsc.12690

18. Kuo B, Huang S, Li X, Lin D. Self-esteem, resilience, social support, and acculturative stress as predictors of loneliness in chinese internal migrant children: a model-testing longitudinal study. *J Psychol*. (2021) 155:387–405. doi: 10.1080/00223980.2021.1891854

19. Chen Y, Hicks A, While AE, Loneliness and social support of older people in China: a systematic literature review. *Health Soc Care Community*. (2014) 22:113–23. doi: 10.1111/hsc.12051

20. Wenbo B. The problems and countermeasures of the social adaptation of the elderly migrant. *Trop Agric Eng.* (2021) 45:60–3.

21. Yuzhen L, Siqi A, Qiong S. Correlation between loneliness and family social support of advanced—age disabled elderly in Tangshan city. *Nurs Res*. (2018) 32:7. doi: 10.3969/j.issn.1009-6493.2018.07.016

22. Huahong L, Junyan C, Zhang J, Chen Y, Chen W, Xuenan C. The influence of family support system on the loneliness of the elderly—taking Shanghai as an example. *Health Nutr China*. (2020) 30:5–7.

23. Wang G, Zhang X, Wang K, Li Y, Shen Q, Ge X, et al. Loneliness among the rural older people in Anhui, China: prevalence and associated factors. *Int J Geriatr Psychiatry*. (2011) 26:1162–8. doi: 10.1002/gps.2656

24. Teh JK, Tey NP, Ng ST. Family support and loneliness among older persons in multiethnic Malaysia. *Sci World J*. (2014) 2014:1–11. doi: 10.1155/2014/654382

25. Pehlivan S, Ovayolu O, Ovayolu N, Sevinc A, Camci C. Relationship between hopelessness, loneliness, and perceived social support from family in Turkish patients with cancer. *Support Care Cancer*. (2012) 20:733–9. doi: 10.1007/s00520-011-1137-5

26. Jewell SL, Letham-Hamlett K, Hanna IM, Luecken LJ, MacKinnon DP. Family support and family negativity as mediators of the relation between acculturation and postpartum weight in low-income mexican-origin women. *Ann Behav Med*. (2017) 51:856–67. doi: 10.1007/s12160-017-9909-x

27. Wang K, Zhang A, Sun F, Hu RX. Self-rated health among older chinese americans: the roles of acculturation and family cohesion. *J Appl Gerontol*. (2021) 40:387–94. doi: 10.1177/0733464819898316

28. Almeida J, Molnar BE, Kawachi I, Subramanian SV. Ethnicity and nativity status as determinants of perceived social support: testing the concept of familism. *Soc Sci Med*. (2009) 68:1852–8. doi: 10.1016/j.socscimed.2009.02.029

29. Perez-Brena NJ, Updegraff KA, Umaña-Taylor AJ. Youths' imitation and de-identification from parents: a process associated with parent-youth cultural incongruence in Mexican-American families. *J Youth Adolesc*. (2014) 43:2028–40. doi: 10.1007/s10964-014-0101-3

30. N, Eres R, Postolovski Thielking M, Lim MH. Loneliness, mental health, and social health indicators in LGBTQIA+ Australians. *Am J Orthopsychiatry*. (2021) 91:358–66. doi: 10.1037/ort0000531

31. Oppedal B, Røysamb E, Sam DL. The effect of acculturation and social support on change in mental health among young immigrants. *Int J Behav Dev*. (2004) 28:481–94. doi: 10.1080/01650250444000126

32. Sun F, Gao X, Gao S, Li Q, Hodge DR. Depressive symptoms among older chinese americans: examining the role of acculturation and family dynamics. *J Gerontol Ser B Psychol Sci Soc Sci*. (2018) 73:870–9. doi: 10.1093/geronb/gbw038

33. *Administrative division of Jinan City*. Available online at: http://www.jinan.gov.cn/col/col129/index.html (accessed April 12, 2022).

34. Oberg K. Cultural shock: adjustment to new cultural environments. *Pract Anthropol.* (1960) 7:177–82. doi: 10.1177/009182966000700405

35. Hays RD, DiMatteo MR. A short-form measure of loneliness. *J Pers Assess*. (1987) 51:69–81. doi: 10.1207/s15327752jpa5101_6

36. Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: new procedures and recommendations. *Psychol Methods*. (2002) 7:422–45. doi: 10.1037/1082-989X.7.4.422

37. Mulasso A, Roppolo M, Giannotta F, Rabaglietti E. Associations of frailty and psychosocial factors with autonomy in daily activities: a cross-sectional study in Italian community-dwelling older adults. *Clin Interv Aging*. (2016) 11: 37–45. doi: 10.2147/CIA.S95162

38. Langlois F, Vu TT, Kergoat MJ, Chassé K, Dupuis G, Bherer L. The multiple dimensions of frailty: physical capacity, cognition, and quality of life. *Int Psychogeriatr*. (2012) 24:1429–36. doi: 10.1017/S1041610212000634

39. Igbokwe CC, Ejeh VJ, Agbaje OS, Umoke P, Iweama CN, Ozoemena EL. Prevalence of loneliness and association with depressive and anxiety symptoms among retirees in Northcentral Nigeria: a cross-sectional study. *BMC Geriatr*. (2020) 20:153–76. doi: 10.1186/s12877-020-01561-4

40. Ojembe BU, Ebe KM. Describing reasons for loneliness among older people in Nigeria. *J Gerontol Soc Work*. (2018) 61:640–58. doi: 10.1080/01634372.2018.1487495

41. Hongjuan L, Yan Z, Yuanyuan C, Jianmei P, Hongsheng L. The effect of psychological stress on life satisfaction among the elderly in rural areas—the mediating role of loneliness. *Chin J Gerontol*. (2020) 40:4216–9. doi: 10.3969/j.issn.1005-9202.2020.19.056

42. Olofsson J, Rämgård M, Sjögren-Forss K, Bramhagen AC. Older migrants' experience of existential loneliness. *Nurs Ethics*. (2021) 28:1183–93. doi: 10.1177/0969733021994167

43. De Jong GJ, Van der Pas S, Keating N. Loneliness of older immigrant groups in Canada: effects of ethnic-cultural background. *J Cross Cult Gerontol*. (2015) 30:251–68. doi: 10.1007/s10823-015-9265-x

44. Barros S, Albert I. Living in-between or within? Cultural identity profiles of second-generation young adults with immigrant background. *Int J Theory Res.* (2020) 20:290–305. doi: 10.1080/15283488.2020.1832491

45. Albert I. Perceived loneliness and the role of cultural and intergenerational belonging: the case of Portuguese first-generation immigrants in Luxembourg. *Eur J Ageing*. (2021) 18:299–316. doi: 10.1007/s10433-021-00617-7

46. Liang L. *Study on the relationship between loneliness, parent-child support and filial piety expectation in the elderly* (dissertation/master's thesis) (2009). Changsha: Central South University.

47. Jie W. The relationship between social support, loneliness and subjective well-being of the elderly. *Psychol Sci*. (2008) 31:984–6. doi: 10.16719/j.cnki.1671-6981.2008.04.059

48. Dykstra PA. The differential availability of relationships and the provision and effectiveness of support to older adults. *J Soc Pers Relat*. (1993) 10:355–70. doi: 10.1177/0265407593103004

49. Shi-guo B, Nian X, Yun JI, Mediating effect of loneliness on relationship between social support and quality of life in the elderly. Chinese health education (2019) 35:161–165.

50. Voorpostel M, Van Der Lippe T. Support Between Siblings And Between Friends: Two Worlds Apart? *J Marriage Family*. (2007) 69:1271–82. doi: 10.1111/j.1741-3737.2007.00446.x

51. North MS, Fiske ST. Modern attitudes toward older adults in the aging world: a cross-cultural meta-analysis. *Psychol Bull*. (2015) 141:993–1021. doi: 10.1037/a0039469

52. Lykes VA, Kemmelmeier M. What predicts loneliness? Cultural difference between individualistic and collectivistic societies in Europe. *J Cross Cult Psychol.* (2013) 45:468–90. doi: 10.1177/0022022113509881

53. Markus H, Kitayama S. Culture and the self: implications for cognition, emotion, and motivation. *Psychol Rev*. (1991) 98:224–53. doi: 10.1037/0033-295X.98.2.224

54. Chokkanathan S. Prevalence of and risk factors for loneliness in rural older adults. *Australas J Ageing*. (2020) 39:545–51. doi: 10.1111/ajag.12835

55. Rodriguez N, Mira CB, Paez ND, Myers HF, Exploring the complexities of familism and acculturation: central constructs for people of Mexican origin. Am J Community Psychol (2007) 39:1–2. doi: 10.1007/s10464-007-9090-7

56. Zambrana RE, Silva-Palacios V, Powell DR. Parenting concerns, family support systems, and life problems in Mexica origin women: a comparison by nativity. *J Community Psychol*. (1992) 20:276–88. doi: 10.1002/1520-6629(199210)20:4<276::AID-JCOP2290200403>3.0.CO;2-8

57. Gil AG, Wagner EF, Vega WA. Acculturation, familism, and alcohol use among Latino adolescent males: longitudinal relations. *J Community Psychol*. (2000) 28:443–8. doi: 10.1002/1520-6629(200007)28:4<443::AID-JCOP6>3.0.CO;2-A

58. Rivera FI. Contextualizing the experience of young Latino adults: acculturation, social support and depression. *J Immigr Minor Health*. (2007) 9:237–44. doi: 10.1007/s10903-006-9034-6

59. Adelman MB. Cross-cultural adjustment: a theoretical perspective on social support. *Int J Intercult Rel*. (1988) 12:183–204. doi: 10.1016/0147-1767(88)90015-6

60. Noh S, Avison WR. Asian immigrants and the stress process: a study of Koreans in Canada. *J Health Soc Behav*. (1996) 37:192–206. doi: 10.2307/2137273

61. Birman D, Trickett EJ. Cultural transitions in first-generation immigrants: acculturation of Soviet Jewish refugee adolescents and parents. *J Cross Cult Psychol*. (2001) 32:456–77. doi: 10.1177/0022022101032004006

62. Singh G, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the United States: an analysis of two national data bases. *Hum Biol*. (2002) 74:83–109. doi: 10.1353/hub.2002.0011

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 30 September 2022
DOI 10.3389/fpubh.2022.955257

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 28 May 2022
ACCEPTED 21 July 2022
PUBLISHED 30 September 2022

CITATION
Guo H and Zou M (2022) Do non-citizens migrate for welfare benefits? Evidence from the Affordable Care Act Medicaid expansion. *Front. Public Health* 10:955257. doi: 10.3389/fpubh.2022.955257

Do non-citizens migrate for welfare benefits? Evidence from the Affordable Care Act Medicaid expansion

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We explore if low-educated noncitizens, who have a considerably high uninsured rate, internally migrate to states with more generous public insurance benefits. We utilize the state-level variation in accessing Medicaid benefits and employ a difference-in-differences methodology that compares in-migration and out-migration rates of non-citizens in states that adopted Medicaid expansion, both before and after the policy implementation, to the outcomes of non-citizens in states that did not adopt the expansion. We find that interstate in-migration (out-migration) rates of Medicaid expansion states did not increase (decrease) relative to that of non-expansion states after the expansion.

KEYWORDS

interstate migration, welfare-induce migration, affordable care act, Medicaid expansion, non-citizen immigrants

JEL Classification: H53, I13, R23

Introduction

Non-citizen immigrants represent a particularly interesting group for understanding welfare-induced migration both because they have low rate of insurance coverage to begin with and because they constitute a sizeable share of the United States population. In 2019, there were 21.3 million non-citizens in the United States, accounting for approximately 7% of the total population. However, 25% of them were uninsured compared to <9% of citizens (1). Due to limited access to both public and private coverage, the uninsured rate is even higher among low-income non-citizen immigrants. Statistics indicate that more than three quarters of the uninsured non-citizens are low-income [below 200% of the Federal Poverty Level (FPL)], and most of them work in jobs that are less likely to provide health insurance. Will low-income non-citizen immigrants, who are highly uninsured and have a low probability of affording their own coverage, internally migrate out of states with more-stringent rules and into states with more-lenient rules in pursuit of public coverage?

Medicaid expansion under the Affordable Care Act (ACA) provides us with an opportunity to improve our understanding on this question. The expansion was originally formulated to extend insurance coverage to non-elderly adults with family incomes up to 138% of the FPL at a national level ($30,305 for a family of three in 2021)[1], but was effectively made a state option by a 2012 Supreme Court ruling. By January 2014, when the expansion was set to begin nationwide, 24 states and the District of Columbia decided to expand their Medicaid program in line with the ACA, whereas the remaining states did not. Later, two additional states implemented during 2014 (MI and NH), three expanded during 2015 (PA, IN and AK), two more expanded in 2016 (LA and MT), as shown in Figure 1[2]. Given that states are not permitted to condition Medicaid eligibility on length of residence, one implication is the possibility that less well-off residents migrate to states that adopted the expansion. One more possibility is that states with expanded Medicaid coverage may result in higher residential satisfaction which would inhibit out-migration.

One strand of the welfare-induced migration literature, largely focused on *international migration*, emphasizes that immigrants make their location decisions at least partly on the basis of the generosity of welfare programs (2). Another strand of the literature explores *intranational migration* within the United States due to variations in public benefits across states. Most of the studies in *intranational migration* focus on the general low-income population (3–6) and conclude with modest welfare migration effects. There is, however, only scant evidence of welfare-induced interstate migration on non-citizen immigrants.

Yasenov et al. (7) is one of the few studies that focus on immigrants. Welfare reform in 1996 barred immigrants who are lawful permanent residents with <5 years of residency in the United States from accessing Medicaid benefits (5-year ban). Later, several states extended coverage to lawfully residing children and pregnant women without a 5-year waiting period. They take advantage of this state level inequalities in eligibility and explore whether these two specific immigrant groups who are excluded from the 5-year ban in some states move across state borders to access public coverage. They find no evidence that the introduction of Medicaid benefits in a specific state was associated with increases in migration of immigrants from other states among the targeted two groups of immigrants.

Non-citizen immigrants' utilization of welfare benefits have been a contentious policy issue for decades. Some believe that "high rates of immigration are straining the health care system to the breaking point" (8). While others claim that immigrants use a disproportionately small share of the nation's health care costs (9, 10) and are paying more than what they are receiving (11, 12). Studying welfare-induced migration is a way of measuring immigrants' response to public benefits. In this paper, we investigate how state variation in accessing Medicaid coverage affected access to insurance coverage and interstate migration of the low-educated non-citizen immigrants. Our general empirical strategy is a difference-in-differences (DD) approach that compares insurance coverage and interstate migration flows of low-educated non-citizen immigrants in states that did and did not expand Medicaid before and after adoption of the policy. To the best of our knowledge, this is the first paper designed to measure the overall immigrant interstate migration response to Medicaid expansion.

The empirical estimates suggest that Medicaid expansion was associated with an increase in insurance rate among low-educated non-citizens by 4.1 percentage points and an increase in Medicaid coverage by about 8.2 percentage points. However, our findings in migration flows indicate that interstate in-migration (out-migration) rate of Medicaid expansion states did not increase (decrease) relative to that of non-expansion states after the expansion, which suggest that the variation in accessing Medicaid coverage did not result in a meaningful effect on interstate movements among the studied sample.

Our study contributes to the literature on welfare-induced migration in several ways. First, we rely on the most recent expansion of Medicaid coverage and focus on the low-educated non-citizen immigrants. Second, we examine the migration responses of non-citizens to and from states with expanded Medicaid eligibility by explicitly exploring both in-migration and out-migration flows. Third, we use several years of data after 2014 to uncover any longer-run effects that may not be visible immediately after the expansion.

Methods

Data source and classification of states

We obtain data for the period 2010–2017 from the American Community Survey (ACS) to explore the impact of Medicaid expansion on insurance coverage and interstate migration flows among non-citizen immigrants. The ACS surveys a cross-sectional 1% sample of U.S. households every year. It's large sample size (approximately 3 million observations in all) allows us to focus on a subset of the general population (i.e., non-citizen immigrants) without losing estimation precision. Besides, participation of this survey is mandatory which reduces concerns about sample selection issue[3]. In the ACS, we observe

1 U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation, 2021 Poverty Guidelines. Available online at: https://aspe.hhs.gov/poverty-guidelines.

2 Hawaii is an expansion state; Alaska expanded in 2015.

3 Response rate during our sample period (2010–2017) is consistently over 90 percent. https://www.census.gov/acs/www/methodology/sample-size-and-data-quality/response-rates/.

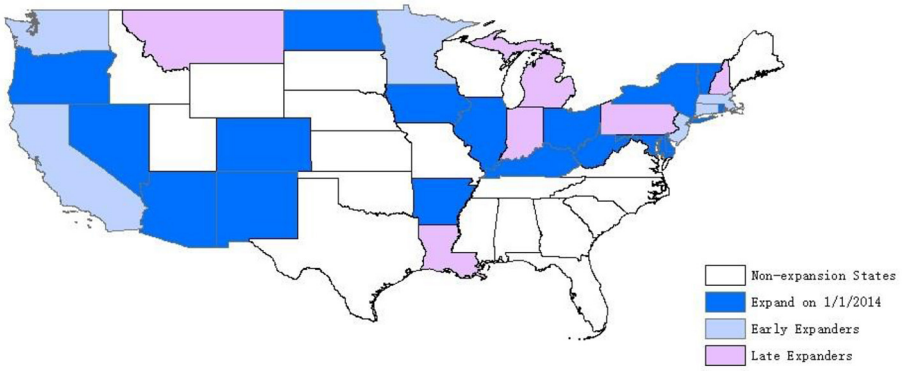

FIGURE 1
Status of Medicaid expansion decisions, as of 2018. **Source**: The Henry (13).

whether a respondent is currently residing in a different state than 1 year prior to interview, as well as the exact state of residence in those two periods[4].

Sample selection and classification of states

There are concerns associated with selecting the analysis sample using income since income is potentially affected by the policy and migration[5]. Instead, education is exogenous to the expansion and the common practice is to use low-educated group as a proxy for low-income group in examining effects of means-tested welfare programs. Accordingly, we restrict our main sample to non-citizen immigrants with less than high school education. Using education level to incorporate eligibility reduces the endogeneity-of-sampling issue, however, it may create attenuation bias. For comparison, we present results for low-income sample in a robustness analysis. To capture a broad range of low-educated non-citizens whose interstate migration behavior might plausibly have been affected by the expansion, our primary sample was further restricted to those at the ages of 18–64[6]. To coincide with the 5-year waiting period that qualified non-citizens need to observe before they become eligible for Medicaid coverage (5-year ban), we restrict the sample to non-citizens with at least 5 years of residency in the United States[7]. With these exclusions, the baseline sample includes 305,386 non-citizens[8].

To classify states into those experienced changes in Medicaid coverage and those not, we rely on Kaiser Family Foundation's (KFF) annual 50 states survey of eligibility rules. One complication with classifying which states into those experienced a change in Medicaid policy ("treated") and those not ("control") is that the ACA allows states flexibility to expand Medicaid coverage before 2014, and several states did so to varying degrees. Since the passage of the ACA in 2010, five states (CA, CT, MN, NJ, and WA) and District of Columbia (DC)[9] have enacted Medicaid expansion that include some or all of the low-income adults who will become eligible for Medicaid, starting

4 The Annual Social and Economic Supplement of the Current Population Survey (March CPS) is similar to the ACS in that it asks individuals whether their residence in the previous year was in the same state as their current residence. However, sample size of the March CPS is only about one-third of the ACS. Therefore, we rely on the ACS dataset.

5 Meyer (14) criticizes the use of sample conditioning on below an income threshold in welfare migration literature, because income usually increases when people migrate from a low benefit state to a high benefit state. This would lead to a bias against finding evidence of welfare migration. Instead, he suggests using the "at-risk group" to study the welfare migration.

6 Adults over the age of 65 are generally be covered by Medicare.

7 We probe the robustness of our results by restricting the sample to those with less than five years of residency. Estimates remain largely unchanged. Results are not reported but available upon request.

8 It is worth noting that immigrants who are naturalized are excluded in our main sample because they are accorded the same access to public benefits as native-born citizens and are more assimilated, meaning their options of benefit use are more similar to those of native-born citizens (15). Buchmueller et al. (16) argue that naturalized citizens "look like" natives. Ku and Matani (17) find that difference in insurance rates between natives and naturalized citizens is not significant, while the percentage of noncitizens who were uninsured was much higher than that of natives. Therefore, we believe separating noncitizen immigrants from naturalized citizens gives a clearer picture of the effects of Medicaid expansion on immigrants.

9 We call these five states plus DC as "early expanders".

TABLE 1 Descriptive statistics (unweighted).

	Non-expansion states		Expansion states	
	Mean	SD	Mean	SD
A: Demographic variables				
Age	41.31	11.10	42.54	10.91
Female	0.46	0.50	0.48	0.50
Married	0.64	0.48	0.62	0.49
Num. of own children	1.62	1.50	1.64	1.47
Hispanic	0.91	0.28	0.88	0.33
Family income as of FPL	160.65	117.42	171.73	121.78
% with income ≤138% of the FPL	0.51	0.50	0.47	0.50
B: Health insurance coverage				
Uninsured	0.69	0.46	0.50	0.50
Employer-sponsored	0.19	0.39	0.23	0.42
Privately purchased	0.24	0.42	0.26	0.44
Medicaid	0.08	0.26	0.24	0.42
C: Labor market				
In labor force	0.69	0.46	0.69	0.46
Unemployed	0.07	0.26	0.10	0.30
Ln (hours)	3.60	0.40	3.58	0.42
Fulltime	0.88	0.32	0.86	0.34
Obs.	109,162		196,224	
D: In-migration rate				
Cross-state migration	0.0123	0.11	0.0068	0.0825
Cross E/NE state migration	0.0065	0.0804	0.0023	0.0477
Obs.	109,162		196,224	
E: Out-migration rate				
Cross-state migration	0.0099	0.0988	0.0082	0.0901
Cross E/NE state migration	0.0041	0.0639	0.0036	0.0600
Obs.	108,898		196,488	

Source: American Community Survey (2010–2017).
Sample is limited to non-citizens with less than high school education at ages 18–64. Each cell in panels A-C reports the sample mean of the variable indicated, among noncitizens in the baseline sample with current state in non-expansion states (column 1) or in expansion states (column 2). Panels D and E report the average in-migration and out-migration rate for the studied sample. Cross-state migration means moved across a state border line. Cross E/NE state migration means moved across a state border line between an expansion state and a non-expansion state. FPL is federal poverty level.

in 2014, under the ACA (18, 19). In addition, MA experienced significant policy reforms prior to 2010. Individuals in these states may or may not experience a policy change after 2014 depend on the degree of prior expansion. In the main analysis sample, we consider states that expanded Medicaid coverage by 2014 as the treatment group[10]. The other issue is that there is no deadline for states to decide whether or not to adopt the expansion. As we discussed, most of states expanded on the first day of 2014, but a handful expanded in later years. In the main analysis sample, we exclude states that expanded after the first day of 2014 (MI, NH, PA, IN, AK, LA, and MT). In other words, we only consider states that did not expand Medicaid coverage during the study period as the control group.

Unweighted summary statistics[11] for the studied sample are calculated and stratified by state Medicaid expansion status (see Table 1). In the primary sample, 64% of the observations are in expansion states, while 36% are in non-expansion states. In terms of demographic differences, characteristics are fairly well-matched, except that non-citizens in non-expansion states

10 To assess whether including states with pre-ACA expansions, either limited or comprehensive, made a difference, we re-estimate all models in several ways. First, we drop MA. Second, we drop the "early expanders". Third, we drop the "early expanders" plus MA. None of specifications yield result that are meaningfully different from the baseline specification.

11 We present the descriptive statistics with the ACS survey weights in Appendix Table A1.

tend to have a higher rate of poverty. In non-expansion states, 51% of the low-educated non-citizens has income at or below 138% of the FPL, while it is 47% in Medicaid expansion states. In terms of health insurance coverage, expansion states have relatively higher rate of coverage, mostly coming from Medicaid coverage, though higher rate of employer-sponsored coverage also contributes to the disparity. In terms of labor market outcomes, however, the two sets of states look fairly similar.

Interstate migration: In-migration and out-migration

The expansion of Medicaid coverage could have attracted non-citizens from non-expansion states to move in or persuaded those in expansion states who might have considered leaving to stay put or change destination, after the expansion. Therefore, the most powerful measure to detect interstate migration effects of the Medicaid expansion is to investigate the relative changes in migration rate between expansion and non-expansion states. Accordingly, we define two binary variables (i.e., in-migration and out-migration) to estimate the potential effects.

It is motivated in part by Goodman (20) who explores whether non-expansion-to-expansion migration increased, relative to the increase in expansion-to-non-expansion migration among low-income population. He shows that migration from non-expansion states to expansion states did not increase relative to migration in the reverse direction. One of our outcome variables, out-migration, is similar to his specification, which is defined from the perspective of a respondent's original state of residence (12 months prior to interview). It equals one if a person had moved out of an expansion state and moved into a non-expansion state (out-migration for expansion states) or moved out of a non-expansion state and moved into an expansion state (out-migration for non-expansion states) in the last 12 months. However, this specification only explores one aspect of the potential migration effect of Medicaid expansion.

Migration is not only affected by factors that push individuals to migrate out (perspective from state-of-origin), but also by factors that pull individuals to move in (perspective from state-of-destination). Based on this logic, when benefits are more favorable in some states, such conditions are expected to create an incentive for potential beneficiaries to migrate in. Earlier studies also show the concern of that characteristics in destination regions may correlate with both welfare policy and immigration pattern (21, 22). Accordingly, we define another outcome variable, in-migration, as from the perspective of state-of-destination (current state of residency). And we assume that a state's in-migration rate is affected by current state's economic conditions. Following Kaushal (23), we introduce state-of-destination fixed effect to control for unobserved time-invariant destination characteristics. If the expansion of Medicaid coverage changes interstate migration rate, then we should expect an increase in in-migration rate and a decrease in out-migration rate. We will discuss further in *Statistical Analysis*.

Swartz and Sommers (5) use "cross-state in-migration and out-migration" to examine the potential interstate migration effect of public insurance expansions in AZ, ME, MA, and NY. They define "cross-state in-migration" as whether a person had moved into an expansion or a non-expansion state from another state in the previous years and define "cross-state out-migration" as whether a person who had been living in a non-expansion state or expansion state had moved to another state in the previous year. However, "cross-state migration" includes not only migrations from expansion states to non-expansion states or from non-expansion states to expansion states but also migrations between expansion states and between non-expansion states. Immigration flows either between expansion states or between non-expansion states should not be counted as welfare-induced migration.

We present average migration rate for both definitions of "in-migration" and "out-migration" in panels D and E of Table 1 for comparison. The first row of panels D and E shows the mean of cross-state in-migration and out-migration rate. The second row shows the mean of our measurement of in-migration and out-migration rate (i.e., moved from an expansion state to a non-expansion state or in a reverse direction). On average, in our sample period, cross-state in-migration rate averaged 0.88 percent each year (1.23 percent in non-expansion states and 0.68 percent in expansion states), and out-migration averaged 0.88 percent[12] (0.99 percent in non-expansion states and 0.82 percent in expansion states). Only 30–50 percent of the non-citizens who migrated across states, or 0.38 percent of the sample, said that they had changed their state of residency from an expansion state to a non-expansion state or in a reverse direction.

To understand broad patterns of migration flows between expansion and non-expansion states in the analysis sample, we plot annual means of in-migration and out-migration rates for Medicaid expansion and non-expansion states in Figure 2. The left figure shows that in-migration rate of non-expansion states decreases relative to that of expansion states after the expansion. The right figure shows that the average percent of non-citizens moving out of expansion states decreases relative to the average percent of non-citizens moving out of non-expansion states, after the expansion. However, the difference in changes is relatively small. Notably, both in-migration and

12 We exclude individuals who migrated from and to other countries; therefore, we have a unique sample for in-migration and out-migration analyses.

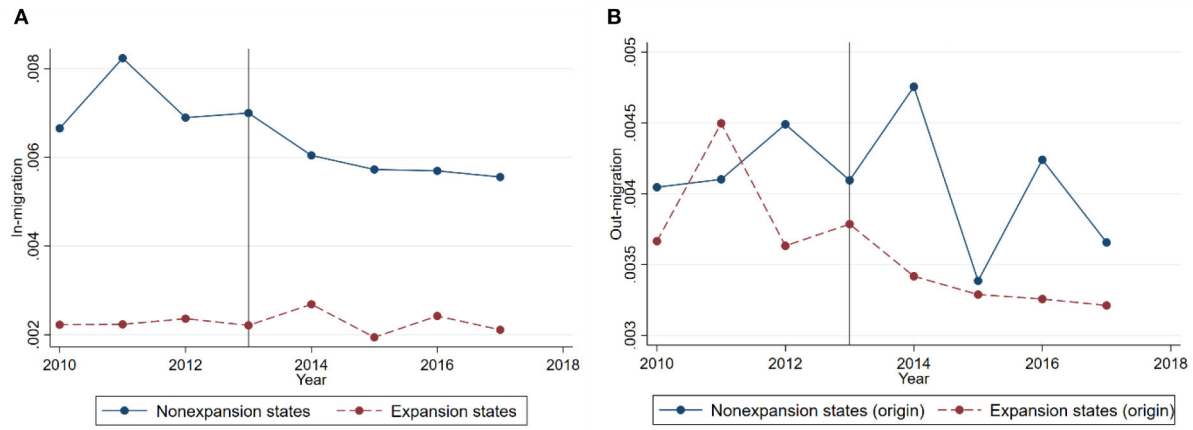

FIGURE 2
(A) In-migration. **(B)** Out-migration. Yearly average in-migration and out-migration rates for the main analysis sample. **Sources**: 2010 to 2017 American Community Survey. Annual means of in-migration and out-migration rates for expansion and non-expansion states are plotted in the figure. The sample consists of less than high school educated non-citizens at ages 18–64 with more than 5 years of residency in the United States.

out-migration rates are generally higher in non-expansion states than in expansion states, both before and after the expansion.

Statistical analysis

Health insurance coverage

The effect of Medicaid expansion in reducing un-insurance rate among the general low-educated population has been well documented in the health economics literature [(24, 25) to name a few]. However, the effect on low-educated non-citizens remain underexplored. Therefore, we first investigate if the expansion of Medicaid coverage associates with changes in insurance coverage of low-educated non-citizens before we formally explore the migration effects.

The ACS asked whether an individual had health insurance coverage as well as the type of coverage at the time of interview. Based on the survey questions, we defined four insurance coverage indicator variables. One was a dummy variable and denotes lack of any type of coverage (i.e., uninsured). The other three were indictors for a specific type of coverage, including privately purchased[13], employer-sponsored and Medicaid. We employ a DD research design and compare changes in health insurance coverage of low-educated noncitizens in states that did and did not expand Medicaid coverage before and after adoption of the policy. The DD approach could cancel out the effect of common factors that affect both the treatment and control groups and isolate the effect of Medicaid expansion. We obtain the DD estimates of the ACA Medicaid expansion by running a regression of the following form on our outcome variables[14]:

$$Y_{ist} = \beta_0 + \beta_1 Expan_{is} \times Post_t + X\gamma + \eta_s + \theta_t + \varepsilon_{it} \quad (1)$$

Equation (1) indicates that the health insurance coverage, for example, Medicaid, of noncitizen "i" in state "s" and year "t" depends on the interaction of an indicator of whether a noncitizen "i's" current state of residency is in the treatment group with a time dummy that equals one after year 2014 ($Expan_{is} \times Post_t$), and demographic characteristics and state-level variables (X). Demographic characteristics include age, age squared, gender and marital status. State-level variables include unemployment rate [taken from the (26)] and the annual average number of weeks of unemployment insurance (UI) benefits available [adopted from Farber and Valletta (27) and Valletta (28)[15]]. A full set of state-of-destination and year dummies, η_s and θ_t, are also included in the equation to account for unobserved state-level heterogeneity and common

13 The private purchases include both employer-sponsored and non-group purchases. Estimates for models that divide the privately insured into those without employer-sponsored insurance are largely consistent with the estimates obtained with employer-sponsored insurance. Also, individuals could report having more than one type of coverage in the ACS, and we allow for this in our analysis. Therefore, the types of coverage are not mutually exclusive.

14 The regressions are weighted by the ACS sample weights. We also performed same regressions without using the sample weights. All estimates are consistent with the main findings. The results are not shown but are available upon request.

15 We are grateful to Dr. Robert G. Valletta at Federal Reserve Bank of San Francisco for providing us with data on unemployment insurance benefit durations.

TABLE 2 Changes in health insurance coverage.

	Medicaid	Private purchase	Employer-sponsored	Uninsured
Expand × post 2014	0.0818***	−0.0381***	−0.0231***	−0.0410**
	(0.0094)	(0.0108)	(0.0060)	(0.0154)
Mean of dep. var. in expansion states before 2014	[0.1867]	[0.2384]	[0.2171]	[0.5759]
State fixed effect and year fixed effect	Yes	Yes	Yes	Yes
Obs.	305,386	305,386	305,386	305,386

Source: American Community Survey (2010–2017).
Estimates report coefficients on interaction term between an indicator for whether the state is an expansion state and an indicator for whether the year is after 2014. Sample used in this analysis is limited to non-citizen immigrants between ages 18 and 64. Regressions are adjusted using indictors for state, year, age, age squared, gender, and marital status. State level variables include the unemployment rate and the annual average number of weeks of unemployment insurance benefits available. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered on current-state level. Mean of dependent variables in the set of expansion states before 2014 are reported in brackets.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

time trends in the outcomes across states. Standard errors are clustered at state-of-destination level to adjust for within-state correlation over time.

In-migration and out-migration

$$In\text{-}migration_{ist} = \beta_0 + \beta_1 Expan_{is} \times Post_t + X\gamma + \eta_s + \theta_t + \varepsilon_{it} \quad (2)$$

the dependent variable, In-migration$_{ist}$, equals 1 for a noncitizen i who have moved from a non-expansion state to an expansion state or in a reverse direction, in the 12 months prior to interview in year t, otherwise equals to zero. $Expan_{is} \times Post_t$ is the interaction of an indicator of whether a respondent's state-of-destination (current state) is an expansion state with a time dummy that equals one after year 2014. X includes the same set of demographic characteristics and state-level variables as in equation (1). Standard errors are clustered at the state-of-destination level. Therefore, coefficient β_1 captures the relative change (expected to be weakly positive) between inflows in these two directions after 2014 relative to that difference in earlier years.

$$Out\text{-}migration_{ist} = \beta_0 + \beta_1 Expan_{origin_{is}} \times Post_t + X_{origin}\gamma + \eta_{origin_s} + \theta_t + \varepsilon_{it} \quad (3)$$

$Expan_{origin}$ is a dummy variable that equals one if a respondent's state-of-origin is an expansion state. X_{origin} includes the same set of controls as in equation (1) but refers to last year. η_{origin_s} is a set of state-of-origin dummies. Standard errors are clustered at the state-of-origin level. Therefore, coefficient β_1 captures the relative difference (expected to be weakly negative) of out-migration rates between expansion and non-expansion states after 2014 relative to that difference in earlier years.

Results

Health insurance coverage

We begin the discussion of results with the effect of Medicaid expansion on insurance coverage, which is classified into Medicaid, private insurance, employer sponsored insurance and uninsured. Regression estimates in Table 2 indicate that the expansion of Medicaid coverage was associated with 4.1 percentage points (from a base of 57.59 percent) decrease in un-insurance rate, 2.31 percentage points (from a base of 21.71 percent) decrease in employer-sponsored coverage, and 3.81 percentage points (from a base of 23.84 percent) decrease in private coverage for low-educated non-citizens in expansion states relative to their counterparts in non-expansion states. The changes were driven entirely by an increase in Medicaid coverage (8.18 percentage points). All estimates are statistically significant. The decrease in private insurance and increase in Medicaid coverage suggest some amount of crowd-out of private for public insurance. In short, our findings in health insurance coverage are in line with published evidence, which found robust evidence that the expansion of Medicaid coverage is associated with significant increase in insurance rate.

The estimates (see Appendix Table A1) for the low-income sample (at or below 138% of the FPL[16]) are very similar to those for the low-educated sample (Table 2), although slightly larger. For example, the 2014 Medicaid expansion was associated with a 10.07 percentage point increase in Medicaid coverage, a 5.51 percentage point decrease in uninsured, and a 4.46 percentage point decrease in private insurance. All estimates are statistically significant. Overall, the estimates suggest a slightly higher rate of crowd-out of private for public insurance than in the low-educated sample.

16 FPL is based on each family's total income for previous years as a percentage of the poverty thresholds.

TABLE 3 Changes in in-migration and out-migration rates: Main results.

	Model 1		Model 2		Model 3	
	In-migration	Out-migration	In-migration	Out-migration	In-migration	Out-migration
Expand × post 2014	0.0001	0.0005	−0.0004	0.0003	0.0007	−0.0007
	(0.0010)	(0.0008)	(0.0010)	(0.0008)	(0.0024)	(0.0015)
Mean of dep. var. in expansion states before 2014	[0.0023]	[0.0023]	[0.0023]	[0.0023]	[0.0023]	[0.0023]
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effect and year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
State-level controls	No	No	Yes	Yes	Yes	Yes
State specific linear trends	No	No	No	No	Yes	Yes
Obs.	305,386	305,386	305,386	305,386	305,386	305,386

Source: American Community Survey (2010–2017).
Sample used in the analysis is limited to non-citizen immigrants between ages 18 and 64 with education level less than high school. Estimates report coefficients on the interaction term of equations (2) and (3). Regressions are adjusted using indictors for state, year, age, age squared, gender, and marital status. State level variables include the unemployment rate and the annual average number of weeks of unemployment insurance benefits available. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered on current-state level for in-migration equations and origin-state level for out-migration equations. Mean of dependent variables in expansion states before 2014 are reported in brackets. See Appendix Table A3 for a full set of results.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

In-migration and out-migration: Baseline results

In this subsection, we address our primary question: whether the expansion of Medicaid coverage associates with changes in interstate migration patterns among the low-educated noncitizen immigrants. To explore this question, we estimate equations (2) and (3) and report the corresponding estimates in Table 3[17].

We first estimate a model that without including state level variables and present the estimates in Model 1. In model 2, we further include the state-level unemployment rate and the annual average number of weeks of unemployment insurance (UI) benefits available. Buchmueller et al. (29) argue that part of the reason that individuals migrate to expansion states is because they can spend more time on unemployment and search for a better job. This raises a concern of that state-level decisions in expanding Medicaid coverage may correlate with state-level economic conditions. The other concern is that Medicaid expansion may correlate with changes in other welfare programs that also affect migration. Most of the states reduced their UI duration back to normal level of 26 weeks when the Emergency Unemployment Compensation program[18] was terminated at the end of 2013, which corresponds exactly to when Medicaid expansion took effect (on Jan 1, 2014). As discussed by Buchmueller et al. (29), the reduction in UI availability could offset and hence bias the estimated impact of Medicaid expansion. Statistics also show that, on average, expansion states tend to be more generous on UI benefits than non-expansion sates, and a number of non-expansion states reduced their normal UI duration below 26 weeks after 2014. Thus, it is important to control for the generosity of UI benefits. In model 3, we further include state-specific linear trends to control for any difference in the trends of interstate migration between expansion and non-expansion states[19].

The estimates in model 1 indicate that Medicaid expansion was associated with an increase in in-migration rate of 0.01-percentage-point and an increase in out-migration rate of 0.05-percentage-point, however both estimates are statistically insignificant. Model 2 includes state unemployment rate and UI durations, and the results indicate that Medicaid expansion was not associated with a change either in in-migration or out-migration. Model 3 adds state-specific trends and results show

17 We only present the coefficient for the variable of interest in Table 3. Coefficients of all demographic characteristics are presented in Appendix Table A3.

18 In response to the 2007-09 "Great Recession," the maximum duration of unemployment benefits was increased from the normal level of 26 weeks to an unprecedented 99 weeks [see Valletta (28) for details].

19 This allows us to address concerns regarding potential biased introduced by state-level controls, such as unemployment rate and UI benefits.

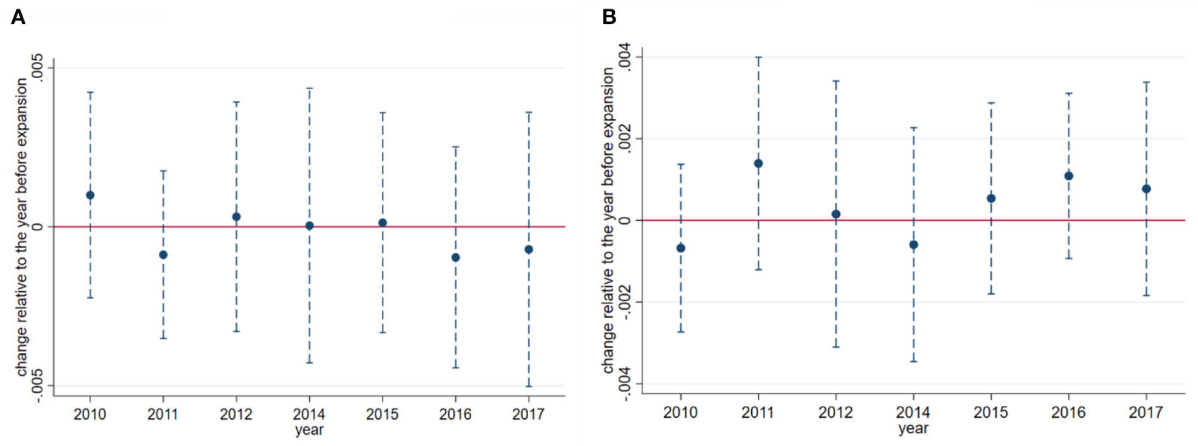

FIGURE 3
(A) In-migration. **(B)** Out-migration. Event study of in-migration and out-migration rates among non-citizens. **Sources**: Authors' difference-in-differences (DD) estimates from the 2010 to 2017 American Community Survey. Coefficients (blue dots) and 95% confidence intervals (blue vertical dashed lines) from DD regressions are plotted in the figure (year 2013 is omitted). The sample consists of less than high school educated non-citizens at ages 18–64 with >5 years of residency in the United States. Regressions are adjusted using indictors for state, year, age, age squared, gender, marital status and two state-level variables. States and year fixed effects are also included. All standard errors (parentheses) are clustered on state. Regressions are weighted by the ACS sample weights.

no potential difference in migration trends between expansion and non-expansion states. In brief, the regression estimates suggest no statistically significant changes in in-migration and out-migration flows resulting from Medicaid expansion[20].

Parallel trend assumption

This estimation strategy relies on a standard parallel trend assumption, which means in the absence of the Medicaid expansion changes in in-migration and out-migration rates would be the same in the treatment and control groups. To assess the validity of this assumption, we re-estimate the models that produced the main results, but allow the treatment indicator to differ by every year instead of just pre- and post-2014. The parallel trend assumption implies that all pre-2014 interactions between the treatment indicator and the year dummies are zero.

Figure 3 provides a visual summary of the preexisting trends in in-migration and out-migration rates. It shows that non-expansion-to-expansion migration and expansion-to-non-expansion migration was following a reasonably parallel trend before the expansion. Indeed, none of the coefficients significant at conventional level and they are not joint significantly different from zero in years prior to 2014 (p-value of 0.5981 for in-migration and 0.5680 for out-migration). Therefore, the parallel trend assumption holds in our study.

Border analysis: Short distance move

Several papers claim that individuals are migrating as short a distance as possible to obtain higher welfare benefits (3, 4). The ACS identifies localities known as Public Use Microdata Areas (PUMAs)[21]–approximately 2,300 areas of at least 100,000 people nested entirely within a state. We separate noncitizens within a state into different regions based on their PUMAs and define two sets of variables to examine this possibility. We report the results in Table 4.

First, we define "state border" as a border between two states. In the first row of panel A, we restrict the sample to individuals in PUMAs (Current-PUMA for in-migration and PUMA-origin for out-migration) that straddle a border between two states. However, only 13% of the sample satisfies this restriction. Therefore, in the remaining rows, we restrict the sample somewhat less stringently. In particular, we keep the

20 We also present results for low-educated natives in (Column 2 of Appendix Table A4) and low-educated naturalized citizens (Column 3 of Appendix Table A4). The estimates are in line with the published evidence that Medicaid expansion was not associated with changes in interstate migration.

21 One concern of using PUMA as local area is that the PUMA classification system changed in 2012. It is thus possible that the composition of individuals in PUMAs within a certain distance of a state border could have changed substantially between 2010 and 2012. Therefore, we re-estimate our border samples by using 2012-2017 data. Regression estimates are largely unchanged. Results are not reported but available upon request.

TABLE 4 Changes in in-migration and out-migration rates: Short distance move.

	In-migration	Out-migration
A: PUMA within a certain distance to state border		
PUMAs that straddle state border	0.0006	0.0018
	(0.0038)	(0.0027)
Obs.	39,505	37,380
<50 km from state border	0.0005	0.0021
	(0.0020)	(0.0013)
Obs.	76,932	69,859
<100 km from state border	−0.0001	0.0016
	(0.0019)	(0.0012)
Obs.	112,521	102,281
B: PUMA within a certain distance to expansion/non-expansion state border		
PUMAs that straddle E/NE state border	0.0007	0.0005
	(0.0084)	(0.0044)
Obs.	15,342	14,566
<50 km from E/NE state border	0.0009	−0.0003
	(0.0033)	(0.0019)
Obs.	17,546	15,861
<100 km from E/NE state border	−0.0018	0.0006
	(0.0039)	(0.0023)
Obs.	36,203	33,015
<200 km from E/NE state border	−0.0013	0.0010
	(0.0032)	(0.0019)
Obs.	63,375	57,638

Source: American Community Survey (2010–2017).
Estimates report coefficients of the interaction term of Equations (2) and (3). Sample used in this analysis is limited to non-citizen immigrants between ages 18 and 64 with education level less than high school. Regressions are adjusted using indictors for state, year, age, age squared, gender, marital status and two state-level variables. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered on current-state level for in-migration equations and origin-state level for out-migration equations.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

sample to those in PUMAs with centroids within 50 km and 100 km to a state border, respectively. In brief, estimates in panel A of Table 4 are quite close to zero in both in-migration and out-migration equations in all specifications.

Second, we define "E/NE state border" as a border between an expansion state and a non-expansion state. We restrict the sample to individuals in PUMAs (Current-PUMA for in-migration and PUMA-origin for out-migration) that straddle an E/NE state border. Of the studied sample, 5% of the observations in PUMAs that straddle a border between an expansion and a non-expansion state. We, therefore, test the result by restrict the sample to those reside in PUMAs with centroids within 50 km, 100 km and 200 km to an E/NE state border. Regression estimates in panel B tell a similar story as the estimates in panel A: there is no association between Medicaid expansion and interstate migration[22].

Subsample analysis

If Medicaid expansion changes migration behavior, it should be easier to identify such an effect among a group with relatively higher demand for health care or with a relatively higher geographic mobility. We conduct a range of tests to investigate this possibility.

First, prior to 2014, unemployed individuals are roughly three times as likely to be uninsured as employed workers (29). In other words, employed workers have a higher probability of covered through employer sponsored insurance which in turn decreases their demand for other types of insurance coverage. In comparison, unemployed individuals may be particularly reliant on public insurance. Molly et al. (30) show that individuals are more likely to have moved across state if they were unemployed in the previous year. Therefore, we restrict the sample to those with no employment to test if they are more responsive to the expansion of Medicaid[23].

Second, prior to the ACA, most states had income eligibility for Medicaid that were more stringent for adults without dependent children than for adults with dependent children[24]. Also, it is much easier for individuals to migrate without dependent children than with dependent children. Therefore, we hypothesize that Medicaid expansion have stronger effects on non-citizens without dependent children than on parents. Accordingly, we limit the sample to those without dependent children to investigate this possibility.

Third, compared with established immigrants who have stronger social networks, new immigrants are more flexible to move. To test this possibility, we restrict the sample to those with <10 years of migration.

Forth, single men have the highest geographic mobility rate in our sample (1.6 percent moved across states and 0.6 percent moved across expansion/non-expansion states). Therefore, we restrict the sample to the most mobile group to investigate if they are more responsive to the expansion.

22 One concern of restricting the sample to border PUMAs is it substantially decreases the number of available observations and may result in statistical power issues.

23 In in-migration equation, we use unemployed at the time of survey; while, in out-migration equation we use unemployed in previous year.

24 Medicaid eligibility income thresholds for parents who were not eligible for specific Medicaid programs such as the Aged, Blind and Disabled (ABD) program ranged from 16% to 215% of the FPL, with an average of 87.33% of the FPL as of January 2013. However, thresholds for nonparent adults who were not eligible for coverage under the ABD program averaged 18.55% as of January 2013 (1).

TABLE 5 Changes in in-migration and out-migration rates: Subsamples with relatively higher demand and/or higher geographic mobility.

	In-migration	Out-migration
Unemployed	−0.0002	−0.0001
	(0.0022)	(0.0013)
Obs.	113,376	93,535
Without dependent children	0.0009	−0.0003
	(0.0014)	(0.0013)
Obs.	142,994	142,994
Years of migration (>5 and ≤10)	0.0007	−0.0015
	(0.0025)	(0.0026)
Obs.	56,773	56,773
Single men	0.0003	0.0005
	(0.0021)	(0.0017)
Obs.	61,891	61,891

Source: American Community Survey (2010–2017).
Estimates report coefficients of the interaction term of equations (2) and (3). Sample used in this analysis is limited to non-citizen immigrants between ages 18 and 64 with education level less than high school. Regressions are adjusted using indictors for state, year, age, age squared, gender, marital status and two state-level variables. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered on current-state level for in-migration equations and origin-state level for out-migration equations.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

We show the results of subgroup analysis in Table 5. While the signs of the estimates are generally consistent with the welfare magnet theory (more in-migration and less out-migration), none of the estimates are statistically significant. In short, results are consistent with a null effect of Medicaid-induced migration, even among sub-populations with expected higher demand for insurance coverage or with greater graphical mobility.

Robustness checks

Robustness analyses consist of several steps. First, we test the sensitivity of our results to alternative definitions of treatment and control groups and present the estimates in panel A of Table 6. And then, we deal with sample selection issue and show the results in panel B. Finally in panel C, we present several robustness checks experiment with dropping groups of individuals with potentially ambiguous treatment statuses.

Panel A shows results of using alternative classifications of treatment and control groups. First, it is reasonable to expect that the effect of the 2014 ACA Medicaid expansion is smaller in states with prior expansions. Therefore, we restrict the treatment group to states without Medicaid expansion prior to January 2014. In this test, we still consider states that did not expand Medicaid coverage during our study period as the control group. Results in column 1 of panel A indicate that our results are not sensitive to the inclusion of "early expanders." Second, as mentioned, in the main specification, we exclude states that expanded Medicaid after the first day of 2014 (MI, NH, PA, IN, AK, LA, and MT). In robustness, we employ two methods to take consideration of the "late expanders." The simpler way to address this problem is considering the "late expanders" as "treated" (column 2). Furthermore, to exploit variations across groups of units that received treatment at different times, we allow variations in treatment timing (column 3)[25]. Results in both columns are not significantly different from those of the models that excluded the "late expanders."

Panel B shows the results of using alternative samples. We present results for non-citizens with incomes up to 138% of the FPL in column 1 of panel B. We also present the results for the sample of non-citizens who qualify for both income restriction (at or below 138% of the FPL) and education restriction (less than high school educated) in column 2 of panel B. Regression estimates are close to zero in both selections, however, estimate in income-based selection is significant at 10 percent level for out-migration and the sign of the estimated coefficient is opposite as what we expected. One problem of using income threshold to select sample is that people may self-select into the treatment group. For example, individuals in expansion states may adjust their income to obtain Medicaid benefits. This would lead to a bias against finding welfare-induced migration and may explain the results obtained using income-based section.

To subsidize health insurance for those too poor to afford it, the ACA also introduces health insurance exchanges for adults with family incomes between 100–400% of the FPL. In non-expansion states, qualifying adults with incomes in the range of 100–138% of the FPL are eligible for federal subsidies in the form of premium tax credits to purchase through health insurance exchanges, which is somewhat less generous[26] than Medicaid coverage. The ACA was written anticipating that all states would expand Medicaid coverage, so it limits subsidies to individuals with income below the poverty line. As a result, individuals with income below 100% of the FPL fall into what has been dubbed the Medicaid "coverage gap" if they reside in states opting not

25 We use cross-state migration as our outcome variables under this specification. We cannot use cross expansion/non-expansion migration because the set of expansion states gets larger and the set of non-expansion states gets smaller along with more states counted as expansion states. Mechanically, this decreases in-migration rate in the set of expansion states and increases in-migration rate in the set of non-expansion states.

26 Additionally, the net premium paid on plans purchased through HIX is positive. Imagine a family of four earning at 138% FPL, which is about $32,000 per year. The insurance premium costs $16,000/ year (which is based on the average cost of 2nd lowest silver plan). Because of the premium subsidies, their insurance premium is capped at 2.04% of their income, and therefore, the maximum the family needs to pay is $653.

TABLE 6 Changes in in-migration and out-migration rates: Alternative ways of handing the sample.

	In-migration	Out-migration	In-migration	Out-migration	In-migration	Out-migration
A: Alternative identification strategies						
	Drop early expanders[a]		Include all states[b]		Allow variation in treatment timing[c]	
Expand × post2014	−0.0004	−0.0002	−0.0002	−0.0002	−0.0015	−0.0006
	(0.0011)	(0.0009)	(0.0012)	(0.0009)	(0.0016)	(0.0021)
Obs.	179,009	179,009	313,830	313,830	313,830	313,830
B: Alternative sample selections						
	Income ≤138%FPL		Edu < HS and Income ≤138% FPL		Income ≤100% FPL	
Expand × post2014	−0.0021	0.0017*	−0.0012	0.0009	−0.0013	0.0006
	(0.0016)	(0.0008)	(0.0016)	(0.0010)	(0.0019)	(0.0011)
Obs.	289,658	289,658	147,278	147,278	193,871	193,871
C: Restricted samples						
	Exclude ages 18–25		Exclude year 2013		Exclude undocumented immigrants	
Expand × post 2014	−0.0003	0.0001	−0.0005	0.0003	0.0009	−0.0010
	(0.0009)	(0.0008)	(0.0010)	(0.0009)	(0.0011)	(0.0013)
Obs.	286,002	286,002	266,353	266,353	116,863	116,863

Source: American Community Survey (2010–2017).

Estimates report coefficients of the interaction term of equations (2) and (3) by using model 2. Regressions are adjusted using indictors for state, year, age, age squared, gender, marital status and two state-level variables. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered on current-state level for in-migration equations and origin-state level for out-migration equations.

[a]Early expanders include: CA, CT, MN, NJ, WA, and DC.

[b]Late expanders include: MI, NH, PA, IN, AK, LA, and MT.

[c]We use cross-state in-migration and out-migration as our outcome variables under this specification. We cannot use cross expansion/non-expansion state migration because the set of expansion states gets larger and the set of non-expansion states gets smaller along with more states counted as expansion states. Mechanically, this decreases in-migration rate in the set of expansion states and increases in-migration rate in the set of non-expansion states.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

to expand Medicaid eligibility. In other words, there is a sharp variation across states in benefits for adults with family incomes below the federal poverty level. We, therefore, restrict the sample to non-citizens with incomes below 100% of the FPL to test the potential effects. Results in the last column of panel B indicate that this group of non-citizens are not statistically significant affected by the expansion.

Panel C report results of using several restricted samples. First, the ACA includes a provision requiring insurers to allow children to stay on their parent's health insurance plans until their 26th birthday, beginning in September 2010. Generally, evidence in the literature indicates that this provision led to a significant increase in insurance coverage among the 18 to 25-year-olds (19, 31). To reduce the possibility of confounding from this earlier provision, we re-estimate our sample by excluding individuals at ages 18–25. Second, as argued by Goodman (20), individuals might migrate in anticipation of expansion. Therefore, moves reported in the 2013 survey could also be part of the treatment effect. Following Goodman (20), we drop observations from the 2013 survey to test the robustness of our main results. Results in columns 1 and 2 indicate, neither restriction yields results that are meaningfully different from the baseline specification. Third, undocumented immigrants are prohibited from receiving public benefits and include them in the sample may lead the estimates biased toward zero. However, like other official datasets representing the U.S. population, the ACS does not share information on the legal status of immigrants. To identify the undocumented immigrants, we employ a "residual methodology" following Passel and Cohn (32) and Borjas (33)[27]. Results presented in the last column of panel C indicate an insignificant effect of Medicaid expansion on either in-migration or out-migration of the documented noncitizens[28].

27 Following Borjas (33), we define a person in the United States as legal if the person meets any of the following criteria: (1) arrived in the United States before 1980; (2) was born in Cuba; (3) has U.S. citizenship; (4) receives public benefits; (5) is employed with the government sector; (6) is employed with occupations that require licensing; (7) is married to a legal immigrant or a U.S. citizen. The residual group of all other foreign-born individuals is then classified as "potentially unauthorized" immigrants.

28 Interpreting in-migration response as an indication of Medicaid-induced migration requires caution in this context, however. This is because such method requires selecting on the basis of Medicaid receipt which could introduce compositional issues.

TABLE 7 Changes in in-migration and out-migration rates: Interstate migration for pregnant women and child immigrants.

	With at least one non-US-born dependent children (age <18 years)		Women at reproductive age (18–49 years)	
	In-migration	Out-migration	In-migration	Out-migration
Expand × post 2014	−0.0222	−0.0111	−0.0037	−0.0359
	(0.0210)	(0.0670)	(0.0058)	(0.0940)
Obs.	9,464	9,464	28,599	28,599

Source: American Community Survey (2010–2017).
Sample used in this analysis is limited to noncitizen immigrants with education less than high school and US residence less than 5 years. Regressions are adjusted using indictors for state, year, age, age squared, gender, marital status and two state-level variables. Regressions are weighted by the ACS sample weights. All standard errors (parentheses) are clustered at current-state level for in-migration equations and origin-state level for out-migration equations.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Interstate migration for pregnant women and child immigrants

Table 7 provides additional DD estimates testing the robustness of our findings. As discussed above, we restrict the main sample to those with more than 5 years of U.S. residency because quantified immigrants must wait 5 years before they are eligible for Medicaid benefits. However, non-US-born children (age <18 years) and pregnant women are excluded from the 5-year ban in some states. The two groups of immigrants might be incentivized to move because they would qualify for the expanded coverage[29]. In robustness, we use this state-level variation in extending Medicaid benefits to these two specific groups of immigrants to estimate if they are more likely to move to states with expanded coverage. We present the results for non-citizen immigrants with at least one non-US-born dependent children (age <18 years) in the left column of Table 7 and present the estimates for women at reproductive age (18–49 years) in right column of Table 7. Neither group of the immigrants experienced significant movement across states in response to the expanded benefits.

Discussion and limitation

Following the passage of the Affordable Care Act (ACA) and the subsequent 2012 Supreme Court decision, some states elected to offer Medicaid coverage to adults with incomes up to 138% of the FPL while others did not. The expansion of Medicaid coverage has the potential to benefit the low-educated non-citizens by providing new coverage pathways for those who are in need. As policy makers continue to debate access to public benefits for non-citizen immigrants, it is important to generate evidence as to whether the expansion of Medicaid coverage shapes interstate migration flow of the more than 4 million Medicaid-eligible non-citizens residing in the United States. In this paper, we investigate whether post-ACA Medicaid coverage differences play a role in insurance coverage and interstate migration flow of the low-educated non-citizens.

Despite the individual-level analyses based on DD models indicate that the 2014 Medicaid expansion was associated with statistically significant increases in insurance coverage rate among the low-educated non-citizens, there is little evidence supporting an increase in in-migration rate or a decrease in out-migration rate in expansion states relative to that of non-expansion states. In other words, states that consider expanding Medicaid coverage are unlikely to experience large increases in migration from other states. We also find no evidence of Medicaid-induced migration when we narrow our analysis to the border PUMAs of expansion and non-expansion states. To home in on the groups with the greatest incentive to migrate, we focus on recently unemployed individuals, childless adults, those within 5 to 10 years of immigration, and single men. We end up with same conclusion that they are no more likely to migrate to benefits providing states. Overall, our findings are generally consistent with welfare-induced migration literature, which has not found robust evidence for interstate migration by potential beneficiaries to states with more generous social welfare programs.

As of 2022, 12 states have not expanded Medicaid coverage. Despite the large increases observed in coverage rate, it remains unclear whether any of the remaining states will adopt the expansion in the near future. States in considering of expanding Medicaid coverage may take welfare-induced migration into account. With an estimated average benefit of $5,500 for the newly eligible in 2014[30], the gain to a migrant from a non-expansion state to an expansion state could potentially be quite

29 States extended Medicaid to pregnant women and child immigrants during our study period. In 2010, 26 states provided Medicaid to pregnant immigrants and 24 states to child immigrants. By 2017, the number increased to 32 for both pregnant immigrants and child immigrants (34).

30 2014 actuarial report: On the financial outlook for Medicaid. Report to Congress. Department of Health and Human Services, 2014.

large. However, our preferred estimates indicate that there was little to no net impact of the Medicaid expansion on either in-migration or out-migration. Our findings suggest it is unlikely that low-educated noncitizens migrate to Medicaid expansion states to obtain public coverages. Therefore, interstate migration is not likely to be a significant source of costs for states choose to adopt the expansion.

The limitations of this study should be acknowledged. First, using education as a proxy for income may include individuals being eligible for treatment who are not actually treated by the policy, which leads to downward bias in the point estimate of interest. Second, undocumented immigrants are not eligible for these benefits. However, like other official datasets representing the U.S. population, the ACS does not include data on legal status of immigrants. Although the "residual methodology" we employed allows us to determine with a high likelihood that a given respondent was undocumented, we could not do so with certainty. Thus, we can only estimate an estimate on the overall low-educated non-citizens, which include both documented and undocumented immigrants. Third, state's decision in expanding Medicaid might be correlated with its economic conditions, which may also affect migration and raise endogenous issues. Nevertheless, we find no violation of the parallel trend assumption and the results hold when we include several state-level economic variables.

Conclusion

We find that Medicaid expansion was not associated with migration to expansion states or out of non-expansion states among the low-educated non-citizens. Having concluded from the evidence that there are no overall systematic migration effects of Medicaid expansion on the overall low-educated non-citizens, we drill down the analysis further, studying movements near state borders, recently unemployed individuals, childless adults, those within 5 to 10 years of immigration, and single men. Overall, estimates in these subsamples are generally consistent with our main findings which show no evidence of welfare-induced migration. In short, the variation across states in accessing Medicaid coverage did not motivate low-educated non-citizens to move to expansion states to pursue public health benefits, and it did not persuade those in expansion states who might have considered leaving to stay put.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://usa.ipums.org/usa/.

Author contributions

MZ contributed to design of the study and wrote the first draft of the manuscript. HG organized the database and performed the statistical analysis. Both authors contributed to the article and approved the submitted version.

Funding

This study was supported and funded by the National Social Science Foundation of China (Grant No. 597). Research on the Mechanism, Effect and Policy of the Impact of Labor Migration Rigidity on the Development of Urban-rural Integration in China and the Jiangsu Provincial Social Science Foundation of China (Grant No. 22ZDA001). Research on the Mechanism of Labor Migration Promoting Urban-rural Integration in Jiangsu Province under the Goal of Common Prosperity.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.955257/full#supplementary-material

References

1. Henry J, Kaiser Family Foundation. *Health Coverage of Immigrants*. (2021). Available online at: https://www.kff.org/racial-equity-and-health-policy/fact-sheet/health-coverage-of-immigrants/

2. Borjas GJ. Immigration and welfare magnets. J Labor Econ. (1999) 17:607–37. doi: 10.1086/209933

3. McKinnish T. Importing the poor: welfare magnetism and cross-border welfare migration. *J Hum Resour.* (2005) 40:57–76. doi: 10.3368/jhr.XL.1.57

4. McKinnish T. Welfare-induced migration at state borders: new evidence from MicroData. *J Public Econ.* (2007) 91:437–50. doi: 10.1016/j.jpubeco.2006.09.002

5. Schwartz AL, Sommers BD. Moving for medicaid? Recent eligibility expansions did not induce migration from other states. *Health Aff.* (2014) 33:88–94. doi: 10.1377/hlthaff.2013.0910

6. Alm J, Enami A. Do government subsidies to low-income individuals affect interstate migration? Evidence from the massachusetts health care reform. *Reg Sci Urban Econ.* (2017) 66:119–31. doi: 10.1016/j.regsciurbeco.2017.06.005

7. Yasenov VI, Lawrence D, Mendoza FS, Hainmueller J. Public health insurance expansion for immigrant children and interstate migration of low-income immigrants. *JAMA Pediatr.* (2020) 174:22–8. doi: 10.1001/jamapediatrics.2019.4241

8. Federation for American Immigration Reform. *The Sinking Lifeboat: Uncontrolled Immigration and the U.S. Health Care System in 2009*. Washington, DC: Federation for American Immigration Reform (2009). Available online at: https://www.fairus.org/issue/publications-resources/sinking-lifeboat-uncontrolled-immigration-and-us-health-care-system. (accessed July 14, 2022).

9. Mohanty SA, Woolhandler S, Himmelstein D, Pati S, Carrasquillo O, Bor D, et al. Health care expenditures of immigrants in the United States: a nationally representative analysis. *Am J Public Health.* (2005) 95:1431–8. doi: 10.2105/AJPH.2004.044602

10. Goldman DP, Smith JP, Sood N. Immigrants and the cost of medical care. *Health Aff.* (2006) 25:1700–11. doi: 10.1377/hlthaff.25.6.1700

11. Zallman L, Woolhandler S, Touw S, Himmelstein DU, Finnegan KE. Immigrants pay more in private insurance premiums than they receive in benefits. *Health Aff.* (2018) 37:1663–8. doi: 10.1377/hlthaff.2018.0309

12. Sherman A, Trisi D, Stone C, Gonzales S, Parrott S. *Immigrants Contribute Greatly to U.S. Economy, Despite Administration's "Public Charge" Rule Rationale*. Center on Budget and Policy Priorities (2019).

13. Henry J, Kaiser Family Foundation. *Status of State Action on the Medicaid Expansion Decision. KFF State Health Facts.* (2021). Available online at: https://www.kff.org/health-reform/state-indicator/state-activity-around-expanding-medicaid-under-the-affordable-care-act/

14. Meyer BD. *Do the Poor Move to Receive Higher Welfare Benefits?* (2000). Available online at: https://harris.uchicago.edu/files/meyer_do_the_poor.pdf. (accessed on December 25, 2021)

15. Ku L, Bruen B. *Poor Immigrants Use Public Benefits at a Lower Rate than Poor Native-Born Citizens*. Cato Onstitute Economic Development Bulletin; Center for Global Liberty and Prosperity (2013). Available online at: https://www.cato.org/sites/cato.org/files/pubs/pdf/edb17.pdf

16. Buchmueller TC, Lo Sasso AT, Lurie I, Dolfin S. Immigrants and employer-sponsored health insurance. *Health Serv Res.* (2006) 42:286–310. doi: 10.1111/j.1475-6773.2006.00600.x

17. Ku L, Matani S. Left out: immigrants' access to health care and insurance. *Health Aff.* (2001) 20:247–56. doi: 10.1377/hlthaff.20.1.247

18. Henry J, Kaiser Family Foundation. *States Getting a Jump Start on Health Reform's Medicaid Expansion*. Washington DC: Kaiser Commission on Medicaid and the Uninsured (2012).

19. Sommers BD, Arntson E, Kenney GM, Epstein AM. Lessons from early medicaid expansions under health reform: interviews with medicaid officials. *Medicaid Res Rev.* (2013) 3:4. doi: 10.5600/mmrr.003.04.a02

20. Goodman L. The effect of the affordable care act medicaid expansion on migration. *J Policy Anal Manage.* (2017) 36:211–38. doi: 10.1002/pam.21952

21. Jaeger D. *Local Labor Markets, Admission Categories, and Immigrant Location Choice*. Hunter College, New York. (2000).

22. Dodson ME. Welfare Generosity and Location Choices among New United States Immigrants. *Int Rev Law Econ.* (2001) 2:47–67. doi: 10.1016/S0144-8188(00)00040-5

23. Kaushal N. New Immigrants' location choices: magnets without welfare. *J Labor Econ.* (2005) 23:59–80. doi: 10.1086/425433

24. Kaestner R, Garrett B, Chen JJ, Gangopadhyaya A, Fleming C. Effects of ACA medicaid expansions on health insurance coverage and labor supply. *J Policy Anal Manage.* (2017) 36:608–42. doi: 10.1002/pam.21993

25. Courtemanche C, Marton J, Ukert B, Yelowitz A, Zapata D. Early impacts of the affordable care act on health insurance coverage in medicaid expansion and non-expansion states. *J Policy Anal Manage.* (2017) 36:178–210. doi: 10.1002/pam.21961

26. Bureau of Labor Statistics. *The Local Area Unemployment Statistics*. Washington, DC: Bureau of Labor Statistics, (2018). Available online at: http://www.bls/gov/lau/.

27. Farber HS, Valletta RG. Do extended unemployment benefits lengthen unemployment spells? *J Hum Resour.* (2015) 50:873–909. doi: 10.3368/jhr.50.4.873

28. Valletta, R. G. Recent extensions of U.S. unemployment benefits: search responses in alternative labor market states. *IZA J Labor Policy*. (2014) 3:1-25 doi: 10.1186/2193-9004-3-18

29. Buchmueller TC, Levy H, Valletta RG. Medicaid Expansion and the Unemployed. *J Labor Econ.* (2021) 39:S575–617. doi: 10.1086/712478

30. Molloy R, Smith CL, Wozniak A. Internal migration in the United States. *J Econ Perspect.* (2011) 25:173–96. doi: 10.1257/jep.25.3.173

31. Barbaresco S, Courtemanche C, Qi Y. Impacts of the affordable care act dependent coverage provision on health-related outcomes of young adults. *J Health Econ.* (2015) 40:54–68. doi: 10.1016/j.jhealeco.2014.12.004

32. Passel JS, Cohn DV. *Unauthorized Immigrant Totals Rise in 7 States, fall in 14 States: Decline in Those from Mexico Fuels Most State Decreases*. Washington, DC: Pew Research Center. (2014).

33. Borjas GJ. The labor supply of undocumented immigrants. *Labour Econ.* (2017) 46:1–13. doi: 10.1016/j.labeco.2017.02.004

34. Gelatt J, Bernstein H, Koball H, Runes C, Pratt E. *State Immigration Policy Resource. Urban Institute; February 17.* (2022).

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 20 October 2022
DOI 10.3389/fpubh.2022.1008370

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 31 July 2022
ACCEPTED 04 October 2022
PUBLISHED 20 October 2022

CITATION
Xiong M and Hu Z (2022) Relative deprivation and depressive symptoms among Chinese migrant children: The impacts of self-esteem and belief in a just world.
Front. Public Health 10:1008370.
doi: 10.3389/fpubh.2022.1008370

Relative deprivation and depressive symptoms among Chinese migrant children: The impacts of self-esteem and belief in a just world

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Background: Studies have shown that relative deprivation is a risk factor for depressive symptoms, but the underlying mechanisms are not yet clarified. Thus, this study formulated a moderated mediation model to investigate the mediating role of self-esteem and the moderating role of belief in a just world between relative deprivation and depressive symptoms among rural-to-urban migrant children.

Methods: A sample of 1,076 Chinese migrant children (M_{age} = 12.25 years, SD = 1.66) completed measurements of relative deprivation, self-esteem, belief in a just world, and depressive symptoms. Furthermore, the mediating mechanism and moderating effect of the study were explored with the SPSS PROCESS macro (Models 4 and 7).

Results: The results showed a significant positive association between relative deprivation and depressive symptoms, with self-esteem partially mediating this association. Moreover, belief in a just world moderated the association between relative deprivation and self-esteem. Namely, the indirect effect of self-esteem was moderated by belief in a just world. Specifically, the mediating effect was stronger for migrant children with higher levels of belief in a just world.

Conclusion: These findings broaden our knowledge of how and when relative deprivation influences depressive symptoms among migrant children. Therefore, appropriate measures should be taken to prevent and manage migrant children' depression and provide them with corresponding guidance. Some measures could be taken by schools and educators to help migrant children with high relative deprivation in improving their self-esteem and belief in a just world, such as self-reference tasks and psychological intervention programs.

KEYWORDS

migrant children, relative deprivation, self-esteem, belief in a just world, depressive symptoms

Introduction

During the past several decades, China has experienced an unprecedented migration from rural to urban regions due to its rapidly developing economy and urbanization (1). A side effect of the large scale of migration is that children have moved with their parents en masse from rural areas to urban regions (2). Rural-to-urban migrant children are described as children, under 18 years old, who have left their original residence and migrated to destination cities for more than 6 months (3). Based on the data from China's Ministry of Education in 2019, there were approximately 14 million migrant children in elementary and junior high schools (4). Researchers have documented that rural-to-urban migration decreases children's well-being while increasing problem behaviors (3, 5). In particular, rural-to-urban migrant children are more susceptible to depression compared to their non-migrant peers (6). Evidence has shown that depression is prevalent among adolescents in the twenty first century (7, 8). Furthermore, a study revealed that about 21% of the 677 Chinese migrant children were diagnosed with depression (9). Depression can lead to various undesirable consequences in psychological and social adjustment (10, 11). Therefore, scrutinizing the risk factors and relevant mechanisms for rural-to-urban migrant children's depression is necessary for prevention and intervention efforts.

Relative deprivation refers to a subjective cognition and affective experience with negative emotions, such as anger and resentment, when people perceive that they are in a disadvantaged position through horizontal or vertical comparison (12, 13). It might be a risk factor for depressive symptoms among migrant children. Studies show that relative deprivation is significantly positively correlated with depression among Chinese college students (14, 15). However, as previous studies have focused on the general population, little is known about the association between relative deprivation and depressive symptoms in migrant children. Additionally, prior research has concentrated on the direct relationship between relative deprivation and depressive symptoms, with the underlying mediating (i.e., how relative deprivation is associated with depressive symptoms) and moderating mechanisms (i.e., when relative deprivation is associated with depressive symptoms) remaining unclear. Thus, to address these gaps, this study proposed a moderated mediation model to reveal the underlying mechanisms of this relationship in rural-to-urban migrant children. Given that high self-esteem is a mental mechanism of individuals in their adaptation to the sociocultural environment (16), this study tested self-esteem as a mediator to clarify the influencing mechanisms of relative deprivation on depressive symptoms. Moreover, prior studies have indicated that belief in a just world is a powerful buffer that mitigates the adverse effects of risk factors on left-behind children's mental health and problem behaviors (17). Thus, belief in a just world, which is defined as the believe that people live in a world where they generally receive rewards and/or punishments they deserve (18), might act as a moderator in this study.

Relative deprivation and depressive symptoms

Research has also indicated that relative deprivation leads to various undesirable outcomes, such as depression (19), anxiety disorders (20), and aggressive behavior (13). Compared with their non-migrant counterparts, children who migrate with their parents from rural to urban areas are more likely to encounter relative deprivation due to the household registration system (or *hukou*) in China (6, 21). Specifically, many cities deny rural-to-urban migrant children access to public schools because public schools' admittance standards are contingent upon local legal residency. Although migrant families relocate to urban areas, they still maintain their rural residential status (6).

Theoretical and empirical research has revealed the relationship between relative deprivation and depressive symptoms. First, considering that relative deprivation contains two components—subjective cognition and affective experience (13)—it may affect depression through both cognition and emotion. Individuals with high relative deprivation experience negative emotions, including indignation, sadness, and disgruntlement (22); these emotions are significant indicators of depression. Thus, relative deprivation may influence depressive symptoms. Additionally, the cognitive model of depression (23) highlighted the role of cognitive vulnerabilities in the onset and development of depression. Namely, unreasonable cognition caused by relative deprivation may aggravate depression in individuals. Second, the relative deprivation theory (24) posits that disadvantaged groups, such as migrant children, experience relative deprivation in upward social comparison. This feeling of deprivation not only results in interpersonal problems, but also damages individual psychological health, which is a risk factor for depressive symptoms (25). More importantly, depression is a crucial dimension of psychological well-being (26). Accordingly, relative deprivation enhances the likelihood of depressive symptoms. Third, cross-sectional and longitudinal studies have also demonstrated that higher levels of relative deprivation are associated with higher levels of depression. For example, individuals with relative deprivation have more depressive symptoms (27). Another longitudinal study by Schmitt et al. (28) documented that earlier relative deprivation could predict later poor mental health (e.g., depression) in a sample of 1276 East Germans over the course of 4 years. Additionally, a meta-analysis showed that relative deprivation predicted the level of depression, with $r = 0.173$ (29). Thus, based on relevant theories and empirical studies, this study assumed that relative deprivation is positively associated with depressive symptoms among migrant children (Hypothesis 1).

Self-esteem as a mediator

Self-esteem is described as one's sense of self-worth, reflecting a positive or negative assessment and attitude toward oneself (30, 31). Multiple studies have revealed that various factors could affect self-esteem, such as family socioeconomic status (32), cyberbullying (33), and social comparison (34). Relative deprivation is also an important inducer of self-esteem as its core psychological process is social comparison (35). Social comparison theory (36, 37) states that upward social comparison is a critical factor leading to low self-esteem. Moreover, when individuals feel this kind of unfavorable socioeconomic status, they may have more negative self-evaluation and tend to conduct self-aggression (38), which decreases the level of self-esteem (39). Compelling evidence suggests that relative deprivation is inversely correlated with self-esteem. Studies on the direct association between relative deprivation and self-esteem have also verified that relative deprivation is a risk factor for low self-esteem (29). For instance, an experimental study by Walker (40) found that personal relative deprivation lowered self-esteem. Further, both cross-sectional and longitudinal research found that relative deprivation was negatively linked to self-esteem (41, 42).

Depression is one of the major adverse consequences of low self-esteem. There are two reasons supporting this inference. Primarily, self-esteem is an important predictor of mental health (43); simultaneously, depression is also a crucial dimension of psychological well-being (44). Besides, according to the vulnerability and scar models of low self-esteem and depression (45, 46), low self-esteem is a vulnerable diathesis of depression. In other words, high level of self-esteem could protect individuals from the influence of depressive symptoms, whereas low self-esteem increases the risk of depressive symptoms. Second, a large body of empirical research suggests that reducing the level of self-esteem predicts more depressive symptoms. Notably, a longitudinal study by Fan et al. (47) suggested that low self-esteem at baseline was a risk factor for depression at a 9 month follow-up in Chinese migrant children. Additionally, a series of cross-sectional studies found that depressive symptoms deteriorated with the aggravation of low self-esteem (48, 49). Thus, we can conclude that low self-esteem affects depressive symptoms. As mentioned above, relative deprivation negatively predicts self-esteem, which leads to more depressive symptoms. Consistent with this theoretical framework, an empirical study showed that self-esteem partially mediated the association between relative deprivation and aggression among young male migrant workers (39). Overall, it is reasonable to assume that self-esteem serves as a mediator. Therefore, this study hypothesized that self-esteem mediates the relationship between relative deprivation and depressive symptoms (Hypothesis 2).

Belief in a just world as a moderator

Although relative deprivation may affect self-esteem and depressive symptoms, it is impossible for all migrant children to be equally influenced. Thus, it is important to verify moderators that may strengthen or weaken the relationship between relative deprivation and unfavorable consequences. Though most people possess belief in a just world, the degree of belief may vary between individuals (50). Belief in a just world works as an effective coping mechanism that buffers the harmful effects of stress against depression (51). High belief in a just world has beneficial outcomes for individuals, such as improving mood and maintaining subjective well-being (52). Furthermore, it can facilitate self-esteem (53); a study revealed that belief in a just world is positively associated with self-esteem (54). At the same time, the just-world theory (55, 56) indicates that individuals with higher belief in a just world are more likely to prefer fairness. Accordingly, belief in a just world may attenuate the adverse effects of negative factors on psychological well-being. For instance, a study by Kim and Park (57) showed that belief in a just world moderated the relationship between perceived sex discrimination and self-esteem, with the relationship being more potent for married Korean working women with a higher belief in a just world. Moreover, high belief in a just world weakened the impact of relative deprivation on life satisfaction (58). Thus, belief in a just world may play a buffering role and alleviate the detrimental consequences of relative deprivation (e.g., low self-esteem).

The risk and protective factor models (59) identified that the undesirable effect of one risk factor (e.g., relative deprivation) on its outcomes (e.g., self-esteem) may be reduced by a protective factor (e.g., belief in a just world). Notably, migrant children with high belief in a just world are more likely to have a sense of security and control (60), which could decrease the impact of relative deprivation and improve the level of self-esteem. Comparatively, low belief in a just world refers to a more negative perception of the world (18). At this point, the protective effect of a low belief, compared with a high belief in a just world, is not significant. Therefore, it is hypothesized that belief in a just world could protect self-esteem from the detrimental effects of relative deprivation (Hypothesis 3).

In summary, based on the relative deprivation theory and the risk-protective factor models, this study constructed a moderated mediation model to investigate whether relative deprivation is indirectly related to depressive symptoms through self-esteem and whether the indirect relationship is moderated by belief in a just world. The aims of this study were 3-fold: (a) to examine whether relative deprivation is positively correlated with depressive symptoms in Chinese migrant children; (b) to test whether self-esteem plays an intermediary role in the relationship between relative deprivation and depressive symptoms; and (c) to explore whether belief in a just world plays a regulatory role in the relationship between relative

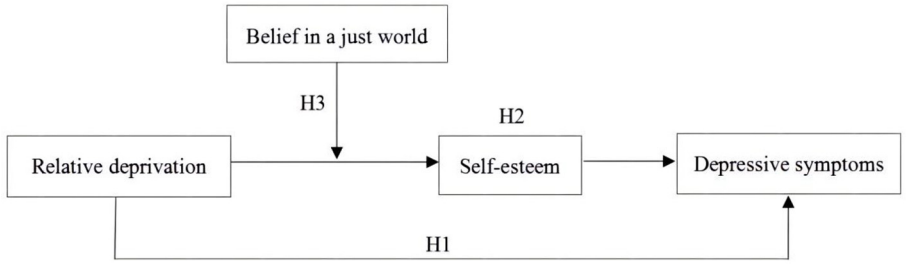

FIGURE 1
Moderated mediation model of the present study. Of these, H1 refers to that relative deprivation is positively associated with depressive symptoms. H2 represents that self-esteem mediate the association between relative deprivation and depressive symptoms. H3 refers to that belief in a just world moderate the relation between relative deprivation and self-esteem.

deprivation and self-esteem. Figure 1 illustrates the moderated mediation model.

Materials and methods

Participants

The migrant children who participated in the study were recruited via a cluster sampling from three primary schools (4th−6th grade) and three junior high schools (7th−9th grade) in Fujian Province, China. The eligibility criteria for migrant children included: (a) school-aged children born in rural regions without an urban *hukou*; (b) those ever living in their rural hometowns; (c) those who had accompanied their parents to the destination cities; and (d) those who had been living in the destination cities for more than 6 months (61). Migrant children completed relevant measurements in a classroom after acquiring permission from school principals and written informed consent from their parents. In this process, trained interviewers ensured standard instructions and provided necessary clarifications for migrant children. Participants completed paper-and-pencil questionnaires, which took ∼20 min. All participants received ballpoint pens as rewards after completing the survey. The procedures were approved by the Ethics Committee of Academic Research at the corresponding author's institution.

A total of 1,167 migrant children's responses were collected. The responses were deleted if more than three items were left unanswered or were answered in the same way. Meanwhile, the mean method was used for the remaining questionnaires to handle missing values. Finally, 1,076 surveys were validated, which accounted for 92.2% of the total administered. The average age was 12.25 years (SD = 1.66), with an age range of 10–15 years. Of the 1,076 participants, 547 (50.8%) were male participants, 524 (48.7%) were female participants, and five students did not report their sex. There were 626 (58.34%) elementary school students and 447 (41.66%) junior high school students. Two hundred and twenty-eight (21.33%) participants were the only children in their families and 841 (78.67%) participants had siblings. Regarding the parent educational background of migrant children, 229 (21.44%) fathers had a primary school level of education or below, 418 (39.14%) had a junior high school level of education, 180 (16.85%) reported a senior high school level of education, 79 (7.4%) had a university degree or above, and 162 (15.17%) reported their education level as unknown. Additionally, 374 (34.99%) mothers had a primary school level of education or below, 365 (34.14%) had a junior high school level of education, 100 (9.35%) had a senior high school level of education, 62 (5.8%) had a university degree or above, and 168 (15.72%) reported their education level as unknown. In terms of monthly family income, 165 (15.79%), 463 (44.3%), and 417 (39.9%) had an average monthly family income of <2,000 yuan, between 2,000 and 5,000 yuan, and more than 5,000 yuan, respectively (31 migrant children did not report).

Measures

Relative deprivation

This was measured using the Relative Deprivation Scale for Migrant Children (62), which had good reliability and validity for Chinese migrant children (63). The scale included 20 items categorized into four dimensions: cognition of individual relative deprivation, the emotion of individual relative deprivation, cognition of group relative deprivation, and the emotion of group relative deprivation. The example items include "*Are you satisfied with this situation*?" and "*How satisfied are you with this situation*?" This scale referred to five aspects of a real situation: family economic status, housing conditions and living environment, stability of residence, opportunities for developing strong points, and the degree of parental involvement in tutoring homework. The items of the cognitive dimension ranged from 1 (*very good*) to 7 (*very bad*), and the items of the emotional dimension ranged from 1 (*very satisfied*) to 7 (*extremely unsatisfied*). Higher scores indicate higher level

of relative deprivation. In this study, Cronbach's α for the scale was 0.92.

Self-esteem

This was assessed using the Rosenberg Self-Esteem Scale (30). In the Chinese revised version, the 8th question (e.g., "*I wish I could earn more respect for myself*") was excluded because of cultural differences (38). Participants rated nine items (e.g., "*On the whole, I am satisfied with myself*;" "*I feel that I have a number of good qualities*") on a 4-point Likert scale (1= *strongly disagree,* 4= *strongly agree*) with higher scores indicating higher self-esteem. The reliability and validity of the scale have been validated among Chinese migrant children (64). In this study, Cronbach's α for the scale was 0.80.

Belief in a just world

The Scale of Belief in a Just World (65) has been widely used to measure belief in a just world. This scale has been used in Chinese migrant children, reporting good reliability and validity (66). The 13 self-report items were divided into two dimensions: personal belief in a just world (e.g., "*I feel that my efforts are noticed and rewarded*") and general belief in a just world (e.g., "*I feel that I get what I deserve*"). Participants responded to items on a 6-point Likert scale, with values ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Higher scores indicate a greater belief in a just world. In this study, Cronbach's α for the scale was 0.88.

Depressive symptoms

We used the Center for Epidemiologic Studies-Depression Scale (67). The Chinese version has been widely used in Chinese research (68) and has good reliability and validity (69). It comprised 20 items (e.g., "*I did not feel like eating*; *my appetite was poor*;" "*I thought my life had been a failure*"), measuring six symptoms of depression (e.g., depressive mood, guilt/unworthiness, and loss of appetite). Participants responded on a 4-point Likert scale ranging from 1 (*rarely or none of the time* [*less than one day*]) to 4 (*most or all of the time*), with higher scores indicating more symptoms of depression. In this study, Cronbach's α for the scale was 0.87.

Statistical analysis

All statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) 25.0. First, descriptive statistics and correlation analyses were conducted to explore the potential associations between relative deprivation, self-esteem, belief in a just world, and depressive symptoms. Second, the SPSS PROCESS macro (Models 4 and 7) suggested by Hayes (70) was performed to further test the mediating role of self-esteem and the moderating role of belief in a just world. It has been extensively used in previous research to examine complex models, including moderated mediation and mediated moderation models (57). Moreover, considering that there are significant age and/or sex differences in individuals' relative deprivation (14) and depression (71), we included age and sex as covariates in all analyses.

Results

Comparison of depressive symptoms levels in different demographic characteristics

There are significant differences in the scores of depressive symptoms among migrant children in terms of grade level, father's educational background, and monthly family income, but there are no significant differences in terms of sex, only child status, and mother's educational background in Table 1. In terms of grade, the depressive scores of junior high school students were significantly higher than those of elementary school students ($p < 0.05$). In terms of father's educational background, the migrant children whose fathers' education level was primary school and below had the highest depressive scores, and the posttest (LSD) suggests that the depressive scores are significantly higher than those of fathers' with other educational levels ($p < 0.05$). In terms of monthly family income, the depressive symptoms of migrant children with <2,000 yuan of monthly family income were significantly higher than those of other levels ($p < 0.001$).

Preliminary results

The results of the means, standard deviations, and Pearson correlations between migrant children's relative deprivation, self-esteem, belief in a just world, and depressive symptoms are presented in Table 2. Relative deprivation was negatively associated with self-esteem and belief in a just world, and positively associated with depressive symptoms. Self-esteem was positively linked to belief in a just world and negatively linked to depressive symptoms. Belief in a just world was negatively correlated with depressive symptoms.

Mediating effect of self-esteem

As shown in Table 3, when controlling for the age and sex of migrant children, relative deprivation was positively correlated with depressive symptoms ($B = 0.21$, $p < 0.001$), and

TABLE 1 Comparison of depressive symptoms scores of the migrant children with different demographic characteristics.

Variable	Project	Number of people	Depressive symptoms	*t*/*F*	*p*
Sex	Male	547	37.34 ± 10.82	1.51	0.13
	Female	524	36.36 ± 10.53		
Grade	Elementary school students	626	36.89 ± 10.33	−2.10	0.04
	Junior high school students	447	38.27 ± 10.97		
Only child status	Only child	228	37.64 ± 11.73	0.20	0.84
	Non-only-child	841	37.47 ± 10.31		
Father education	Primary school education or below	229	39.29 ± 10.76	2.90	0.02
	Junior high school education	418	37.48 ± 10.41		
	Senior high school education	180	36.40 ± 10.84		
	University degree or above	79	37.30 ± 10.24		
	Unclear	162	36.06 ± 10.48		
Mother education	Primary school education or below	374	38.48 ± 10.32	1.58	0.18
	Junior high school education	365	36.57 ± 10.56		
	Senior high school education	100	37.58 ± 11.46		
	University degree or above	62	36.87 ± 11.15		
	Unclear	168	37.32 ± 10.40		
Monthly family income	<2,000 yuan	165	40.35 ± 11.18	7.74	<0.001
	2,000–5,000 yuan	463	36.74 ± 10.25		
	>5,000 yuan	417	36.74 ± 10.53		

TABLE 2 Descriptive statistics and correlations among key variables.

Variables	*M*	*SD*	1	2	3	4	5	6
1.Age	12.25	1.66	-					
2.Sex	-	-	−0.01	-				
3.Relative deprivation	3.22	0.96	0.24**	−0.01	-			
4.Self-esteem	2.88	0.51	−0.08**	0.05	−0.27**	-		
5.Belief in a just world	4.17	0.94	−0.17**	0.04	−0.37**	0.34**	-	
6.Depressive symptoms	1.84	0.53	0.07*	−0.05	0.21**	−0.55**	−0.32**	-

N = 1,076. Sex was a virtual variable: 0 represented female students, 1 represented male students. $^{*}p < 0.05$, $^{**}p < 0.01$.

negatively correlated with self-esteem ($B = -0.27$, $p < 0.001$). Self-esteem was negatively correlated with depressive symptoms ($B = -0.54$, $p < 0.001$). Additionally, relative deprivation was still positively correlated with depressive symptoms ($B = 0.06$, $p < 0.01$) when relative deprivation and self-esteem predicted depressive symptoms together. The bias-corrected percentile bootstrap method revealed that the mediating effect of relative deprivation on depressive symptoms through self-esteem was 0.15, SE was 0.02, and its 95% confidence interval was [0.11, 0.18] (did not contain 0). The direct (0.06) and indirect (0.15) effect accounted for ∼28.57 and 71.42% of the total effect, respectively. Namely, self-esteem partially mediated the relationship between relative deprivation and depressive symptoms among migrant children. Therefore, Hypothesis 2 was supported.

Moderating effect of belief in a just world

As noted, Hypothesis 3 predicted that belief in a just world would moderate the first half of the mediating relationship between relative deprivation and depressive symptoms through self-esteem. As shown in Table 4, after controlling for age and sex, relative deprivation negatively predicted self-esteem ($B = -0.17$, $p < 0.001$), and the interaction of relative deprivation and belief in a just world showed significant effects on self-esteem ($B = -0.05$, $p < 0.05$). This finding suggests that the relationship between relative deprivation and self-esteem was moderated by the belief in a just world, that is, the mediating role of self-esteem was moderated by belief in a just world.

Moreover, to understand the moderating effect better, we conducted a simple slopes analysis (72). The simple slopes test

TABLE 3 Mediating effect of self-esteem between relative deprivation and depressive symptoms.

Predictors (IV)	Model 1 (criterion: depressive symptoms)		Model 2 (criterion: self-esteem)		Model 3 (criterion: depressive symptoms)	
	B	*t*	*B*	*t*	*B*	*t*
Age	0.01	0.67	−0.01	−0.55	0.01	0.45
Sex	0.09	1.61	−0.11	−1.82	0.04	0.76
Relative deprivation	0.21***	6.58***	−0.27	−8.77***	0.06	2.20**
Self-esteem					−0.54	−20.09***
R^2	0.05		0.08		0.31	
F	17.16***		29.39***		118.76***	

N = 1,076. **p < 0.01, ***p < 0.001.

TABLE 4 Moderated mediation analysis results with belief in a just world as a moderator.

Predictors (IV)	Depressive symptoms			Self-esteem		
	B	SE	*t*	*B*	SE	*t*
Age	0.007	0.02	0.45	0.002	0.02	0.09
Sex	0.04	0.05	0.76	−0.09	0.06	−1.6
Relative deprivation	0.06	0.03	2.21**	−0.17	0.03	−5.43***
Self-esteem	−0.54	0.03	−20.09***	-	-	-
Belief in a just world	-	-	-	0.29	0.03	9.31***
Relative deprivation × Belief in a just world	-	-	-	−0.05	0.03	−2.05*
R^2	0.31			0.15		
F	118.76***			36.92***		

N = 1,076. *p < 0.05, **p < 0.01, ***p < 0.001.

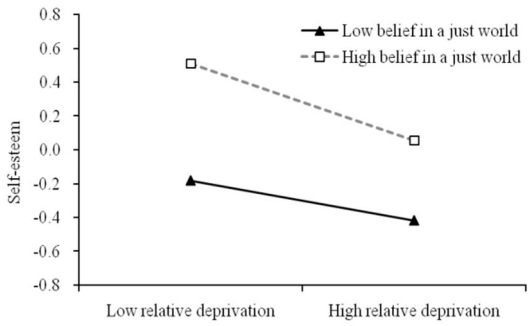

FIGURE 2
Moderator role of belief in a just world between relative deprivation and self-esteem.

reflected the association between relative deprivation and self-esteem at two levels of belief in a just world (1 SD below the mean and 1 SD above the mean). Figure 2 shows that relative deprivation was a stronger negative predictor of self-esteem for migrant children who had a higher level of belief in a just world (*simple slope* = −0.22, $t = -5.42$, $p < 0.001$) than for migrant children who had lower beliefs in a just world (*simple slope* = −0.12, $t = -2.87$, $p < 0.01$). The bias-corrected percentile bootstrap method further showed the indirect effect of relative deprivation on depressive symptoms via self-esteem was moderated by belief in a just world. Specifically, the mediating effect of relative deprivation on depressive symptoms via self-esteem was stronger at high belief in a just world (effect size = 0.12, 95% CI = [0.07, 0.17]), but weaker in low belief in a just world (effect size = 0.06, 95% CI = [0.02, 0.11]). Thus, Hypothesis 3 was supported. Figure 3 distinctly describes the moderated mediation model and key path coefficients for migrant children.

Discussion

The moderated mediation model emphasized relative deprivation as a vital predictor of depressive symptoms, which illustrates rural-to-urban migrant children with a high level of relative deprivation may be at a high risk of depressive symptoms. This result has gained extensive attention and empirical support (27, 73). Besides, the current study showed that self-esteem played a mediating role between relative

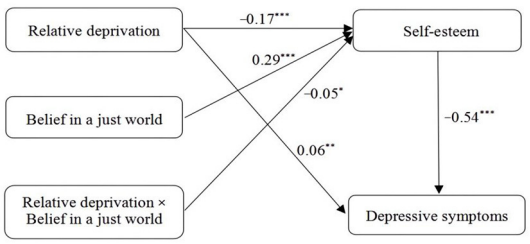

FIGURE 3
The moderated mediation model with key results. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

deprivation and depressive symptoms. Meanwhile, the first half of the mediation process was moderated by belief in a just world. Specifically, with the effect being stronger for migrant children with high belief in a just world than for those with low belief in a just world. These findings deepen our understanding of the underlying relationship mechanisms between relative deprivation and depressive symptoms.

Association between relative deprivation and depressive symptoms

Previous studies have shown that the level of relative deprivation at baseline predicted depression at a 1.5 year follow-up period in single-parent children (41). Also, recent research has indicated that relative deprivation is positively related to depression (74). Consistent with previous studies (15, 27, 75), this study found that relative deprivation significantly predicted depression; in other words, relative deprivation was a risk factor for depressive symptoms among migrant children. Two possible explanations have been postulated to explain the relationship between relative deprivation and depressive symptoms, namely cognition and emotion. First, relative deprivation plays a significant cognitive vulnerability role for health (22) and is likely to create a strong sense of hopelessness, which might lead to depression (76). Thus, this result coincides with the cognitive model of depression. Second, migrant children exposed to a high level of relative deprivation generate undesirable emotional experiences (13, 77), such as anger, anxiety, and dejection. This accumulation of negative emotions is one of the major reasons for depression (78).

The social rank theory of depression (79) states that subordination or inferiority due to relative deprivation induces depression. Compared with advantageous groups (non-migrant children), rural-to-urban migrant children are more likely to develop deep hopelessness and fatalism about their educational attainment and future achievements when they perceive that they are relatively deprived (73). These feelings and negative emotion lower migrant children's expectations, thereby resulting in more depressive symptoms. Therefore, migrant children suffering from relative deprivation might experience more depressive symptoms.

Mediating effect of self-esteem

Our study found that self-esteem partially mediated the link between relative deprivation and depressive symptoms among migrant children. This result is congruent with previous empirical studies and our assumption that self-esteem has a mediating role in this relationship (31, 32). Self-esteem was a significant mechanism for explaining why and how relative deprivation influenced depressive symptoms. First, regarding the first stage of the mediation effect, higher relative deprivation was correlated with lower self-esteem. Migrant children feel inequality and deprivation in family socioeconomic status, welfare guarantee, and educational opportunity during upward comparison to their urban peers, which induces relative deprivation, and thereby underestimation of ego values, triggering negative self-assessment and cognition. Sociometer theory (80) highlights the social nature of self-esteem and presumes that it serves as a sociometer—an internal scale of others' evaluations of oneself. Consequently, relative deprivation had a significant and negative effect on self-esteem in rural-to-urban migrant children. Moreover, an experimental study conducted by Kim et al. (81) confirmed that personal relative deprivation negatively predicted self-esteem.

Second, low self-esteem was correlated with more depressive symptoms in the second stage of the mediation model. This finding is consistent with a recent study by Bang et al. (31), which revealed that high self-esteem reduced the occurrence rate of depression. One possible reason is that high self-esteem can protect individuals against the harmful impact of depression (69). Under these circumstances, migrant children with high self-esteem have a distinct self-concept and favorable assessment (82); thus, the impact of negative factors is likely to be attenuated. Additionally, high self-esteem is linked to good mental and behavioral health, such as high self-efficacy (83) and prosocial behavior (84). Conversely, migrant children with low self-esteem have more unfavorable self-cognitions and self-evaluations as well as self-aggression, which are vulnerable factors of depression (85). We think that rural-to-urban migrant children will feel their own inferior family socioeconomic status during urban integration, which will induce a sense of frustration as well as deprivation, and may further weaken their self-assessment or the level of self-esteem, thereby increasing depressive symptoms. Therefore, our hypothesis that self-esteem plays a mediating role between relative deprivation and depressive symptoms among migrant children was supported.

Moderating effect of belief in a just world

This study demonstrated that belief in a just world moderated the first half of the mediating relationship between relative deprivation and depressive symptoms through self-esteem. In line with the risk-buffering hypothesis (86), the belief in a just world might alleviate the adverse impact of relative deprivation on self-esteem. This result aligns with our assumption that belief in a just world generates a moderating effect; that is, the mediating effect of self-esteem was moderated by belief in a just world. Specifically, the relationship between relative deprivation and self-esteem was stronger for rural-to-urban migrant children with high belief in a just world than for those with low belief in a just world.

Based on prior studies (50, 57), there are several reasons why belief in a just world plays a moderating role between relative deprivation and self-esteem. First, the justice motivation theory (55) asserts that belief in a just world provides numerous psychological resources to prevent disadvantaged groups (e.g., migrant children) from the negative effects of stressful and unfair events. In other words, the more resources migrant children have, the more capacity they have for facing unfairness (57). Second, individuals with high belief in a just world could cope with harmful consequences of relative deprivation in a non-judgmental or active manner (87). Migrant children with high belief in a just world have comprehended relative deprivation in some positive way that enabled them to accept the gap with urban peers and cope more effectively with their negative cognition and emotion (88), and thus to be less likely to experience low self-esteem. Additionally, migrant children believe that the societal issue of migration could be improved by themselves when the belief in a just world is high. Third, belief in a just world buffers against the negative effect of relative deprivation (25). Individuals with low belief in a just world are motivated to perceive relative deprivation compared with those with a high belief in a just world. In our study, relative deprivation and belief in a just world interact and mutually affect self-esteem. Thus, migrant children with high belief in a just word might avoid negative effects if they have low relative deprivation, and migrant children with high relative deprivation exacerbate unfavorable effects (e.g., low self-esteem) if they have low belief in a just world. In accordance with the model of risk and protective factors (59), belief in a just world is a protective factor and ameliorates the impact of relative deprivation. In brief, migrant children who have high belief in a just world may better handle relative deprivation and the consequent adverse consequences.

Limitations and implications

Although several important insights were gained from our study, several limitations must also be considered. First, causal inferences among the variable associations could not be made owing to the cross-sectional survey design. Thus, future studies should conduct longitudinal or experimental research to confirm causal associations in the theoretical model. Second, the self-report method may have introduced social desirability bias and common method bias. Future research should thus collect data using multiple methods and from multiple informants. Third, some significant demographic information was neglected when we collected questionnaires, such as the ethnic conditions. Future research should take various information of migrant children into full consideration to further validate the findings of this study. Fourth, since this study was conducted on Chinese rural-to-urban migrant children, the generalization of our findings to other groups or populations from different countries may not be possible. Future studies should consider different types of participants (e.g., non-migrant children and foreign migrant children).

Despite these limitations, this study has important implications. First, this study's findings have profound theoretical implications. Based on relevant research and theories, the psychological mechanisms underlying relative deprivation and depressive symptoms were revealed. Specifically, this study explained how and when relative deprivation influenced migrant children's depressive symptoms. The present model was in line with the just-world theory (56) and risk and protective factor models (59). Furthermore, the large sample utilized in this study provides sufficient evidence for the relationship between relative deprivation and depressive symptoms. Additionally, testing mediator and moderator variables in a single model provides more comprehensive information than assessing two separate models (89).

Second, the study's results have far-reaching practical implications. Specifically, this study aimed to examine the relationship between relative deprivation and depressive symptoms and extend the relationship to a new group, namely Chinese rural-to-urban migrant children. Furthermore, given the direct association between relative deprivation and depressive symptoms, the findings highlighted that parents should help migrant children learn that relative deprivation has adverse impacts on depressive symptoms and assist them in exerting a positive role of relative deprivation (90). Meanwhile, the signs and undesirable outcomes of depressive symptoms were highlighted, which can enable educators to recognize them. Considering that self-esteem was a significant mechanism linking relative deprivation to depressive symptoms, migrant children should learn some self-reference tasks (91) and compassionate actions (92) to enhance self-esteem. Moreover, the moderating effect of belief in a just world suggests that improving migrant children's belief in a just world is an effective complementary intervention strategy to relieve relative deprivation and depressive

symptoms. Research has demonstrated that belief in a just world can be cultivated and developed through intervention training and daily practice, such as psychological intervention programs (54).

Conclusion

Although further replication and extension are needed, this study expanded the understanding of the potential mechanisms of relative deprivation on depressive symptoms in Chinese rural-to-urban migrant children by supporting the mediating role of self-esteem and the moderating role of belief in a just world. This moderated mediation model is significant because it moves beyond simple mediation and/or moderation and emphasizes how and when relative deprivation affects depressive symptoms. Moreover, these results provide a vast and compelling body of evidence that can be utilized in clinical practice. These findings can guide parents, educators, and society to take measures to improve migrant children's self-esteem and belief in a just world, thus protecting them from the detrimental effects of high level of relative deprivation and decreasing the risk of depressive symptoms.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Academic Research at Yangtze University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MX conceived and designed the study, performed the survey, and authored and reviewed drafts of the paper. ZH analyzed the data, prepared figures and tables, and wrote it into the article. Both authors contributed to the article and approved the submitted version.

Funding

This research was supported by grants from the Major Project for Philosophy and Social Science Research of Hubei Province (No. 19ZD020) and from the Key Project of Educational Science Planning of Hubei Province (No. 2022GA028) in China.

Acknowledgments

We thank all of the primary school and junior high school students who participated in our study. We also would like to thank *Editage* for their professional English language editing and polishing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Lan X, Scrimin S, Moscardino U. Emotional awareness moderates the association between discrimination and emotional-behavioral problems: a cross-informant study in Chinese rural-to-urban migrant youth. *J Early Adolesc.* (2020) 40:857–79. doi: 10.1177/0272431619874399

2. Wang L, Mesman J. Child development in the face of rural-to-urban migration in China: a meta-analytic review. *Perspect Psychol Sci.* (2015) 10:813–31. doi: 10.1177/1745691615600145

3. Hu H, Lu S, Huang CC. The psychological and behavioral outcomes of migrant and left-behind children in China. *Child Youth Serv Rev.* (2014) 46:1–10. doi: 10.1016/j.childyouth.2014.07.021

4. Ministry of Education of the People's Republic of China. *National Education Development Statistical Bulletin in 2019.* (2020). Available online at: http://www.gov.cn/xinwen/2020-05/20/content_5513250.htm (accessed May 20, 2020).

5. Rosado JI, Johnson SB, McGinnity KA, Cuevas JP. Obesity among Latino children within a migrant farmworker community. *Am J Prev Med.* (2013) 44:S274–81. doi: 10.1016/j.amepre.2012.11.019

6. Ye Z, Chen L, Harrison SE, Guo H, Li X, Lin D. Peer victimization and depressive symptoms among rural-to-urban migrant children in China: the protective role of resilience. *Front Psychol.* (2016) 7:1542. doi: 10.3389/fpsyg.2016.01542

7. Holden C. Mental health: global survey examines impact of depression. *Science.* (2000) 288:39–40. doi: 10.1126/science.288.5463.39

8. Cairns KE, Yap MBH, Pilkington PD, Jorm AF. Risk and protective factors for depression that adolescents can modify: a systematic review and meta-analysis of longitudinal studies. *J Affect Disord.* (2014) 169:61–75. doi: 10.1016/j.jad.2014.08.006

9. Shuang M, Yi QW, Ling J, Guan ZO, Jing G, Zhi Q, et al. Relationship between parent–child attachment and depression among migrant children and left-behind children in China. *Public Health.* (2022) 204:1–8. doi: 10.1016/j.puhe.2021.12.015

10. Rock PL, Roiser JP, Riedel WJ, Blackwell AD. Cognitive impairment in depression: a systematic review and meta-analysis. *Psychol Med.* (2014) 44:2029–40. doi: 10.1017/S0033291713002535

11. Melhem NM, Porta G, Oquendo MA, Zelazny J, Keilp JG, Iyengar S, et al. Severity and variability of depression symptoms predicting suicide attempt in high-risk individuals. *JAMA Psychiatry.* (2019) 76:603–13. doi: 10.1001/jamapsychiatry.2018.4513

12. Crosby F. A model of egoistical relative deprivation. *Psychol Rev.* (1976) 83:85–113. doi: 10.1037/0033-295X.83.2.85

13. Smith HJ, Pettigrew TF, Pippin GM, Bialosiewicz S. Relative deprivation: a theoretical and meta-analytic review. *Pers Soc Psychol Rev.* (2012) 16:203–32. doi: 10.1177/1088868311430825

14. Zhang J, Tao MK. Relative deprivation and psychopathology of Chinese college students. *J Affect Disord.* (2013) 150:903–7. doi: 10.1016/j.jad.2013.05.013

15. Huang JJ, Liu QX. Social exclusion under COVID-19 and Wuhan college students' smart phone addiction: the mediating role of relative deprivation and depression. *Chin J Clin Psychol.* (2021) 29:1327–32. doi: 10.16128/j.cnki.1005-3611.2021.06.042

16. Pyszczynski T, Greenberg J, Solomon S, Arndt J, Schimel J. Why do people need self-esteem? A theoretical and empirical review. *Psychol Bull.* (2004) 130:435–68. doi: 10.1037/0033-2909.130.3.435

17. Lan T, JiaX, Liu X. How belief in a just world might shape responses to discrimination: a case study of left-behind children in China. *Int J Soc Psychiatry.* (2018) 64:266–75. doi: 10.1177/0020764018760951

18. Wang J, Wang Z, Liu X, Yang X, Zheng M, Bai X. The impacts of a COVID-19 epidemic focus and general belief in a just world on individual emotions. *Pers Individ Differ.* (2021) 168:110349. doi: 10.1016/j.paid.2020.110349

19. Mclaughlin KA, Costello EJ, Leblan CW, Sampson NA, Kessler RC. Socioeconomic status and adolescent mental disorders. *Am J Public Health.* (2012) 102:1742–750. doi: 10.2105/AJPH.2011.300477

20. Zenses AK, Lenaert B, Peigneux P, Beckers T, Boddez Y. Sleep deprivation increases threat beliefs in human fear conditioning. *J Sleep Res.* (2019) 29:e12873. doi: 10.1111/jsr.12873

21. Lu S, Huang CC, Rios J. Mindfulness and academic performance: an example of migrant children in China. *Child Youth Serv Rev.* (2017) 82:53–9. doi: 10.1016/j.childyouth.2017.09.008

22. Mishra S, Carleton RN. Subjective relative deprivation is associated with poorer physical and mental health. *Soc Sci Med.* (2015) 147:144–9. doi: 10.1016/j.socscimed.2015.10.030

23. Beck AT. The evolution of the cognitive model of depression and its neurobiological correlates. *Am J Psychiatry.* (2008) 165:969–77. doi: 10.1176/appi.ajp.2008.08050721

24. Mummendey A, Kessler T, Klink A, Mielke R. Strategies to cope with negative social identity: predictions by social identity theory and relative deprivation theory. *J Pers Soc Psychol.* (1999) 76:229–49. doi: 10.1037/0022-3514.76.2.229

25. Yu G, Zhao F, Wang H, Li S. Subjective social class and distrust among Chinese college students: the mediating roles of relative deprivation and belief in a just world. *Curr Psychol.* (2018) 39:2221–30. doi: 10.1007/s12144-018-9908-5

26. Lim GY, Tam WW, Lu Y, Ho CS, Zhang MW, Ho RC. Prevalence of depression in the community from 30 countries between 1994 and 2014. *Sci Rep.* (2018) 8:1–10. doi: 10.1038/s41598-018-21243-x

27. Beshai S, Mishra S, Meadows TJS, Parmar P, Huang V. Minding the gap: subjective relative deprivation and depressive symptoms. *Soc Sci Med.* (2017) 173:18–25. doi: 10.1016/j.socscimed.2016.11.021

28. Schmitt M, Maes J, Widaman K. Longitudinal effects of egoistic and fraternal relative deprivation on well-being and protest. *Int J Psychol.* (2010) 45:122–30. doi: 10.1080/00207590903165067

29. Pettigrew TF. Samuel Stouffer and relative deprivation. *Soc Psychol Quart.* (2015) 78:7–24. doi: 10.1177/0190272514566793

30. Rosenberg M. Rosenberg self-esteem scale (RSE). Acceptance and commitment therapy. *Meas Package.* (1965) 61:52. doi: 10.1037/t01038-000

31. Bang H, Won D, Park S. School engagement, self-esteem, and depression of adolescents: the role of sport participation, volunteering activity, and gender differences. *Child Youth Serv Rev.* (2020) 113:105012. doi: 10.1016/j.childyouth.2020.105012

32. Chen W, Niu GF, Zhang DJ, Fan CY, Tian Y, Zhou ZK. Socioeconomic status and life satisfaction in Chinese adolescents: analysis of self-esteem as a mediator and optimism as a moderator. *Pers Individ Differ.* (2016) 95:105–109. doi: 10.1016/j.paid.2016.01.036

33. Palermiti AL, Servidio R, Bartolo MG, Costabile A. Cyberbullying and self-esteem: an Italian study. *Comput Hum Behav.* (2017) 69:136–41. doi: 10.1016/j.chb.2016.12.026

34. Cramer EM, Song H, Drent AM. Social comparison on Facebook: motivation, affective consequences, self-esteem, and Facebook fatigue. *Comput Hum Behav.* (2016) 64:739–46. doi: 10.1016/j.chb.2016.07.049

35. Osborne D, Sibley CG, Sengupta NK. Income and neighbourhood-level inequality predict self-esteem and ethnic identity centrality through individual- and group-based relative deprivation: a multilevel path analysis. *Eur J Soc Psychol.* (2015) 45:368–77. doi: 10.1002/ejsp.2087

36. Festinger L. A theory of social comparison process. *Hum Rev.* (1954) 7:117–40. doi: 10.1177/001872675400700202

37. Gerber JP, Wheeler L, Suls J. A social comparison theory meta-analysis 60+ years on. *Psychol Bull.* (2018) 144:177–97. doi: 10.1037/bul0000127

38. Liu QQ, Zhou ZK, Yang XJ, Niu GF, TianY, Fan CY. Upward social comparison on social network sites and depressive symptoms: a moderated mediation model of self-esteem and optimism. *Pers Individ Differ.* (2017) 113:223–8. doi: 10.1016/j.paid.2017.03.037

39. Peng J, Zhang J, Xia Z, Wang X, Dan Z, Zheng S, et al. How does relative deprivation relate to aggression in young male migrant workers? The mediator of self-esteem. *Curr Psychol.* (2021). doi: 10.1007/s12144-021-02094-8. [Epub ahead of print].

40. Walker I. Effects of personal and group relative deprivation on personal and collective self-esteem. *Group Processes Interg.* (1999) 2:365–80. doi: 10.1177/1368430299024004

41. Xiong M, Liu RJ, Ye YD. Reciprocal relations between relative deprivation and psychological adjustment among single-parent children in China: a longitudinal study. *Acta Psychol Sin.* (2021) 53:67–80. doi: 10.3724/SP.J.1041.2021.00067

42. Andreassen CS, Pallesen S, Griffiths MD. The relationship between addictive use of social media, narcissism, and self-esteem: findings from a large national survey. *Addict Behav.* (2017) 64:287–93. doi: 10.1016/j.addbeh.2016.03.006

43. Bajaj B, Robins RW, Pande N. Mediating role of self-esteem on the relationship between mindfulness, anxiety, and depression. *Per Individ Differ.* (2016) 96:127–31. doi: 10.1016/j.paid.2016.02.085

44. Zender R, Olshansky E. Women's mental health: depression and anxiety. *Nurs Clin N Am.* (2009) 44:355–64. doi: 10.1016/j.cnur.2009.06.002

45. Butler AC, Hokanson JE, FlynnHA. A comparison of self-esteem lability and low trait self-esteem as vulnerability factors for depression. *J Pers Soc Psychol.* (1994) 66:166–77. doi: 10.1037/0022-3514.66.1.166

46. Orth U, Robins RW, Meier LL, Conger RD. Refining the vulnerability model of low self-esteem and depression: disentangling the effects of genuine self-esteem and narcissism. *J Pers Soc Psychol.* (2016) 110:133–49. doi: 10.1037/pspp0000038

47. Fan XH, Chen FJ, Tang WP, Huang YS, Yuan SY. The dynamic relationship between perceived discrimination, self-esteem and depression in migrant children. *Chin J Clin Psychol.* (2016) 24:45–8. doi: 10.16128/j.cnki.1005-3611.2016.01.010

48. Berber Çelik Ç, Odaci H. Does child abuse have an impact on self-esteem, depression, anxiety and stress conditions of individuals? *Int J Soc Psychiatry.* (2020) 66:171–8. doi: 10.1177/0020764019894618

49. Rossi A, Panzeri A, Pietrabissa G, Manzoni GM, Castelnuovo G, Mannarini, et al. The anxiety-buffer hypothesis in the time of COVID-19: when self-esteem protects from the impact of loneliness and fear on anxiety and depression. *Front Psychol.* (2020) 10:2177. doi: 10.3389/fpsyg.2020.02177

50. White K, MacDonnell R, Ellard JH. Belief in a just world: consumer intentions and behaviors toward ethical products. *J Mark.* (2012) 76:103–118. doi: 10.1509/jm.09.0581

51. Carifio J, Nasser R. Belief in a just world and depression in elderly nursing home residents. *Work.* (2012) 43:303–12. doi: 10.3233/WOR-2012-1371

52. Saba Y. Exploring the relationship of belief in just world with subjective well-being among students. *Pak J Psychol.* (2015) 46:29–40. Available online at: http://pjpku.com/index.php/pjp/article/view/67

53. Donat M, Peter F, Dalbert C, Kamble CD. The meaning of students' personal belief in a just world for positive and negative aspects of school-specific well-being. *Soc Justice Res.* (2016) 29:73–102. doi: 10.1007/s11211-015-0247-5

54. Jiang H, Chen G, Wang T. Relationship between belief in a just world and Internet altruistic behavior in a sample of Chinese undergraduates: multiple mediating roles of gratitude and self-esteem. *Pers Individ Differ.* (2017) 104:493–8. doi: 10.1016/j.paid.2016.09.005

55. Lerner MJ. *The Belief in a Just World. Perspectives in Social Psychology*. Boston, MA: Springer (1980).

56. Lerner MJ, Clayton S. *Justice and Self-Interest: Two Fundamental Motives*. New York, NY: Cambridge University Press (2011).

57. Kim E, Park H. Perceived gender discrimination, belief in a just world, self-esteem, and depression in Korean working women: a moderated mediation model. *Women Stud Int Forum.* (2018) 69:143–50. doi: 10.1016/j.wsif.2018.06.006

58. Osborne D, Sibley CG. Through rose-colored glasses: system-justifying beliefs dampen the effects of relative deprivation on well-being and political mobilization. *Pers Soc Psychol Bull.* (2013) 39:991–1004. doi: 10.1177/0146167213487997

59. Scal P, Ireland M, Borowsky IW. Smoking among American adolescents: a risk and protective factor analysis. *J Commun Health.* (2003) 28:79–97. doi: 10.1023/A:1022691212793

60. Dalbert C. Belief in a just world. In: Leary MR, Hoyle RH, editors. *Handbook of Individual Differences in Social Behavior*. New York, NY: Guilford Publications (2009). p. 288–97.

61. Chen LH, Su SB, Li XM, TamCC, Lin, DH. Perceived discrimination, schooling arrangements and psychological adjustments of rural-to-urban migrant adolescents in Beijing, China. *Health Psychol Behav Med.* (2014) 2:713–22. doi: 10.1080/21642850.2014.919865

62. Xiong M, Chen J, Johnson W. Relative deprivation and social anxiety among Chinese migrant children: testing a moderated mediation model of perceived control and belief in a just world. *J Health Psychol.* (2021) 27:2581–602. doi: 10.1177/13591053211059388

63. Xiong M, Zou H. How does relative deprivation influence Chinese migrant adolescents' life satisfaction? Testing two integrated models of perceived control and two types of belief in a just world. *Curr Psychol.* (2022). doi: 10.1007/s12144-022-02821-9. [Epub ahead of print].

64. Fang L. Educational aspirations of Chinese migrant children: the role of self-esteem contextual and individual influences. *Learn Individ Differ.* (2016) 50:195–202. doi: 10.1016/j.lindif.2016.08.009

65. Dalbert C. The world is more just for me than generally: about the Personal Belief in a Just World Scale's validity. *Soc Justice Res.* (1999) 12:79–98. doi: 10.1037/t33337-000

66. Zhang Z, Zhang J. Belief in a just world mediates the relationship between institutional trust and life satisfaction among the elderly in China. *Pers Individ Differ.* (2015) 83:164–9. doi: 10.1016/j.paid.2015.04.015

67. Radloff LS. The CES-D Scale: a self-report depression scale for research in the general population. *Appl Psychol Meas.* (1977) 1:385–401. doi: 10.1177/014662167700100306

68. Yang XJ, Fan CY, Liu QQ, Lian SL, Cao M, Zhou ZK. The mediating role of boredom proneness and the moderating role of meaning in life in the relationship between mindfulness and depressive symptoms. *Curr Psychol.* (2019) 40:4635–46. doi: 10.1007/s12144-019-00408-5

69. Kim E, Hogge I, Salvisberg C. Effects of self-esteem and ethnic identity. *Hispanic J Behav Sci.* (2014) 36:144–63. doi: 10.1177/0739986314527733

70. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Press (2013).

71. Angold A, Erkanli A, Silberg J, Eaves L, Costello EJ. Depression scale scores in 8∼17-year-olds: effects of age and gender. *J Child Psychol Psychiatry.* (2002) 43:1052–63. doi: 10.1111/1469-7610.00232

72. Aiken LS, West SG. *Multiple Regression: Testing and Interpreting Interactions*. Thousand Oaks, CA: Sage Publications, Inc. (1991).

73. Kim J. Does relative deprivation within schools influence adolescent depression? *Soc Ment Health.* (2021) 11:201–16. doi: 10.1177/2156869320959396

74. Qin W, Xu L, Jing Y, Han W, Hu F. Relative deprivation, depression and quality of life among adults in Shandong Province, China: a conditional process analysis based on social support. *J Affect Disord.* (2022) 312:136–43. doi: 10.1016/j.jad.2022.06.019

75. Kuo CT, Chiang TL. The association between relative deprivation and self-rated health, depressive symptoms, and smoking behavior in Taiwan. *Soc Sci Med.* (2013) 89:39–44. doi: 10.1016/j.socscimed.2013.04.015

76. Smith HJ, Pettigrew TF. The subjective interpretation of inequality: a model of the relative deprivation experience. *Soc Pers Psychol Compass.* (2014) 8:755–65. doi: 10.1111/spc3.12151

77. Abramson LY, Metalsky GI., Alloy LB. Hopelessness depression: a theory-based subtype of depression. *Psychol Rev.* (1989) 96:358–72. doi: 10.1037/0033-295X.96.2.358

78. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 5th ed. Washington, DC: American Psychiatric Association (2013).

79. Sloman L, Gilbert P, Hasey G. Evolved mechanisms in depression: the role and interaction of attachment and social rank in depression. *J Affect Disord.* (2003) 74:107–21. doi: 10.1016/S0165-0327(02)00116-7

80. Leary MR, Baumeister RF. The nature and function of self-esteem: sociometer theory. *Adv Exp Soc Psychol.* (2000) 32:1–62. doi: 10.1016/S0065-2601(00)80003-9

81. Kim H, Callan MJ, Gheorghiu AI., Matthews WJ. Social comparison, personal relative deprivation, and materialism. *Br J Soc Psychol.* (2016) 56:373–92. doi: 10.1111/bjso.12176

82. Zheng YL, Yang XJ, Liu QQ, Chu XW, Huang QT, Zhou ZK. Perceived stress and online compulsive buying among women: a moderated mediation model. *Comput Hum Behav.* (2019) 103:13–20. doi: 10.1016/j.chb.2019.09.012

83. Baumeister RF, Campbell JD, Krueger JI, Vohs KD. Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles? *Psychol Sci Publ Int.* (2003) 4:1–44. doi: 10.1111/1529-1006.01431

84. Fu X, Padilla-Walker LM, Brown MN. Longitudinal relations between adolescents' self-esteem and prosocial behavior toward strangers, friends and family. *J Adolesc.* (2017) 57:90–8. doi: 10.1016/j.adolescence.2017.04.002

85. Wang X, Wang W, Xie X, Wang P, Wang Y, Nie J, et al. Self-esteem and depression among Chinese adults: a moderated mediation model of relationship satisfaction and positive affect. *Pers Individ Differ.* (2018) 135:121–7. doi: 10.1016/j.paid.2018.06.055

86. Zimmerman MA, Ramirez-Valles J, Maton KI. Resilience among urban African American male adolescents: a study of the protective effects of sociopolitical control on their mental health. *Am J Commun Psychol.* (1999) 27:733–51. doi: 10.1023/A:1022205008237

87. Nudelman G, Nadler A. The effect of apology on forgiveness: belief in a just world as a moderator. *Pers Individ Differ.* (2017) 116:191–200. doi: 10.1016/j.paid.2017.04.048

88. McParland JL, Knussen C. Just world beliefs moderate the relationship of pain intensity and disability with psychological distress in chronic pain support group members. *Eur J Pain.* (2010) 14:71–6. doi: 10.1016/j.ejpain.2008.11.016

89. Fairchild AJ, MacKinnon DP. A general model for testing mediation and moderation effects. *Prev Sci.* (2008) 10:87–99. doi: 10.1007/s11121-008-0109-6

90. Zoogah DB. Why should I be left behind? Employees' perceived relative deprivation and participation in development activities. *J Appl Psychol.* (2010) 95:159–73. doi: 10.1037/a0018019

91. Maricuțoiu LP, Payne BK, Iliescu D. It works both ways. Enhancing explicit self-esteem using the self-reference task. *J Exp Soc Psychol.* (2019) 80:8–16. doi: 10.1016/j.jesp.2018.08.017

92. Mongrain M, Chin JM, Shapira LB. Practicing compassion increases happiness and self-esteem. *J Happ Stud.* (2011) 12:963–81. doi: 10.1007/s10902-010-9239-1

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 24 October 2022
DOI 10.3389/fpubh.2022.1009454

OPEN ACCESS

EDITED BY
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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 01 August 2022
ACCEPTED 10 October 2022
PUBLISHED 24 October 2022

CITATION
Meng M, Wang Z and Yu J (2022) The impact of medical service on the return behavior: A city-level study in China.
Front. Public Health 10:1009454.
doi: 10.3389/fpubh.2022.1009454

The impact of medical service on the return behavior: A city-level study in China

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Due to the constraints of the rural-urban household registration systems, the migrants of China currently receive varying degrees of medical services. The fact that many migrants choose to return to their hometowns due to the inequality in medical care has been a social phenomenon. Using data from the 2017 China Migrant Dynamic Survey (CMDS), this paper explores the effect of medical services on population migration. Probit regression analysis method was utilized to examine the relationship between medical service level (MSL) and medical service improvement (MSI) and return behavior (RB), as well as the interaction effect between MSL and MSI, and the moderating effect of health status (HS) and health education (HE). Multiple heterogeneity tests were performed. Grouping regressions were conducted using rural household registration (RHR), grouping regressions were conducted using new rural cooperative medical system (NRCMS), and multinomial Probit regressions were conducted using migration distance and age factors. The following findings were obtained. First, when MSL is low but MSI is high in the locality of household registration, the return probability of migrants will increase. MSL also has a positive interaction effect with MSI, and they jointly increase the return probability of migrants; Second, HS and HE have a positive moderating effect on the relationships between MSL and RB and between MSI and RB; Third, heterogeneity analysis indicates that the migrants with RHR or the migrants not covered by the NRCMS are more prone to return due to the reason of medical service. In addition, the analysis also shows that middle-aged and older people who return across provinces have the highest tendency to return due to medical services and young people have the lowest propensity to return across and within provinces. The study could help local governments change their public medical care policies and close the gap between medical services in different areas. As a result, it is necessary to understand population migration trends and promote New Urbanization Strategies.

KEYWORDS

medical service, return behavior, health status, health education, rural household registration, new rural cooperative medical system

Introduction

Since the reform and opening-up in China, large-scale cross-regional population migration has constantly been reshaping the spatial pattern distribution of population. Due to the uneven regional economic development and loosened household registration policy, nationwide waves of population migration have emerged. According to the data

of the 7th National Population Census released by the National Bureau of Statistics in 2021, the total migrants in China have grown significantly to 375.82 million in 2020 from 221.43 million in 2010, representing an annual growth rate of 6.97%. With industrial restructuring and upgrading in the coastal regions and the shift of labor-intensive industries toward central and western regions where considerable economic development has been gained, the rural and urban employment landscape has drastically changed, and the return of the migrants to their hometowns have become an increasingly widespread phenomenon. In 2014, the Chinese government formulated the New Urbanization Development Plan to encourage the migrants to transfer their rural household registration to cities and towns, especially small and medium-sized cities closer to their homes. This initiative has successfully promoted the large-scale return of the migrants. According to the China Migrants Development Report, about 22.8% of the migrants chose to return in 2017, and more than 70% of the returning population said they did not want to go back out (1). Especially in recent years, many rural laborers from central and western regions have chosen to return to developed coastal areas due to the impact of the COVID-19 epidemic, and the population migration shows the co-existence trend of outflow and inflow.

Population migration has drawn increasing scholarly interest and relevant studies mainly focus on settlement intention (2, 3), income level (4), health (5), social integration (6), and other aspects of the migrants. The population migration often exhibits three patterns: settling in inflow region, continuous migration and return migration. With improvements in welfare associated with China's RHR, advancements in rural area construction and the increasing effect of the market on resource allocation, return migration has become an important option for population migration (7). Earlier theories on return migration included neoclassical microeconomics, the new economics of migration and social network theory. Neoclassical micro economists, represented by Todaro (8), maintain that return migration is a decision made by migrants after weighing the difference between the maximum expected return and migration cost; supporters of the new economics of migration assert that return migration is the behavior of migrants aiming at maximizing their household welfare (9). And the social network theory emphasizes that the social connections and social network in the outflow region constitute the main factor driving migrant return (10). Research on return migration in China began in the 1990s, and the unique rural land system in China has created conditions for return migration. Differing from the universal term of migrants in western theories, the return migration in China's context involves more finely divided individuals like the new generation of migrant workers, college students from the second generation of peasant families and returning entrepreneurs. Chinese scholars have mainly focused on the differentiated return intentions of the migrants caused by policy, social, environmental and economic factors (7).

Currently, scholars have studied on the topic of medical services for migrants. For example, Ismayilova et al. (11) mainly studied the relationship between migration status, migration patterns and access to health care among Kazakhstan's labor migrants. Kim et al. (12) focused on the health utilization patterns and healthcare needs among Korean expatriates in Vietnam, Cambodia, and Uzbekistan. Studies by Vaalavuo and Sihvola (13) found that the impact of specialized health care services on population migration in Finland. Snyder and Wilson (14) conducted a study on the association between urban Aboriginal peoples' mobility and health service use in two distinct Canadian cities. Gu et al. (15) investigated the effect of the quantity and quality of health services on emergent migration in China. However, current studies on return migration have barely addressed medical services, and most studies have concentrated on return intentions. For example, based on a survey of African immigrant groups in Spain and Italy, De Haas and Fokkema (16) examined how social culture, economy, international connection and other factors affect return intentions of the migrants. Haug (17) examined the effect of social capital in the inflow region on international immigrants' return intentions. Li et al. (18) explored the relationship between familial factors and the return intentions of migrant workers. Studies by Gu et al. (19) found that factors influencing the return intentions of migrant workers in China to return home, including familial relationships, housing, society and space. Overall speaking, although the return intentions reflect and predicts, to some extent, the future return trend of the migrants, it does not represent the final return result (20). In fact, the emergence of return intentions is only the starting point, and RB is the final result of this process (21). Nonetheless, studies of RB are few except those by a few scholars like Leibbrand and Zhang (22, 23). Therefore, not only the topic of medical services has not been involved in the RB of migrants in previous studies, but also the returning problem has been mainly focused on return intentions and has not been involved in RB. In view of the deficiencies in the above studies, it is necessary to conduct an in-depth study on medical services and RB of migrants.

Considering that in China, migrants are characterized by low socioeconomic status, low socioeconomic status, labor-intensive jobs and a lack of convenient access to health insurance. In the meantime, medical services for the migrants have not been given enough attention. All of these have put medical services for the migrants in a disadvantageous position. Against the background of an increasing need for medical services, medical services in the original inflow regions are still highly exclusive to the migrants, where local residents are still prioritized in the distribution of rivalrous public goods (24). Under such conditions, constantly improving MSL in the city of their registered residence becomes more attractive to the

migrants. Therefore, the following questions are raised: Does medical service cause the migrants to make return decisions and behavior? To what extent does it affect such decisions and behavior? How does this effect differ across individuals with different characteristics? It is difficult to answer these questions through traditional microscopic data research because return as a retrospective migration activity requires the acquisition of information about individuals' historical migration behaviors. Limited by data availability, the existing literature is mostly concentrated on theoretical analysis or exploration of the return intentions based on questionnaire-based surveys, without examining the reality of RB. This paper tries examine the effect of medical services on RB of the migrants and the moderating effect of HS and HE of the migrants, which could not only help gain an in-depth understanding of the patterns of population migration and promoting coordinated development, but help local governments timely adjust their public medical care policies and smoothen population return channels.

Research hypothesis

The Law of the People's Republic of China on the Promotion of Basic Medical and Health Care, promulgated in 2019, explicitly points out that medical services fall in the category of medical and health services, which are disease prevention, diagnosis, treatment, nursing, rehabilitation and other services provided by adopting suitable drugs, appropriate technologies and suitable equipment. Based on the concept stated above, this paper decomposes medical services into MSL and MSI, which, respectively, mean the absolute value of medical service resources in one city area in a given year and the level of improvement of such medical service resources within a certain period of time. Moreover, defined from a spatial perspective, RB refers to a phenomenon that the migrants leave the city where the household registration is located during the process of migration, and then returns to the city where the household registration is located after a period of time (7). For the migrants in China, the restrictions of the household registration system make it impossible for them to truly enjoy the supporting medical services in the inflow region (25). An inability to obtain local household registration poses a huge barrier to accessing health care and insurance (26). The results of the Seventh National Census show that the inflow of migrants still mainly occurs in the more economically developed eastern region. Despite a high MSL, the large population base of the region has caused a limited MSL available per capita and indirectly resulted in relatively high medical service expenses. Although China has proposed to establish an instant settlement system for medical treatment in different places since 2010, under the localized management of medical insurance, there are often problems such as low reimbursement ratio, cumbersome procedures related to settlement, difficulty in information sharing, and pressure on fund advance, etc. Participating in medical insurance locally can save many reimbursement troubles for migrant people[1]. At the same time, in the Chinese context, even if a migrant is ill in a non-registered cities, he or she expects to be accompanied by a relative from afar, as opposed to the care of an hired caregiver. Kinship care is not just companionship when one is sick but also spiritual care. Because distance is a central factor in the spatial choices of migrants from a geographic perspective (27), the cost of companionship incurred away from home, family, and friends tend to increase with distance. Considering that migrants generally have low-income levels and higher financial insecurity (26), the scarcity of health insurance in inflow urban cities and the additional costs arising from off-site hospitalization and care, all of these reasons lead to migrants paying higher costs for health care services than local residents (28), and further enhance their desire for more affordable medical services. Hence, with barriers to accessing medical services in the target areas of migration, some of the migrants have to return home to seek more cost-effective medical services (29). Although a relatively lower MSL in central and western China, the higher convenience and affordable prices of medical services in their home regions still account for their choice to seek medical services in the city of registered residence. Additionally, with progress in implementing "The Medical Insurance System Covering the Whole Population," the levels of basic medical insurance and public medical services targeting populations in less developed regions and rural areas have also been steadily improving. This has stimulated their willingness to return, causing increasing MSL to generate huge attractiveness to the migrants. To sum up, when MSL is relatively low but MSI is considerably large in cities of household registration, the migrants still tend to make the return decision and thus increase the return probability given their considerations of restrictions of the household registration system and financial factors. Therefore, the following hypotheses are proposed:

H1: When MSL in the household city is low, but MSI is high, the return probability of migrants will increase.

After understanding the effects of MSL and MSI in cities of household registration, MSL and MSI also promote and influence each other and jointly promote the occurrence of RB. The low level of medical services in the region will encourage the local government to increase medical investment, which in turn will improve the medical service situation and

1 Considering that the sample is 2017 data, the paper analyzes the problems of medical treatment in other places mainly for the scenario in 2017. However, as of early 2022, there are still more problems, such as cumbersome direct settlement filing procedures, different settlements and reimbursement policies between regions, and unconnected information systems for heterogeneous medical treatment.

enhance the quality of medical services, thereby increasing the probability of the migrants returning. Existing studies also confirm that province-level units with less developed public medical services should enhance their capacity in the area (30). With the promulgation of the Plan for Universal Medical Care during the "14^{th} 5-year Plan," advancing the construction of urban-rural medical coordination system and enhancing the support for medical care in less developed regions have been recognized as priorities for governmental work. Continuous improvement in medical services also helps reverse the backwardness of the level of medical services in these regions. Presently, the need for medical services has been a fast ascent (31), forcing some migrants who sacrifice part of their medical service needs in the face of dual pressures from the household registration system and financial conditions to return home (25). If medical services in the city of registered residence continue to improve to a considerable extent, the city of registered residence will have a significant appeal to the migrants even if the absolute level of medical services still lags behind that of the more developed regions in the east. The above analysis indicates that the interactions between MSL and MSI increase the return probability of migrants, so the following hypotheses are proposed:

H2: There is a positive interaction effect between MSL and MSI. The larger the interaction effect, the higher the return probability of migrants.

The relationship between the migrants and the state of their physical health is referred to by scholars as the "healthy migrant effect" (32). Studies show that the migrants enjoy an advantage of good health during their early stage of migration, but with progression in time, their health advantage gradually diminishes and factors like long working time, poor working conditions and barriers against accessing health care services in the inflow regions all contribute to the decline of the health of the migrants (33). Eventually, those with poor health are more likely to return home (34, 35). Long further points out that the returning behavior of the migrants as a result of health issues actually represents a contradiction between urban-rural medical resource distribution and the need for these resources, reflecting the role of the medical service situation in driving the return behavior of the migrants (36). In the meantime, migrants in poor health are more likely to experience worsening economic conditions due to the pressure of health care costs, making them more likely to be attracted to return by the relatively affordable health care services available in the city of registered residence. Therefore, migrants with poor health conditions are more likely to exhibit RB due to their inability to pay for and enjoy the medical services provided by their original inflow cities. Meanwhile, they are more included to choose the return option when MSL improves in the city of registered residence. The above analysis shows poor health conditions have a moderating effect on the relationships between MSL and RB and between MSI and RB. Therefore, the following hypotheses were made:

H3: HS has a positive moderating effect on the relationship between MSL and RB, as well as the relationship between MSI and RB.

Studies show that the migrants prevalently have a low health literacy. Due to a lack of health-related knowledge, migrants are more likely to resort to self-care when sick than seek medical care (37). At the same time, when faced with a major illness, people with poor health literacy may delay seeking medical care because they are unaware of preventive measures or symptoms of the illness, which may eventually lead to the deterioration of the condition (38). HE refers to well-planned, organized, systematic social education activities aiming to help people voluntarily adopt behaviors and lifestyles beneficial for their health (28). HE is considered an important path toward improving health literacy among the migrants (39). The higher the level of HE received by the migrants, the higher their health awareness and their need for medical services. That is, HE strengthens their attention to medical services. Therefore, when the MSL is low but the MSI continues to grow, the migrants with higher HE levels is more likely to choose to return to the city with household registration, pointing to the positive moderating effect of HE.

H4: HE has a positive moderating effect on the relationship between MSL and RB, as well as the relationship between MSI and RB.

Methodology

Data source

The data in this study are mainly derived from the CMDS in 2017 and the China City Statistical Yearbook in 2018. CMDS, released by the National Health Care Commission, is based on the randomization principle of screening and locking sample sites in the more concentrated areas of the migrants in 31 provinces (Districts, Cities) and the Xinjiang Production and Construction Corps in mainland China, while using a stratified, multi-stage, size-proportional PPS method for sampling. The target respondents of the database are the migrants who have lived in the inflow area for more than 1 month and are 15 years old and above, with a

sample size of about 170,000[2]. Detailed information on the purpose, design, sample and questionnaire of the CMDS can be found in the CMDS-related design scheme published by the National Health Commission. City-level data were obtained from the China City Statistical Yearbook published by the National Bureau of Statistics. In this paper, we determined whether the return behavior of the migrants occurred: using the prefecture-level city as the unit, the prefecture-level city to which the sample belonged was matched with the city-level data. After excluding missing values, the total sample size is 111,540.

Measurement

Dependent variables

Unlike previous studies on migration intentions, this paper was based on the results of the CMDS survey to screen samples in a two-step process to determine whether the respondents' actual RB occurred. In the first step, if the respondents had left the place of household registration for 6 months or more, and their permanent residence was the same as the place of household registration at the time of the survey, the preliminary decision was returned (23). In the second step, according to question 304.1 of the CMDS questionnaire, the samples whose flow range was "intra-city flow" were excluded. Ensure that the respondents left the city where their household registration was in the flow, which was in line with the definition of return behavior in this paper.

Independent variables

According to the purpose of the study, MSL and MSI were used as independent variables. Drawing on Li's definition of medical service and based on data from the China City Statistical Yearbook in 2018 (40, 41), this paper selected a total of five indicators, namely the number of hospitals, the number of hospital beds, the number of licensed physicians, the number of urban workers' basic old-age insurance participants, and the number of urban workers' basic medical insurance participants. Factor analysis in principal component analysis was used to weight the composite score as MSL in the city where the migrants is located. This paper considered MSI as the improvement degree of MSL, which can be regarded as the MSL of a city in a certain year minus the MSL of 6 years ago. Specifically, through principal component analysis, each city's comprehensive scores of MSL in 2017 and 2012 were separately calculated, and the former minus the latter was used as MSI of the city where the survey respondent was located.

Moderator variable

The moderator variables in this study were HS and HE. According to the Health and Public Services survey module of CMDS data, respondents were required to fill in the question, "whether you had any illness or physical discomfort in the last year?" If the answer was yes, the code was counted as 1, defining that in poor HS; if the answer were no, the code was counted as 0, defining that in good HS. In the CMDS, respondents were asked to answer the nine HE questions, "In the past year, did you receive health education on mental health/smoking/chronic diseases/AIDS/occupational diseases/maternal and child health/tuberculosis/reproductive health and contraception/self-help in public emergencies?" Participation in one of these HE was counted as 1, not counted as 0, and the score ranges 0–9.

Control variables

To obtain the effects of medical services on RB of migrants, this paper controlled other factors that may affect it. Based on the control variable designs of existing scholars (23, 28), this paper selected control variables from the city and individual levels. From the city level, five variables were selected: gross regional product per capita (GRP), education status (ES), region attribution (RA), logistics infrastructure (LI), and information infrastructure (II). From the individual level, a total of five variables were selected: age characteristics (AC), RHR, NRCMS, educational background (EB), and personal income (PI). The measurement of control variables is shown in Table 1.

Empirical model

Considering that the explained variable RB is a binary variable, Probit model is suitable for modeling. Equations (A)∼(D) verify four research hypotheses, respectively:

$$Prob\left(RB_{ij}=1\middle|MSL_j, MSI_j, HS_{ij}, HE_{ij}, control_{1,ij}, ..., control_{M,ij}\right) = \Phi(\beta_0+\beta_1 MSL_j+\beta_2 MSI_j+\sum_{m=1,...,M}\beta_{m+3}control_{m,ij}+\varepsilon_{ij}) \quad (A)$$

2 Both "inflow" and "outflow" data are obtained from the CMCD, with "inflow" representing the current city of the survey respondent and "outflow" representing the city of the household registration of the survey respondent before the migration occurred. If the CMCD data for a specific survey respondent shows that the "inflow" city and the "outflow" city are the same, it means that a return behavior has occurred after the migration. In this paper, the return behavior is defined as the phenomenon that the migrant population leaves the city of their household registration and returning to their city after a period of time, i.e., for the returning population, both "inflow" and "outflow" represent the city where the household registration is located, and they are the same.

TABLE 1 Control variable measurement.

Variable name	Variable symbol	Description
Gross regional product per capita	GRP	The amount of GRP per capita in the city in which the migrants currently resided in 2017.
Education status	ES	The number of primary and secondary school students in the city where migrant workers were located in 2017.
Region attribution	RA	According to the regional division of the city to which the migrants belong, the RA variable was divided into three groups: eastern region, central region, and western region.
Logistics infrastructure	LI	Revenue from the city's postal business at year-end.
Information infrastructure	II	Revenue generated by the city's telecommunications business at year-end.
Age characteristics	AC	Variables derived from CMCD data were used to distinguish migrants by their age stage.
Rural household registration	RHR	Data from the CMDS was used to determine whether a respondent was an agricultural registered permanent resident. If the answer was yes, the code was counted as 1, not counted as 0.
New rural cooperative Medical system	NRCMS	Survey respondents about their participation in this rural health insurance program using CMDS data[3]. Participation in this insurance was counted as 1, not counted as 0.
Educational background	EB	Accordingly to the statistics of the educational background of CMDS data, primary schools and below were counted as 1, junior high schools, vocational colleges, and senior high schools were counted as 2, undergraduates and junior colleges were counted as 3, and graduates and above were counted as 4.
Personal income	PI	Based on data from the CMDS survey, the average monthly income of the respondent in the past year was used.

$$Prob\left(RB_{ij}=1\middle|MSL_j,MSI_j,HS_{ij},HE_{ij},control_{1,ij},...,control_{M,ij}\right)$$
$$=\Phi(\beta_0+\beta_1 MSL_j+\beta_2 MSI_j+\beta_3 MSL_j\times MSI_j$$
$$+\sum_{m=1,...,M}\beta_{m+3}control_{m,ij}+\varepsilon_{ij}) \quad (B)$$

$$Prob\left(RB_{ij}=1\middle|MSL_j,MSI_j,HS_{ij},HE_{ij},control_{1,ij},...,control_{M,ij}\right)$$
$$=\Phi\begin{pmatrix}\beta_0+\beta_1 MSL_j+\beta_2 MSI_j+\beta_3 HS_{ij}\times MSL_j\\+\beta_4 HS_{ij}\times MSI_j\\+\sum_{m=1,...,M}\beta_{m+4}control_{m,ij}+\varepsilon_{ij}\end{pmatrix} \quad (C)$$

$$Prob\left(RB_{ij}=1\middle|MSL_j,MSI_j,HS_{ij},HE_{ij},control_{1,ij},...,control_{M,ij}\right)$$
$$=\Phi\begin{pmatrix}\beta_0+\beta_1 MSL_j+\beta_2 MSI_j+\beta_3 HE_{ij}\times MSL_j\\+\beta_4 HE_{ij}\times MSI_j\\+\sum_{m=1,...,M}\beta_{m+4}control_{m,ij}+\varepsilon_{ij}\end{pmatrix} \quad (D)$$

Taking Equation (A) as an example, it represents the probability that i (migrants) chooses to return from j (inflow area) under given MSL, MSI and other conditions. Moreover, $control_{ij}$ represents the control variable, and ε_{ij} is the residual term. Equations (B)∼(D) are based on Equation (A), and the other variables have the same meaning.

3 In January 2016, the State Council issued "The Opinions on Integrating Urban and Rural Residents Basic Medical Insurance System," deciding to integrate the two systems of urban residents' medical insurance and NRCMS into a unified basic medical insurance system for urban and rural residents, but as of 2017 the opinion is still in the promotion stage, and CMDS data show that in 2017 the migrant population is still mainly participating in the NRCMS.

Results

Factor analysis

The explanatory variable MSL was measured by calculating the composite score using factor analysis in principal component analysis. In this paper, the composite scores of MSL in 2017 and 2012 were calculated in turn. By performing the KMO test and Bartlett's sphericity test on the indicators, it was found that the KMO values were 0.793 and 0.803, respectively, and the significance of Bartlett's sphericity test was at the 1% level, indicating that the above data were suitable for the factor analysis method. Most public factor extraction degrees were above 0.8, indicating a good information extraction effect. According to the criterion that the characteristic root is >1 to extract the common factors, the variance contribution rate is 88.70% and 83.99%, which can better represent most of the information of the original indexes. The score coefficient matrix derived from the factor rotation using the maximum variance method was combined with the score coefficient matrix using the variance contribution rate as the weight to calculate the composite score. The variable MSL was measured using the 2017 composite score, and the variable MSI was measured using

10.3389/fpubh.2022.1009454

TABLE 2 Descriptive statistics.

Variables	RB	Mean	SD
MSL	Occurrence	−0.54	0.37
	Non-occurrence	0.03	1.01
MSI	Occurrence	−0.07	0.19
	Non-occurrence	0.01	0.27
HS	Occurrence	0.46	0.50
	Non-occurrence	0.45	0.50
HE	Occurrence	3.83	3.48
	Non-occurrence	3.32	3.39
GRP	Occurrence	5.65	2.87
	Non-occurrence	8.61	3.65
ES	Occurrence	67.18	37.99
	Non-occurrence	84.87	74.17
RA	Occurrence	2.04	0.61
	Non-occurrence	1.78	0.83
LI	Occurrence	15.30	23.62
	Non-occurrence	48.51	66.51
II	Occurrence	44.11	38.21
	Non-occurrence	139.43	177.78
AC	Occurrence	35.95	8.86
	Non-occurrence	37.55	10.98
RHR	Occurrence	0.78	0.42
	Non-occurrence	0.78	0.42
NRCMS	Occurrence	0.71	0.45
	Non-occurrence	0.79	0.41
EB	Occurrence	2.56	0.94
	Non-occurrence	2.38	0.97
PI	Occurrence	0.67	0.48
	Non-occurrence	0.71	0.55

the difference between the 2017 composite score and 2012 for the following statistics and tests.

Descriptive statistics

In order to see more clearly the differences in RB among the migrants, the sample was divided into two groups for descriptive statistics based on the occurrence or non-occurrence of RB. The variables for all descriptive statistics are shown in Table 2.

As can be seen from Table 2, from the perspective of cities, the difference in MSL variables in the two groups is obvious. The average value of the non-occurrence group of RB is much higher than that of the occurrence group, indicating that the current migrants that does not return is generally located in areas with abundant medical resources, which is also in line with the fact that the current migrants generally go to work in coastal and developed areas of China. However, the difference in the variable of MSI between the two groups is small, indicating that with the continuous improvement of China's medical service system, medical services have gradually covered less developed and remote areas, leading to a further increase in the equality of medical services among cities in China. In terms of LI, II, GRP per capita, and ES, there is a huge gap in economic development, educational resources, logistics construction and information construction between the two groups. Moreover, from the individual level, the variable of HE was significantly different between the occurrence group and the non-occurrence group, which indicates that the migrants with RB generally received a higher degree of HE. Except for the HE variable, there was no significant difference in other variables.

Regression result

Stepwise Probit regression was performed after data standardization for continuous variables, the LR CHI2 values of the Models (A)∼(D) were all significant in Table 3, indicating that the overall regression effect of each model was good.

As can be seen from Model (A) in Table 3, after controlling for other variables that may affect the RB of migrants, MSL has a significant negative impact on RB of migrants ($\beta = -0.27$, $p < 0.01$), and the MSI has a significant positive impact on RB of migrants ($\beta = 0.18$, $p < 0.01$). It indicates that the RB of migrants tends to the original household registration cities with relatively low MSL but rapid MSI. Hypothesis 1 has been verified.

On the basis of Model (A), Model (B) added the intersection term of MSL and MSI. It can be seen from Model (B) that after controlling for other variables that may affect RB, MSL and MSI are not significantly different from Model (A), and MSL × MSI has a significant positive impact on RB of migrants ($\beta = 0.86$, $p < 0.01$). It indicates that MSL and MSI play a positive interaction effect, which jointly increases the probability of RB. Hypothesis 2 is verified.

On the basis of Model (A), Model (C) added the intersection terms of MSL and HS, as well as MSI and HS. As shown from Model (C), after controlling for other variables that may affect RB, MSL and MSI, there is no significant difference with Model (A). At the same time, MSL × HS and MSI × HS have a significant positive influence on RB ($\beta = 0.06$, $p < 0.05$; $\beta = 0.16$, $p < 0.05$), indicating that HS play a positive moderating role, and hypothesis 3 is verified.

On the basis of Model (A), the intersection terms of MSL and HE, MSI and HE are added in Model (D). As you can see in Model (D), after controlling for other variables that may affect RB, MSL and MSI, there is no significant difference with Model (A). At the same time, MSL × HE and MSI × HE have a significant positive influence on RB ($\beta = 0.01$, $p < 0.05$; $\beta = 0.04$, $p < 0.01$), indicating that HE play a positive moderating role, and hypothesis 4 is verified.

TABLE 3 Results of Probit regression.

Variables	RB			
	Model (A)	Model (B)	Model (C)	Model (D)
MSL	−0.27*** (-6.92)	−0.43*** (-11.03)	−0.29*** (-7.16)	−0.29*** (-7.14)
MSI	0.18*** (4.60)	0.00 (0.05)	0.12** (2.39)	0.03 (0.45)
MSL × MSI		0.86*** (27.91)		
HS	−0.17*** (-12.74)	−0.16*** (-11.58)	−0.13*** (-6.95)	−0.17*** (-12.63)
HE	0.01*** (5.40)	0.01*** (3.84)	0.01*** (5.48)	0.02*** (6.06)
MSL × HS			0.06** (2.34)	
MSI × HS			0.16** (2.32)	
MSL × HE				0.01** (2.05)
MSI × HE				0.04*** (3.88)
GRP	−0.18*** (-16.15)	−0.15*** (-12.67)	−0.18*** (-16.19)	−0.18*** (-16.24)
ES	0.52*** (25.49)	0.71*** (33.47)	0.52*** (25.08)	0.52*** (25.31)
RA	0.05*** (4.86)	0.06*** (5.56)	0.05*** (5.00)	0.05*** (4.71)
LI	0.30*** (12.68)	−0.14*** (-5.27)	0.31*** (12.98)	0.31*** (12.94)
II	−2.02*** (-28.38)	−1.65*** (-23.11)	−2.02*** (-28.42)	−2.02*** (-28.46)
AC	−0.05*** (-7.08)	−0.05*** (-6.39)	−0.05*** (-7.06)	−0.05*** (-7.04)
RHR	−0.07*** (-3.77)	−0.08*** (-3.88)	−0.07*** (-3.75)	−0.07*** (-3.71)
NRCMS	0.16*** (9.03)	0.12*** (6.99)	0.16*** (9.08)	0.15*** (9.00)
EB	0.14*** (17.37)	0.14*** (17.40)	0.14*** (17.40)	0.14*** (17.44)
PI	0.01** (1.97)	0.01* (1.87)	0.01** (1.99)	0.01* (1.91)
Pseudo R2	0.16	0.17	0.16	0.16
LR CHI2	8081.69***	8956.26***	8090.58***	8098.36***

The numbers in parentheses are Z-test values. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively. The following are the same.

Heterogeneous impact analysis

Considering that most migrants in the Chinese scenario have household registration in rural areas (7), their physical health and medical behavior are also widely concerned (36, 38). This study considers the different performances of rural migrants and non-rural migrants in the decision-making process of return. Therefore, it is necessary to distinguish the rural migrants for more in-depth analysis and exploration. In order to better screen out the rural migrants from the original migrant sample, the control variables RHR and NRCMS, which reflect the rural attributes of migrants, were selected for grouping. Based on Model (A) in Table 2, Models 1a and 1b are constructed according to whether migrants are agricultural registered permanent residents, and Models 1c and 1d are constructed based on whether the migrants have NRCMS insurance. The results of Probit regression analysis for Models 1a∼1d are shown in Table 4.

In Models 1a and 1b of Table 4, there is a heterogeneous effect of MSL and MSI on RB under different household registration nature. The coefficients of MSL and MSI in the RHR subgroup are larger and both significant, indicating that for the rural migrants, it is more probable to return to the city of their household registration where MSL is lower but MSI is faster. The regression results from models 1c and 1d show that the coefficients of MSL and MSI are larger for the Non-NRCMS subgroup and both are significant. The findings suggest that for the migrants not covered by basic medical insurance, they are more likely to choose to return for more economical medical services in the city of their household registration. The reason for the difference is that the introduction of the NRCMS has promoted the willingness of the rural population to see a doctor, but the burden of medical expenses of the rural household has further increased. Yao et al. (42) conducted a study on urban-rural medical disparities in China and found that medical insurance holders in agricultural households have higher out-of-pocket costs and hospitalization costs than non-agricultural households and are also more likely to be induced by medical treatment to incur more costs. Thus, considering the high health care burden in the inflow area and the cumbersome reimbursement process of the NRCMS, both for the migrants with household registration in a rural area and for the uninsured migrants, they are influenced by the city-level medical services and thus are more likely to make the decision to return to their hometown.

10.3389/fpubh.2022.1009454

TABLE 4 Results table of Probit regression for different groups.

Variables	RB			
	Model 1a RHR	Model 1b Non-RHR	Model 1c NRCMS	Model 1d Non-NRCMS
MSL	−0.21*** (-4.74)	−0.53*** (-7.04)	−0.15*** (-3.07)	−0.35*** (-5.72)
MSI	0.24*** (5.51)	−0.06 (-0.65)	0.07 (1.40)	0.29*** (3.72)
HS	−0.17*** (-11.22)	−0.16*** (-5.44)	−0.20*** (-12.21)	−0.12*** (-4.80)
HE	0.01*** (4.60)	0.01** (2.42)	0.01*** (3.20)	0.02*** (4.98)
GRP	−0.19*** (-15.00)	−0.17*** (-6.83)	−0.21*** (-14.76)	−0.14*** (-7.46)
ES	0.53*** (22.75)	0.52*** (11.43)	0.58*** (23.78)	0.41*** (10.55)
RA	0.08*** (6.84)	−0.04** (-1.99)	0.08*** (6.51)	−0.01 (-0.39)
LI	0.30*** (11.60)	0.32*** (5.78)	0.29*** (8.63)	0.28*** (7.92)
II	−2.10*** (-25.51)	−1.62*** (-11.46)	−2.31*** (-24.81)	−1.51*** (-14.02)
AC	−0.04*** (-4.40)	−0.09*** (-5.60)	−0.05*** (-5.74)	−0.05*** (-3.60)
RHR			−0.20*** (-6.72)	−0.01 (-0.45)
NRCMS	0.11*** (5.71)	0.22*** (6.49)		
EB	0.16*** (17.58)	0.08*** (4.94)	0.16*** (15.19)	0.12*** (9.16)
PI	0.01 (1.11)	0.03** (2.19)	0.01 (0.95)	0.02* (1.94)
Pseudo R^2	0.16	0.15	0.17	0.14
LR CHI2	6510.30***	1681.55***	6099.88***	2144.43***
Number	88313	23227	73264	38276

The numbers in parentheses are Z-test values. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

In order to further refine the effects of MSL and MSI on RB, this paper is based on the dual grouping of migration distance and age, inspired by Gu et al. (19) view that "health services affect the migration distance of older people." Migration distance and age are also from CMCD data. The heterogeneity analysis of the sample can explain to some extent the difference in the decision to return between middle-aged and older people and younger people. Referring to the WHO age classification criteria, this paper takes 45 years as the cut-off, and samples below this age are young people, while others are middle-aged and older people. Then the migration distance is distinguished according to inter-provincial migration and intra-provincial migration, so the samples are divided into middle-aged and older people who return across provinces (IREG), middle-aged and older people who return within provinces (PREG), young people who return across provinces (IRYG), young people who return within provinces (PRYG), and those who do not return. Model 2a∼2d were the experimental groups, and Model 2e participated in the regression as the baseline group. The results of multinomial Probit regression analysis for Models 2a∼2e are shown in Table 5.

Models 2a∼2d are regression results based on return distance and age grouping, as shown in Table 5. The results show that the coefficients of MSL indicator in the four models are 0.04,−0.65,−0.36, and−0.04, indicating that the tendency degree of return because of MSL is ranked as IREG> PRYG> IRYG> PREG. The coefficients of MSI indicator in the four models are 0.64, 0.36,−0.09, and−0.29, indicating that the tendency degree of return because of MSI is ranked as IREG> PREG> IRYG> PREG. The results suggest that PREG chooses to return when MSL is low and MSI is high in the city with household registration, while IREG tends to choose to return when MSI is high and is likely to return when MSL is high. Compared to middle-aged and older people, PRYG are least likely to return because of MSL and MSI of the city of household registration. PRYG still choose to return when MSL is low, but are not very attached to MSI.

By comparing the MSL results of each group in Table 5, it can be seen that the level of medical services in IREG is not significant compared to PREG, indicating that the need for medical services is more urgent for the elderly returning across provinces. Due to more restrictions on inter-province medical services, middle-aged and older adults tend to return across provinces even though higher MSLs in the city of household registration can result in higher medical costs. In comparison, PREGs are closer in migration distance and can reach the city of household registration in a short time. Furthermore, the interoperability of the provincial health care system reduces certain medical costs, so they do not tend to return to the city of household registration when MSL is higher. However, for young people, PRYG is not significant compared to IRYG. These findings are understandable because young people have a lower

10.3389/fpubh.2022.1009454

TABLE 5 Results table of multinomial Probit regression for different groups.

Variables	RB				
	Model 2a IREG	Model 2b PREG	Model 2c IRYG	Model 2d PRYG	Model 2e Non-return population
MSL	0.04 (0.33)	−0.65*** (-10.21)	−0.36** (-2.23)	−0.04 (-0.42)	
MSI	0.64*** (6.02)	0.36*** (5.46)	−0.09 (-0.57)	−0.29*** (-3.39)	
HS	−0.09** (-2.45)	−0.25*** (-11.31)	−0.18*** (-3.68)	−0.24*** (-8.41)	
HE	0.02*** (3.70)	0.02*** (4.77)	0.01* (1.72)	0.01 (1.45)	
GRP	−0.32*** (-9.37)	−0.25*** (-13.24)	−0.11*** (-2.76)	−0.19*** (-7.91)	
ES	0.57*** (10.69)	0.82*** (24.53)	0.50*** (6.50)	0.53*** (12.15)	
RA	0.11*** (3.78)	0.11*** (6.51)	0.01 (0.32)	−0.06*** (-2.96)	
LI	0.38*** (5.28)	0.35*** (8.37)	0.37*** (3.84)	0.52*** (9.80)	
II	−2.61*** (-12.36)	−2.28*** (-19.82)	−2.28*** (-8.13)	−3.34*** (-19.52)	
RHR	−0.16*** (-2.89)	0.02 (0.63)	−0.37*** (-5.44)	−0.11*** (-2.89)	
NRCMS	0.09* (1.81)	0.32*** (11.00)	0.05 (0.87)	0.14*** (3.90)	
EB	−0.19*** (-8.43)	0.22*** (17.75)	−0.12*** (-3.89)	0.45*** (28.03)	
PI	−0.01 (-0.30)	0.04*** (3.37)	0.03 (1.13)	−0.03* (-1.73)	
WALD CHI2			6085.83***		
Number	784	3,888	337	1,791	104,740

The numbers in parentheses are Z-test values. ***, **, and * represent significance at the 1, 5, and 10% levels, respectively.

demand for medical services compared to middle-aged and older people, and more often go to work outside the province for reasons such as salary and development opportunities. Young people who return to the province are less disturbed by the level of medical services, so the empirical result is insignificant. The MSI analysis of each subgroup shows that both IREG and PREG are positively significant, indicating that for middle-aged and older people, the improvement of MSLs in the household registration city has a strong attraction to return and can meet their medical needs. The MSI coefficients of IRYG and PRYG are negative, indicating that the return attraction brought by the improvement of medical services is insufficient for young people. Moreover, young people may stay in the outflow city and not choose to return due to other considerations.

Discussion

With the emergence of the trend of return migration in China and the deepening of the reform of the household registration system since the 1990s, many disciplines such as geography, economics, sociology, and demography have paid attention to the issue of return migration. While early studies focused on the demographic and socio-economic characteristics of migrants, in recent years, the initiative and selectivity of migrants have received more attention. This paper focuses on the phenomenon of migrants choosing to return due to medical services, and has important practical implications for local governments to improve the level of medical services, increase the growth rate of medical services, pay attention to the medical needs of the elderly, and reduce the gap in medical services between urban and rural areas. On the whole, the paper has the following contributions.

Firstly, in this study, we explored medical services effects on RB. The current research on return migration is mostly about return intentions. Although it predicts the decision-making tendency of migrants to a certain extent, whether RB occurs is unknown (20). It was notable that the survey of migrants also found that many people with return intentions did not choose to return due to family, work, medical treatment, education and other reasons. This paper uses the large sample data of CMDS to identify whether the exact RB of migrants occurs, defines the RB of migrants from the perspective of spatial flow, and also provides reference for the subsequent research on RB. Furthermore, this paper divided the medical service into two aspects: MSL and MSI, which expanded the connotation of the concept of medical service. MSL represents the capacity and strength of the current medical service, while MSI represents the development potential and growth trend. It was found that low MSL and large MSI in the city of household registration would increase the return possibility of migrants. In addition, MSL and MSI have a positive interaction effect on RB. Due to the limitations of the household registration system and economic situation, the migrants do not blindly pursue the absolute high MSL but chooses their hometown with greater development potential for medical services. Accordingly, the phenomenon is worth further thinking about. Undeniably,

this study not only deepens the RB of migrants under the influence of medical services, expands the scope of return research, but also provides practical value for local governments to grasp the psychological needs of migrants for medical services, pay attention to the steady and rapid medical services, and attract more migrants to return to the city of their household registration.

The second, we explored the moderating effects of HS and HE on medical services and RB. We found that HS and HE has positive moderating effects on the relationship between MSL and RB and the relationship between MSI and RB, respectively. Whether it is MSL or the MSI, the premise of the impact on the RB of migrants is that the migrant people need certain medical services, but these medical service needs vary from person to person. In order to further explore the mechanism of medical services on RB under different scenarios, two health factors of migrants were selected as moderating variables from the perspective of medical service demand. Previous studies have shown that HS and HE are both important factors affecting medical services of migrants (32, 39), scenario-based studies using the two as moderating variables have strong theoretical and practical significance.

Then, we selected two variables for heterogeneity analysis separately. Grouping regressions were performed on the two variables, RHR and NRCMS. It was notable that the RHR group or the Non-NRCMS group are more likely to return as a result of the level and improvement of medical services. Some scholars have paid attention to the huge difference in medical services between urban and rural populations. Studies have pointed out that the rural population generally has problems such as weak health awareness, limited health investment, high medical expenses, and low utilization of medical services (42). In this case, the migrants with RHR will have more restrictions on medical services. At the same time, the NRCMS, as a government-organized mutual assistance system for rural residents, is unable to better enjoy medical services in the inflow area due to the restriction of reimbursement from other places so as to reduce the medical burden. The above analysis shows the disadvantages of the current rural migrants in medical services, and inspires the government to pay attention to the coordinated development of regional medical services.

Finally, the age and migration distance factors of the migrants were considered. The multinomial group regression was carried out. It was found that middle-aged and older people with long migration distances chose to return when both MSL and MSI were higher, and those with short migration distances chose to return when MSL was lower and MSI was higher. In contrast, young people have a lower overall willingness to return for medical services regardless of migration distance. From the above analysis, one may conclude that the migrants of different ages have different tendencies to return due to the factors of medical services under the limitation of different migration distances. Therefore, under the multinomial grouping of migration distance and age, the paper makes a deep interpretation of the conclusion of the relationship between medical services and RB in different scenarios.

This study still has some limitations and shortcomings. On the one hand, medical services involve many aspects. This study only selects MSL and MSI from the city level and does not explore other aspects of medical services. On the other hand, panel data was not used for analysis. Given the randomness of a questionnaire survey, it is less likely that the same person will be surveyed for several consecutive years. Therefore, the current mainstream studies on migrants all use cross-sectional data. However, cross-sectional data have some flaws in the long-term migration behavior of the migrants. In the future, data from other sources will be considered for detailed research.

Conclusion

Using data from CMDS as a sample, medical services were separated into two aspects: MSL and MSI, and the relationship between medical services and RB was explored using Probit regression analysis to investigate the interaction effects of MSL and MSI, as well as the moderating effects of HS and HE. Moreover, the migrants were further regressed in the heterogeneity analysis by grouping them separately according to whether they possessed RHR or whether they participated in NRCMS. Equally, multinomial Probit regression was conducted for migrants according to whether they were middle-aged and older people and whether they were interprovincial migrants.

(1) When MSL is low but the MSI is large, the return probability of migrants will increase. There is also a positive interaction effect between MSL and MSI. The larger the interaction effect, the higher the return probability of migrants.
(2) HS and HE have a positive moderating effect on the relationship between MSL and RB, as well as the relationship between MSI and RB.
(3) Through heterogeneity analysis, this paper shows that migrants with RHR and those who did not participate in the NRCMS were more likely to choose to return due to medical services. The analysis also shows that middle-aged and older people who return across provinces have the highest tendency to return due to medical services, and young people have the lowest tendency both across and within provinces.

Local governments should pay attention to the groups of migrants and the supply of medical service resources and grasp the real attractiveness of medical services implied by the status quo of the household registration system and market demand. The study has the following insights:

(1) First, the government needs to focus on improving MSL and increasing the economic support for basic medical services. To achieve full coverage of medical insurance and comprehensive reform of urban public hospitals, promote the national networking of basic medical insurance and settlement of medical treatment in different places, and better realize the allocation of medical resources for the migrants. Especially for the regions with backward MSL, it is more necessary to try to tap medical service resources to enhance medical service upgrading potential to really narrow the gap with well-developed regions.

(2) Secondly, regarding population migration management, the government should pay attention to the HS and HE of migrants and strengthen the health records of the migrants. The government should actively carry out health education-related publicity work, so that the migrants can, as far as possible, prevent problems before they occur and seek medical treatment in time to avoid minor illnesses becoming serious ones. It is necessary to update the health records of the migrants on time and accelerate the sharing of information. The government should ensure the authenticity, integrity, and scientific nature of the information in the health records of the migrants and gradually realize the interconnection of the health records of the migrants across regions and departments.

(3) Finally, the government should pay attention to the medical service needs of the rural household migrants and promote the reform of the rural medical system. It should also strengthen the construction of the rural medical service system and eliminate the gap areas in rural medical and health institutions. At the same time, the government should care for the middle-aged and older people and help them obtain the same or similar medical coverage as the registered elderly population in the inflow area. Communities can establish service centers for the elderly based on the service and management of the migrants in their jurisdictions and provide relevant services directly to the middle-aged and older people.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

MM and JY developed the main ideas of the study, gathered the data, performed the model construction and estimation, and wrote the manuscript. ZW participated in revising the manuscript and proofreading the article. All authors have read and agreed to the published version of the manuscript.

Funding

This article was supported by the project study on influencing factors of labor productivity (#KY-2020-wt010) from Chinese Academy of Labour and Social Security.

Acknowledgments

We thank all participants and staff at the study sites for their cooperation. We would like to thank the reviewers for their helpful remarks.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

1. National Health and Family Planning Commission. *2017 Report on China's Floating Population Development*. Beijing: China Population Publishing House (2018).

2. You Z, Yang H, Fu M. Settlement intention characteristics and determinants in floating populations in Chinese border cities. *Sustain Cities Soc.* (2018) 39:476–86. doi: 10.1016/j.scs.2018.02.021

3. Wang Y, Wang Z, Zhou C, Liu Y, Liu S. On the settlement of the floating population in the Pearl River delta: understanding the factors of permanent settlement intention versus housing purchase actions. *Sustainability.* (2020) 12:9771. doi: 10.3390/su12229771

4. Zhang P, Liu Y, Miao L. Impacts of social networks on floating population wages under different marketization levels: empirical analysis of China's 2016

national floating population dynamic monitoring data. *Appl Econ.* (2021) 53:2567–83. doi: 10.1080/00036846.2020.1863323

5. Yu H, Wu W, Yu L, Wu L. Health literacy and health outcomes in China's floating population: mediating effects of health service. *BMC Public Health.* (2021) 21:691. doi: 10.21203/rs.3.rs-32594/v3

6. Tu Y, Zhang Y, Yang Y, Lu S. Treat floating people fairly: how compensation equity and multilevel social exclusion influence prosocial behavior among China's floating population. *J Bus Ethics.* (2020) 175:323–38. doi: 10.1007/s10551-020-04641-y

7. Li Z, Liu D, Lin S. A literature review of the study on return floating population in China. *Hum Geogr.* (2020) 35:1–62. doi: 10.13959/j.issn.1003-2398.2020.01.001

8. Todaro MP. A model of labor migration and urban unemployment in less developed countries. *Am Econ Rev.* (1969) 59:138–48.

9. Stark O, Bloom DE. The new economics of labor migration. *Am Econ Rev.* (1985) 75:173–8.

10. Massey DS, Arango J, Hugo G, Kouaouci A, Pellegrino A, Taylor JE. Theories of international migration: a review and appraisal. *Popul Dev Rev.* (1993) 19:431–66. doi: 10.2307/2938462

11. Ismayilova L, Lee HN, Shaw S, El-Bassel N, Gilbert L, Terlikbayeva A, et al. Mental health and migration: depression, alcohol abuse, and access to health care among migrants in Central Asia. *J Immigr Minor Health.* (2014) 16:1138–48. doi: 10.1007/s10903-013-9942-1

12. Kim HY, Kim JY, Park HY, Jun JH, Koo HY, Cho IY, et al. Health service utilization, unmet healthcare needs, and the potential of telemedicine services among Korean expatriates. *Glob Health.* (2018) 14:1–8. doi: 10.1186/s12992-018-0433-y

13. Vaalavuo M, Sihvola MW. Are the sick left behind at the peripheries? health selection in migration to growing urban centres in Finland. *Eur J Popul.* (2021) 37:341–66. doi: 10.1007/s10680-020-09568-8

14. Snyder M, Wilson K. Urban Aboriginal mobility in Canada: #xamining the association with health care utilization. *Soc Sci Med.* (2012) 75:2420–4. doi: 10.1016/j.socscimed.2012.09.020

15. Gu H, Jie Y, Lao X. Health service disparity, push-pull effect, and elderly migration in ageing China. *Habitat Int.* (2022) 125:102581. doi: 10.1016/j.habitatint.2022.102581

16. De Haas H, Fokkema T. The effects of integration and transnational ties on international return migration intentions. *Demogr Res.* (2011) 25:755–82. doi: 10.4054/DemRes.2011.25.24

17. Haug S. Migration networks and migration decision-making. *J Ethn Migr Stud.* (2008) 34:585–605. doi: 10.1080/13691830801961605

18. Li G, Fang Y, Song Y, Chen J, Wang M. Effects of family encouragement on migrant workers' return-to-hometown intention and turnover: the moderating role of career-related concerns. *Career Dev Int.* (2019) 25:165–85. doi: 10.1108/CDI-01-2019-0023

19. Gu H, Ling Y, Shen T. Return or not return: examining the determinants of return intentions among migrant workers in Chinese cities. *Asian Popul Stud.* (2021) 17:51–70. doi: 10.1080/17441730.2020.1825161

20. Wanner P. Can Migrants' emigration intentions predict their actual behaviors? evidence from a Swiss survey. *J Int Migr Integr.* (2021) 22:1151–79. doi: 10.1007/s12134-020-00798-7

21. Cassarino JP. Theorising return migration: the conceptual approach to return migrants revisited. *Int J Multicult Soc.* (2004) 6:253–79. doi: 10.1590/s1980-85852013000200003

22. Leibbrand C, Massey C, Alexander JT, Tolnay S. Great Migration's great return? an examination of second-generation return migration to the South. *Soc Sci Res.* (2019) 81:117–31. doi: 10.1016/j.ssresearch.2019.03.009

23. Zhang Y, Chen Y. Retain or return: the impact of housing on return migration. *Popul Res.* (2022) 46:75–88. Available online at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=RKYZ202202006&DbName=DKFX2022

24. Li M, Zheng L. When can I go home? school provisioning and the decision to immigrate. *J Financ Res.* (2021) 4:111–30. Available online at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=JRYJ202104007&DbName=CJFQ2021

25. Yang X. The impact of urban public services quality on population mobility. *Chin J Popul Sci.* (2017) 2:104–28. Available online at: https://kns.cnki.net/kcms/detail/detail.aspx?FileName=ZKRK201702011&DbName=CJFQ2017

26. Chen X. Why do migrant households consume so little? *China Econ Rev.* (2018) 49:197–209. doi: 10.1016/j.chieco.2017.11.005

27. Pappalardo L, Simini F, Rinzivillo S, Pedreschi D, Giannotti F, Barabási AL. Returners and explorers dichotomy in human mobility. *Nature Commun.* (2015) 6:8166. doi: 10.1038/ncomms9166

28. Tian Y, Luo T, Chen Y. The promotional effect of health education on the medical service utilization of migrants: evidence from China. *Front Public Health.* (2021) 9:818930. doi: 10.3389/fpubh.2021.818930

29. Peng B, Ling L. Association between rural-to-urban migrants' social medical insurance, social integration and their medical return in China: a nationally representative cross-sectional data analysis. *BMC Public Health.* (2019) 19:1–16. doi: 10.1186/s12889-019-6416-y

30. Guan M. Associations between geodemographic factors and access to public health services among Chinese floating population. *Front Public Health.* (2020) 8:563180. doi: 10.3389/fpubh.2020.563180

31. Shao H, Jin C, Xu J, Zhong Y, Xu B. Supply-demand matching of medical services at a city level under the background of hierarchical diagnosis and treatment-based on didi chuxing data in Haikou, China. *BMC Health Serv Res.* (2022) 22:1–12. doi: 10.1186/s12913-022-07762-4

32. Zhang L, Liu S, Zhang G, Wu S. Internal migration and the health of the returned population: a nationally representative study of China. *BMC Public Health.* (2015) 15:1–9. doi: 10.1186/s12889-015-2074-x

33. Niu J, Qi Y. Internal migration and health stratification in urban China. *Asian Pac Migr J.* (2015) 24:432–62. doi: 10.1177/0117196815609492

34. Hu X, Cook S, Salazar M A. Internal migration and health in China. *Lancet.* (2008) 372:1717–9. doi: 10.1016/S0140-6736(08)61360-4

35. Ullmann S H, Goldman N, Massey DS. Healthier before they migrate, less healthy when they return? the health of returned migrants in Mexico. *Soc Sci Med.* (2011) 73:421–8. doi: 10.1016/j.socscimed.2011.05.037

36. Long C, Han J, Liu Y. Has rural-urban migration promoted the health of Chinese migrant workers? *Int J Environ Res Public Health.* (2020) 17:1218. doi: 10.3390/ijerph17041218

37. Su S, Zhang F, Liu Q, Wang Y, Wen J, Tang X, et al. Factors associated with utilization of reproductive healthcare services among migrant women workers in Chong Qing, China. *Int J Gynaecol Obstet.* (2014) 127:66–8. doi: 10.1016/j.ijgo.2014.04.005

38. Li X, Yang H, Wang H, Liu X. Effect of health education on healthcare-seeking behavior of migrant workers in China. *Int J Environ Res Public Health.* (2020) 17:2344. doi: 10.3390/ijerph17072344

39. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med.* (2011) 155:97–107. doi: 10.7326/0003-4819-155-2-201107190-00005

40. Division of Urban Social and Economic Survey NBS. *China City Statistical Yearbook—2018.* Beijing: China Statistical Press (2018).

41. Li Z, Hu M. Spatio-temporal disparity and driving forces of the supply level of healthcare service in the Yangtze River Delta. *Front Public Health.* (2022) 10:863571. doi: 10.3389/fpubh.2022.863571

42. Yao Y, Liu b, Liu G, Zang W. Medical insurance, household registration system and healthcare utilization—evidences from CHARLS data analysis. *Insur Stud.* (2014) 06:105–16. Available online at: 10.13497/j.cnki.is.2014.06.001

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 25 October 2022
DOI 10.3389/fpubh.2022.1015699

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 10 August 2022
ACCEPTED 04 October 2022
PUBLISHED 25 October 2022

CITATION
Liu S, Xia D, Wang Y, Xu H, Xu L, Yuan D, Liang A, Chang R, Wang R, Liu Y, Chen H, Hu F, Cai Y and Wang Y (2022) Predicting the risk of HIV infection among internal migrant MSM in China: An optimal model based on three variable selection methods. *Front. Public Health* 10:1015699. doi: 10.3389/fpubh.2022.1015699

Predicting the risk of HIV infection among internal migrant MSM in China: An optimal model based on three variable selection methods

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Introduction: Internal migrant Men who have sex with men (IMMSM), which has the dual identity of MSM and floating population, should be more concerned among the vulnerable groups for HIV in society. Establishing appropriate prediction models to assess the risk of HIV infection among IMMSM is of great significance to against HIV infection and transmission.

Methods: HIV and syphilis infection were detected using rapid test kits, and other 30 variables were collected among IMMSM through questionnaire. Taking HIV infection status as the dependent variable, three methods were used to screen predictors and three prediction models were developed respectively. The Hosmer-Lemeshow test was performed to verify the fit of the models, and the net classification improvement and integrated discrimination improvement were used to compare these models to determine the optimal model. Based on the optimal model, a prediction nomogram was developed as an instrument to assess the risk of HIV infection among IMMSM. To quantify the predictive ability of the nomogram, the C-index measurement was performed, and internal validation was performed using bootstrap method. The receiver operating characteristic (ROC) curve, calibration plot and dynamic component analysis (DCA) were respectively performed to assess the efficacy, accuracy and clinical utility of the prediction nomogram.

Results: In this study, 12.52% IMMSMs were tested HIV-positive and 8.0% IMMSMs were tested syphilis-positive. Model A, model B, and model C fitted well, and model B was the optimal model. A nomogram was developed based on the model B. The C-index of the nomogram was 0.757 (95% CI: 0.701–0.812), and the C-index of internal verification was 0.705.

Conclusions: The model established by stepwise selection methods incorporating 11 risk factors (age, education, marriage, monthly income, verbal violence, syphilis, score of CUSS, score of RSES, score of ULS, score of ES and score of DS) was the optimal model that achieved the best predictive power. The risk nomogram based on the optimal model had

relatively good efficacy,accuracy and clinical utility in identifying internal migrant MSM at high-risk for HIV infection, which is helpful for developing targeted intervention for them.

KEYWORDS

prediction model, nomogram, internal migrant MSM, HIV, random forests, stepwise selection, univariable selection

Introduction

In recent years, men who have sex with men (MSM) have emerged as a high-risk group for HIV infection in China, with the rate of HIV infection rising year by year (1). A large-scale systematic analysis reported that the national HIV prevalence among MSM from 2001 to 2018 was 5.7%, and the study prevalence ranged from 0 to 22.91% (2). Previous studies have shown that the internal migrant MSM (IMMSM) constituted most of the MSM populations, ranging from 71.2 to 91.3% (3–5). IMMSM is defined as changes of usual residence within countries and have had sex with a male in the last 6 months (6). Migration within China has been identified as a major factor influencing the transmission of HIV in China, and the high migration rate among MSM populations poses a huge challenge to HIV prevention and control (1, 7).

Because of the better employment opportunities, less social discrimination, and more comfortable living environment, a large number of MSM moved to the metropolis and developed regions, but due to the imperfection of China's household registration system and urban social security system, the migrant populations had lower access to social benefits such as education and health services than the local populations (1, 8). According to prior studies, migrant MSM had lower levels of HIV knowledge and fewer opportunities for HIV testing compared with the local MSM populations, but they were at higher risk of engaging in high-risk sexual behaviors, such as unprotected anal intercourse (UAI), multiple sexual partners (MSP), and transactional sex (9–11). It has been documented that the HIV infection rates in migrant MSM were higher than those in local MSM (1, 12). Migrant MSM, which has the dual identity of MSM and floating population, should be more concerned among the vulnerable groups in society.

Joint United Nations Programme on HIV/AIDS (UNAIDS) has set the 95-95-95 strategy to achieve the goal of ending the global HIV epidemic by 2030, with the goal of making 95% of people living with HIV aware of their HIV serostatus by 2030 (13). Nevertheless, HIV testing rate among MSM has been low in China. A study including 988 participants found that only 57.1% of MSM have been tested for HIV in the past year (14). Thus, other methods are required to distinguish those at high-risk for HIV infection. Establishing appropriate prediction models to assess the risk of HIV infection in migrant MSM populations is beneficial for an individual to aware risk of infection and proactively avoid adverse factors, and is also in favor of the government to identify high-risk groups and integrate limited resources for targeted interventions specific to this population. While several HIV risk assessment tools have been targeted at MSM domestic and overseas (15–18), none has yet been developed for internal migrant MSM.

A variety of risk factors associated with HIV infection among MSM have been identified within the existing literatures. Among these factors, sociodemographic characteristics like age and education, behaviors such as UAI, sex trade and alcohol use before sex, sexually transmitted diseases have been widely studied (19–23). However, most studies to date have overlooked the important role that psychological factors play on HIV infection. As a sexual minority, MSM lives in surroundings full of stressors, such as stigma, prejudice and discrimination, which may compound negative mental health. Accordingly, compared with the heterosexual communities, MSM have suffered from serious mental health problems, including depression, distress, and trauma (24). Unfortunately, psychological problems and the relationship between these problems and HIV infection among migrant MSM is an underexplored area. Therefore, prediction models that incorporating psychological factors may assess the vulnerabilities for HIV infection more effectively.

Given these multiple gaps in knowledge of risk assessments of HIV infection among migrant MSM, in the present study, we explored numerous risk factors including sociodemographic characteristics, behaviors and experiences, condom use related factors, STDs infection status and psychological variables for HIV infection. After that, three different methods (Boruta, stepwise selection and univariable selection) were used to establish and validate prediction models. Then, an optimal model was selected to develop nomogram as an instrument to assess the risk of HIV infection among IMMSM, which may help to develop targeted interventions for them in the future.

Method

Study design and sampling

A cross-sectional study was performed simultaneously in four cities in China: east China (Shanghai), southern China (Shenzhen), northeastern China (Shenyang) and Southwest China (Kunming). It is difficult to target MSM by using probability sampling because they tend to hide their sexual orientation. The "snowball" sampling technique, which is advantageous in addressing population covertness was chosen for the present study. In each city, with the help of non-government organizations or local center for disease control and prevention, 5–10 socially adept MSM were recruited as "seeds" for the "snowball sampling". Subsequently, with the introduction of the initial "seeds", more and more MSM were recruited and acted as new "seeds". Each participant took part in a face-to-face interview with a trained staff in which they were informed of the details of the study. Written informed consent was obtained from participants before the survey. The recruitment procedure and the design of this study were approved by the Ethics Committee of School of Public Health, Shanghai Jiao Tong University.

Inclusion and exclusion criteria

Inclusion criteria: physiologically male, at least 18 years of age, and self-reported to have had sex with a male in the past 6 months. Exclusion criteria: those whose current place of residence and registered place are the same; cannot complete the questionnaire independently. 229, 195, 92, and 187 IMMSMs were recruited in Shanghai, Shenyang, Kunming and Shenzhen, respectively. All of them completed the test and questionnaire and were included in this study. All participants were given one free HIV test as well as a $17.84 subsidy.

Measurements

HIV and syphilis infections were tested by using rapid test kits (Beijing Aipu Medical Equipment Co.). The information collected through the questionnaire included basic demographic information (age, marriage, monthly income, etc.), homosexual sexuality (condom use, commercial sex, etc.), substance use (alcohol, cigarettes, drugs).

Rosenberg self-esteem scale (RSES)

The level of self-esteem was assessed by the 10 items, 4-point Likert-type RSES. Answers ranging from 1 (strongly disagree) to 4 (strongly agree), the higher the scores, the higher the level of self-esteem.

University of California at Los Angels loneliness scale (ULS)

Loneliness was assessed by ULS, which included 8 items, answers ranging from 1 (never) to 4 (often). The higher total scores indicated the stronger feeling of loneliness.

Patient health questionnaire-9 (PHQ-9)

Depression was assessed by the PHQ-9, with the total scores from 0 to 27. Answers range from 0 (never) to 3 (almost everyday). The higher scores indicated the higher level of depression.

Entrapment scale (ES)

Entrapment was assessed by the 16-item ES with answers ranging from 0 (never) to 4 (always), the higher the scores, the higher the level of entrapment.

Defeat scale (DS)

Defeat was assessed by the 16-item DS, with answers ranging from 0 (never) to 4 (always), the higher the scores, the higher the level of defeat.

Interpersonal needs questionnaire (INQ-15)

Interpersonal need was measured using the 15-item, 7-point Likert-type INQ-15. Answers were rated ranging from 1 (strongly not comply) to 7 (strongly comply) where a higher total score indicates a higher level of unmet interpersonal needs.

Suicidal ability scale (SAS)

The 9-item Likert-type SAS was applied to measure individual's suicidal ability. Answers were rated ranging from 0 (strongly disagree) to 8 (strongly agree), with a higher total score indicating higher suicidal ability.

Social support scale (SSS)

We employed the SSS to assess subjectively recognized social support from family, friends, and significant others. The scale is a 7-point Likert scale with 12 items, ranging from 1 (very strongly disagree) to 7 (very strongly agree). A higher total score indicated higher social support.

Sexual compulsivity scale (SCS)

The 10-item Likert-type SCS was applied to measure individual's out-of-control sexual thoughts and behaviors. Answers were rated ranging from 1 (strongly disagree) to 4 (strongly agree), with a higher total score indicating higher sexual compulsivity.

All of the above scales are widely used in the MSM population (25–40), and total of 31 independent variables were collected.

Statistical analysis

Scale reliability test

Scale reliability is broadly defined in the population as the ratio of the variance of true scores to the variance of observed scores, while Cronbach's coefficient alpha is a statistic for assessing scale reliability based on internal consistency (41). Cronbach's coefficient alpha $\geq$0.7 represents a good correlation and alpha <0.5 represents an unacceptable correlation (42, 43).

Feature description

Categorical variables were expressed as frequencies and percentages, and continuous variables were described as medians and quartiles (non-normal distributions). Chi-square test, corrected Chi-square test and Fisher exact test were used to assess the differences in categorical variables between HIV-positive MSM and HIV-negative MSM. Differences in continuous variables between HIV-positive MSM and HIV-negative MSM were evaluated using Mann–Whitney U test. All tests were two-sided and $P \leq 0.05$ was set as the level of significant difference.

Variable selection methods

Boruta

Boruta is based on the same idea which forms the foundation of the random forest classifier, namely, that by adding randomness to the system and collecting results from the ensemble of randomized samples one can reduce the misleading impact of random fluctuations and correlations. The Boruta algorithm consists of following steps (44):

1. Extend the Information System by Adding Copies of all the 31 Variables.
2. The Added Attributes Are Processed to Remove Their Association With the Response.
3. Run a Random Forest Classifier on the Extended Information System and Gather the Z Scores Computed.
4. Find the Maximum Z Score Among Shadow Attributes (MZSA), and Then Assign a hit to Each Attribute That Scored Better Than MZSA.
5. For Each Attribute With Undetermined Importance Perform a two-Sided Test of Equality With the MZSA.
6. Deem the Attributes Which Have Importance Significantly Lower Than MZSA as 'Unimportant' and Permanently Remove Them From the Information System.
7. Deem the Attributes Which Have Importance Significantly Higher Than MZSA as 'Important'.
8. Remove all Shadow Attributes.
9. Repeat the Procedure Until the Importance Is Assigned for all the Attributes, or the Algorithm Has Reached the Previously set Limit of the Random Forest Runs.

Stepwise selection

Stepwise selection is a variation of forward selection. At each step of the variable selection process, after a variable has been added to the model, variables are allowed to be removed from the model (45). For example, if the significance of a given predictor is higher than a specific threshold, it is removed from the model. The iterative process is ended when the pre-defined stopping rule is satisfied.

Univariate selection

The steps for univariate selection were: variables with $P \leq 0.1$ in the comparison of differences between HIV-positive and HIV-negative groups were included in the univariate logistic regression, and the variables with $P \leq 0.05$ in the univariate logistic regression would be used to develop the prediction model.

Hosmer-Lemeshow test

Assessing the goodness of fit of a model is an important and essential part of any modeling exercise. The Hosmer-Lemeshow (H-L) test for the goodness of fit of logistic regression is very popular because it is easy to implement, simple to interpret, and widely adopted by popular statistical packages (46). It is widely used for the evaluation of risk-scoring models in medicine (47, 48). The null hypothesis of H-L test is that there is no significant difference between the predicted and observed values, which implies a perfect fit of the model (49).

Determination of the optimal model

Three prediction models were developed by using multivariate logistic regression and we compared the models by determining the net reclassification improvement (NRI) and integrated discrimination improvement (IDI) to select the optimal model.

Development and validation of nomogram

The nomogram is a visualization of the prediction model. In this study, a nomogram will be developed based on the best prediction model to assess the risk of HIV infection among IMMSM. The receiver operating characteristic (ROC) curve, calibration plot and dynamic component analysis (DCA) were respectively performed to assess the efficacy, accuracy and clinical

utility of the prediction nomogram. Discrimination was calculated using the C-index, ranging from 0.5 to 1.0 (1.0 means perfect discrimination) (50), and internal validation was performed using bootstrap method. Bootstrap samples are random samples drawn with replacement from the original sample, and 1,000 bootstrap samples were fitted in this study to calculate a relatively corrected C-index.

Results

Statistical description

Cronbach's alpha of mental health scales: RSES was 0.842, ULS was 0.824, PHQ-9 was 0.905, ES was 0.969, DS was 0.938, INQ-15 was 0.854, SAS was 0.787, SSS was 0.949, SCS was 0.934. The results showed good reliability for all mental health scales.

703 IMMSM were included in this study. The median age of the IMMSMs was 31.00 (26.00, 35.00) years old, 576 (81.9) IMMSMs were unmarried, 442 (62.9%) IMMSMs had received a college education, 88 (12.52%) IMMSMs were tested HIV-positive, 56 (8.0%) IMMSMs were tested syphilis-positive, 134 (19.1%) IMMSMs had experienced verbal violence due to their sexual orientations, 350 (49.8%) IMMSMs had irregular homosexual anal sex partners, 368 (52.3%) IMMSMs had substance use experience. Specific demographic and scale scores are shown in Table 1.

Variable Description: No. 1, Age, Age of the participant at the time of the survey; No. 2, CUAS, the Condom Use Attitude Scale, with higher scores indicating more positive attitudes; No. 3, CUSS, the Condom Use Skills Scale, assessed subjects' negotiation skills with condom use and refusal of unprotected sex, the higher the scores, the better the condom use skills; No. 4, CUSNSS, the Condom Use Subjective Normative Scale, assessed others' (family, friends, peers at the same job, significant others) perceptions of participants' adherence to condom use during anal sex, with higher scores indicating more positive attitudes; No. 5, CUSES, the Condom Use Self-Efficacy Scale, assessed their ability to participate effectively in condom use, and the higher the scores, the higher the condom use self-efficacy; No. 6, RSES, the Rosenberg Self-Esteem Scale, assessed their level of self-esteem, and the higher the scores, the higher the level of self-esteem; No. 7, ULS, the UCLA (University of California at Los Angels) Loneliness Scale, assessed their level of loneliness, the higher the scores, the stronger the loneliness; No. 8, PHQ-9, the Patient Health Questionnaire, assessed their level of depression, and the higher the scores, the higher the level of depression; No. 9, ES, the Entrapment Scale, assessed their level of entrapment, and the higher the scores, the higher the level of entrapment; No. 10, DS, the Defeat Scale, assessed their level of defeat, and the higher the scores, the higher the level of defeat; No. 11, INQ-15, the Interpersonal Needs Questionnaire, assessed their level of interpersonal needs, the higher the scores, the more unmet interpersonal needs; No. 12, SAS, the Suicidal Ability Scale, assessed their level of suicidal ability, and the higher the scores, the higher the level of suicidal ability; No. 13, SSS, the Social Support Scale, assessed their level of social support, the higher the scores, the higher the support; No. 14, SCS, the Sexual Compulsivity Scale, assessed their level of sexual compulsivity, the higher the scores, the stronger the compulsivity; No. 15, experienced of receiving HIV education, Yes or No; No. 16, had HIV Voluntary Counseling and Test, Yes or No; No. 17, experienced of verbal violence such as harassment, insults, threats, Yes or No; No. 18, experienced of physical violence such as pushing, Yes or No; No. 19, had regular homosexual anal sex partners, Yes or No; No. 20, had irregular homosexual anal sex partners, Yes or No; No. 21, supplied sexual services for male sexual partners, Yes or No; No. 22, used substances, Yes or No; No. 23, had taken pre-exposure prophylaxis in the past, Yes or No; No. 24, had infected with syphilis, Yes or No; No. 25, education level; No. 26, marriage status; No. 27, Monthly income; No. 28, residence time; No. 29, sexual orientation; No. 30, frequency of smoking, never means not even once, sometimes means 3 to 5 times a month, always means more than 3 times a week, and Everyday means at least once a day; No. 31, frequencies of drinking behavior before sex.

Screening of predictive factors by three methods

Three HIV infection prediction models were developed based on three different variable screening methods. The Boruta algorithm screened 11 factors (Education, score of CUAS, score of CUSS, score of RSES, score of ULS, score of PHQ-9, score of ES, score of DS, score of INQ-15, score of SAS and score of SCS) and developed model A (Supplementary Table 1). Stepwise selection method (both forward and backward) was used to screen 11 factors (Age, Education, Marriage, Monthly income, Verbal Violence, Syphilis, score of CUSS, score of RSES, score of ULS, score of ES and score of DS) and built model B (Supplementary Table 2). There were 9 variables with P-values ≤ 0.1 in the exploration of differences between HIV-positive IMMSM and HIV-negative IMMSM (Table 1). Subsequently, univariate logistic regression was created for each of these variables with HIV infection status, and the results showed that 7 variables (score of CUAS, score of CUSS, score of ULS, Education, Monthly income, Syphilis and Substance use) had P-values ≤ 0.05 (Supplementary Table 3). So, the univariate selection screened 7 factors and built model C. The coefficients and P-values of the variables for each model were shown in Table 2. The results of

TABLE 1 Characteristics of the IMMSMs.

No.	Characteristics	Total ($n = 703$)	HIV-negative ($n = 615$)	HIV-positive ($n = 88$)	p-value
1	Age	31.00 (26.00, 35.00)	31.00 (26.00, 35.00)	32.00 (28.00, 36.00)	0.143
2	Score of CUAS	24.00 (22.00, 28.00)	25.00 (22.00, 28.00)	24.00 (20.00, 26.25)	0.003
3	Score of CUSS	24.00 (20.00, 29.00)	25.00 (21.00, 29.00)	23.00 (17.00, 27.00)	0.001
4	Score of CUSNSS	16.00 (14.00, 20.00)	16.00 (14.00, 20.00)	16.00 (13.00, 19.00)	0.080
5	Score of CUSES	26.00 (22.00, 29.00)	26.00 (22.00, 29.00)	24.00 (20.00, 28.00)	0.048
6	Score of RSES	19.00 (16.00, 22.00)	19.00 (16.00, 22.00)	18.00 (15.00, 22.25)	0.224
7	Score of ULS	17.00 (13.00, 21.00)	17.00 (13.00, 21.00)	16.00 (12.00, 20.00)	0.075
8	Score of PHQ-9	7.00 (3.00, 9.50)	7.00 (3.00, 9.50)	6.00 (2.00, 9.25)	0.146
9	Score of ES	11.00 (1.00, 24.00)	10.00 (2.00, 24.00)	12.00 (0.00, 25.25)	0.478
10	Score of DS	18.00 (11.00, 28.00)	18.00 (11.00, 28.00)	15.50 (12.00, 25.25)	0.278
11	Score of INQ-15	42.00 (30.00, 52.00)	42.00 (30.00, 52.00)	42.50 (28.00, 51.00)	0.770
12	Score of SAS	20.00 (12.00, 28.00)	21.00 (12.00, 28.00)	20.00 (6.50, 26.25)	0.101
13	Score of SSS	61.00 (48.00, 72.00)	60.00 (48.00, 72.00)	61.00 (49.00, 72.00)	0.744
14	Score of SCS	22.00 (18.00, 26.00)	22.00 (18.00, 26.00)	20.00 (15.75, 25.00)	0.101
15	HIV education				0.783
	NO	306 (43.5)	266 (43.3)	40 (45.5)	
	YES	397(56.5)	346(56.7)	48(54.5)	
16	VCT				0.632
	YES	553(78.7)	486(79.0)	67(76.1)	
	NO	150 (21.3)	129 (21.0)	21 (23.9)	
17	Verbal violence				0.170
	YES	134(19.1)	112(18.2)	22(25.0)	
	NO	569 (80.9)	503 (81.8)	66 (75.0)	
18	Physical violence				0.506
	YES	41(5.8)	34(5.5)	7(0.8)	
	NO	662 (94.2)	581 (94.5)	81 (92.0)	
19	Regular homosexual anal sex partners				0.538
	YES	305(43.4)	270(43.9)	35(39.8)	
	NO	398 (56.6)	345 (56.1)	53 (60.2)	
20	Irregular homosexual anal sex partners				0.598
	YES	350 (49.8)	309 (50.2)	41 (46.6)	
	NO	353(50.2)	306(49.8)	47(53.4)	
21	Homosexual sex trade				0.787
	YES	32 (4.6)	27 (4.4)	5 (5.7)	
	NO	671 (95.4)	588 (95.6)	83 (94.3)	
22	Substance use				0.051
	YES	368 (52.3)	331 (53.8)	37 (42.0)	
	NO	335 (47.7)	284 (46.2)	46 (58)	
23	PrEP				0.996
	YES	30 (4.3)	26 (4.2)	4 (4.5)	
	NO	673 (95.7)	589 (95.8)	84 (95.5)	
24	Syphilis				0.021
	YES	56 (8.0)	43 (7.0)	13 (14.8)	
	NO	647 (92.0)	572 (93.0)	75 (85.2)	

(Continued)

TABLE 1 (Continued)

No.	Characteristics	Total ($n = 703$)	HIV-negative ($n = 615$)	HIV-positive ($n = 88$)	p-value
25	Education				<0.001
	Primary school and below	11 (1.5)	7 (1.1)	4 (4.5)	
	Junior high school	109 (15.5)	84 (13.7)	25 (28.5)	
	High school	141 (20.1)	118 (19.2)	23 (26.1)	
	College and above	442 (62.9)	406 (66.0)	36 (40.9)	
26	Marriage				0.626
	Unmarried	576 (81.9)	501 (81.5)	75 (85.3)	
	Married	95 (13.5)	86 (14.0)	9 (10.2)	
	divorced	32 (4.6)	28 (4.5)	4 (4.5)	
27	Monthly income ($)				<0.001
	≤446.40	182 (25.9)	167 (27.1)	15 (17.0)	
	446.55–892.80	240 (34.1)	193 (31.4)	47 (53.4)	
	892.95–1785.60	196 (27.9)	175 (28.5)	21 (23.9)	
	≥1785.75	85 (12.1)	80 (13.0)	5 (5.7)	
28	Time for residence				0.497
	1 year and below	177 (25.2)	158 (25.7)	19 (21.6)	
	1–5 years	296 (42.1)	254 (41.3)	42 (47.7)	
	5 years and above	230 (32.7)	203 (33.0)	27 (30.7)	
29	Sexual orientation				0.361
	Heterosexuality	12 (1.7)	11 (1.8)	1 (1.1)	
	Homosexuality	467 (66.4)	408 (66.3)	59 (67.0)	
	Bisexual	198 (28.2)	176 (28.6)	22 (25.0)	
	Unclear	26 (3.7)	20 (3.3)	6 (6.9)	
30	Smoking				0.170
	Never	471 (67.0)	421 (68.5)	50 (56.8)	
	Sometimes	101 (14.4)	85 (13.8)	16 (18.2)	
	Always	48 (6.8)	39 (6.3)	9 (10.2)	
	Everyday	83 (11.8)	70 (11.4)	13 (14.8)	
31	Drinking before sex				0.489
	Never	480 (68.3)	424 (68.9)	56 (63.6)	
	Sometimes	206 (29.3)	178 (28.9)	28 (31.9)	
	Always	13 (1.8)	10 (1.6)	3 (3.4)	
	Every time	4 (0.6)	3 (0.6)	1 (1.1)	

Values are presented as median (IQR) or number (%).

Hosmer-Lemeshow test showed that the corresponding *P*-values of the 3 models were 0.7124, 0.1066, and 0.153, respectively. The *P*-values of the three models were greater than 0.05, indicating that these models had good fits and were valid.

Hosmer-Lemeshow test for model fit

Model A, model B and model C were performed H-L test respectively, and the *P*-values of the results were 0.683, 0.663, and 0.579 respectively. All results were insignificant, which indicated that all three models were fitted well.

Comparison of models and determination of the best prediction model

Table 3 shows the NRI and IDI between these three models. Taking model A as the reference, we compared model A with model B. The values of NRI and IDI were greater than zero and

10.3389/fpubh.2022.1015699

TABLE 2 Models established by 3 variable selection methods.

Variables	Estimate	z-value	P-value	OR (95% CI)
Model A				
Score of CUAS	−0.053	−1.533	0.125	0.949(0.887–1.015)
Score of CUSS	−0.043	−1.988	0.047	0.958(0.919–1.000)
Score of RSES	−0.042	−1.167	0.243	0.959(0.893–1.028)
Score of ULS	−0.045	−1.300	0.194	0.956(0.894–1.022)
Score of PHQ-9	−0.026	−0.736	0.461	0.974(0.908–1.043)
Score of ES	0.037	2.155	0.031	1.038(1.003–1.074)
Score of DS	−0.029	−1.217	0.224	0.972(0.927–1.017)
Score of INQ-15	−0.012	−0.932	0.351	0.988(0.962–1.013)
Score of SSS	−0.001	−0.115	0.908	0.999(0.979–1.019)
Score of SCS	−0.024	−1.101	0.271	0.977(0.936–1.019)
Education				
Primary school and below	-	-	-	1
Junior high school	−0.355	−0.506	0.613	0.701(0.183–3.037)
High school	−0.663	−0.937	0.349	0.515(0.133–2.261)
College and above	−1.417	−2.036	0.042	0.243(0.064–1.044)
Model B				
Age	0.030	1.630	0.103	1.031(0.993–1.069)
Verbal Violence	−0.429	−1.453	0.146	0.651(0.370–1.180)
Syphilis	0.746	2.019	0.043	2.108(0.991–4.254)
score of CUSS	−0.054	−2.620	0.009	0.947(0.910–0.987)
score of RSES	−0.054	−1.504	0.132	0.947(0.882–1.016)
score of ULS	−0.061	−1.908	0.056	0.941(0.883–1.001)
score of ES	0.031	1.843	0.065	1.032(0.998–1.066)
score of DS	−0.048	−2.037	0.042	0.953(0.909–0.998)
Education				
Primary school and below	-	-	-	1
Junior high school	−0.622	−0.840	0.401	0.537(0.129–2.501)
High school	−0.897	−1.207	0.227	0.408(0.098–1.904)
College and above	−1.443	−1.995	0.046	0.236(0.059–1.066)
Marriage				
Unmarried	-	-	-	1
Married	−1.034	−2.309	0.021	0.355(0.14–0.821)
divorced	−0.667	−1.064	0.287	0.513(0.131–1.615)
Monthly income				
≤446.40	-	-	-	1
446.55-892.80	0.849	2.527	0.012	2.338(1.233–4.64)
892.95-1785.60	0.366	0.962	0.336	1.442(0.688–3.087)
≥1785.75$	−0.646	−1.081	0.280	0.524(0.146–1.584)
Model C				
Score of CUAS	−0.035	−1.044	0.296	0.965(0.904–1.032)
Score of CUSS	−0.061	−2.181	0.029	0.941(0.89–0.994)
Score of CUSES	0.022	0.73	0.465	1.023(0.964–1.088)
Syphilis	0.699	1.944	0.052	2.011(0.963–3.977)
Substance use	−0.328	−1.29	0.197	0.721(0.436–1.184)
Education				
Primary school and below				1
Junior high school	−0.9	−1.26	0.208	0.407(0.103–1.795)

(Continued)

TABLE 2 (Continued)

Variables	Estimate	z-value	P-value	OR (95% CI)
High school	−1.148	−1.609	0.108	0.317(0.08–1.399)
College and above	−1.589	−2.312	0.021	0.204(0.055–0.862)
Monthly income ($)				
≤446.40				1
446.55-892.80	0.938	2.805	0.005	2.555(1.354–5.062)
892.95-1785.60	0.482	1.28	0.201	1.62(0.780–3.448)
≥1785.75$	−0.161	−0.28	0.779	0.851(0.250–2.478)

TABLE 3 Comparison of the prediction ability among different models through NRI and IDI.

Variable	Model A–B	Model A–C	Model B–C
NRI	0.466	0.197	−0.362
2.5%CI	0.252	−0.026	−0.579
97.5%CI	0.680	0.419	−0.145
P-value	<0.001	0.083	0.001
IDI	0.036	0.005	−0.031
2.5%CI	0.016	−0.015	−0.050
97.5%CI	0.056	0.026	−0.011
P-value	<0.001	0.611	0.002

both were significant ($P < 0.05$), which indicates that model B was superior to model A. The values of NRI and IDI for model C compared to model A were not statistically significant, which indicates model C did not exhibit superiority for predicting HIV infection among IMMSM. Taking model B as the reference, model C compared with model B, the values of NRI and IDI were less than zero and both were significant ($P < 0.05$), which indicates that model B was superior to model C. There was a significant improvement in model B compared to model A and model C. Therefore, model B was the optimal prediction model to predict the risk of HIV infection among IMMSM in this study.

Development and validation of the nomograms

A nomogram with 11 variables (Age, Education, Marriage, Monthly income, Verbal Violence, Syphilis, score of CUSS, score of RSES, score of ULS, score of ES and score of DS) was constructed based on the model B (Figure 1), and a dynamic nomogram can be accessed and used via a URL: https://liubi.shinyapps.io/DynNomapp/. The AUC of the nomogram was 0.757(95% CI: 0.701–0.812), and the ROC showed in Figure 2. Calibration curves of the nomogram demonstrated good consistency between the predicted and observed results (Figure 3). The result of DCA revealed that using the nomograms to predict HIV infection among IMMSM added more net benefit than the treat-all or treat-none strategies (Figure 4), suggesting good clinical utility of the nomograms. The C-index for the prediction nomogram was 0.757 (95% CI: 0.701–0.812), which was confirmed to be 0.705 via bootstrapping validation.

Discussion

In this study, 30 variables were collected among IMMSM through questionnaire on four aspects—sociodemographic characteristics, homosexual behavior, substance use, and mental health. Another 2 variables-HIV and syphilis infection were detected using rapid test kits. Taking HIV infection status as the dependent variable, three methods (Boruta, stepwise selection and univariable selection) were used to screen predictors and three prediction models (model A, model B and model C) were developed by multivariate logistic regression respectively. By comparing NRI and IDI between these three models, model B was considered the optimal model. The nomogram passed the validation of ROC, calibration curve and DCA, indicating its good efficacy, accuracy and clinical utility in predicting HIV infection among IMMSM. The C-index of internal verification was 0.705, which indicated that the model had medium prediction accuracy. To summarize the above validation results, the nomogram of the model has moderate predictive power.

Sociodemographic characteristics in the prediction nomogram

Four sociodemographic characteristics (age, education level, monthly income and marital status) were incorporated in our prediction nomogram. Age was found to be a risk factor for HIV infection among IMMSM, as participants with higher age were more likely to report HIV infection. Several studies have reported similar results (2, 51, 52). One reason might be that older IMMSM have been exposed to

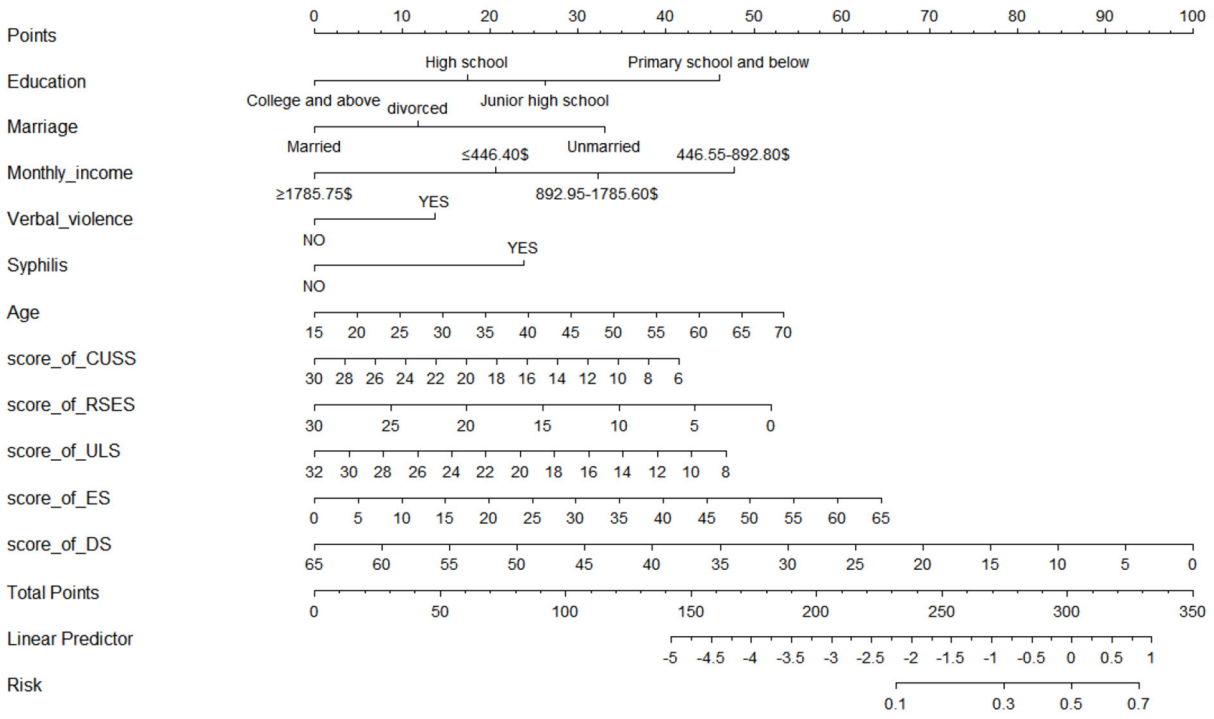

FIGURE 1
The nomogram for predicting HIV infection among internal migrant MSM.

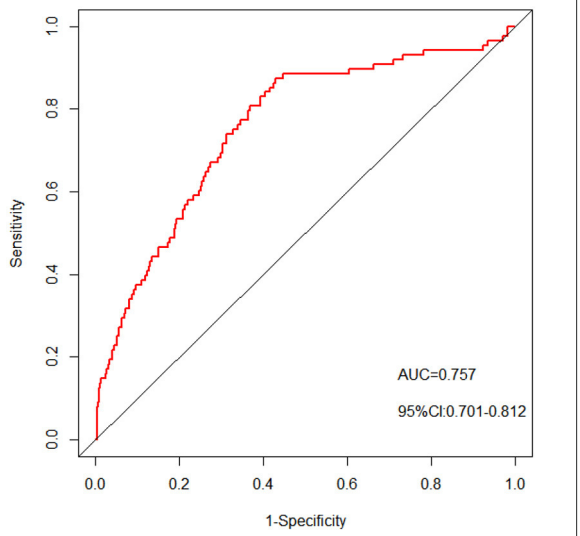

FIGURE 2
The pooled AUC of the ROC curve. The y-axis means the true positive rate of the risk prediction. The x-axis means the false positive rate of the risk prediction. The red line represents the performance of the nomogram.

HIV for a longer time. It has been argued that as IMMSM get older, they might have a greater chance of becoming infected over time, so prevalence within older age will be higher than that in the younger groups (52). Additionally, unprotected anal intercourse is more common in older MSM than in younger MSM (53). Another possible reason was that the older MSM may not be as prudent as the younger counterparts when engaging in sexual behavior due to their rich sexual experience.

In the prediction nomogram, lower levels of education contributed higher risk values for HIV infection among IMMSM. In the one hand, the less educated IMMSM usually have less chance to obtain health information and support (2), which may lead to their poorer abilities on protecting themselves from HIV infection. In the other hand, ADDIN EN.CITE (54, 55) some studies found that condom use frequencies as well as the number of consistent sexual partner were significantly higher among MSM with higher levels of education (e.g., college students or teachers) than among others (56–58), which suggested that low HIV infection risk in more educated IMMSM may benefits from their low participation in risky sexual behaviors.

In this study, the monthly income range with the highest contribution risk value was 446.55–892.80$, then 892.95–1785.60$, followed by ≤446.40$, and the lowest was ≥1,785.75$. Socioeconomic status (SES) is an important determinant of health. It seems complicated to explain the contribution of monthly income to the risk value of HIV

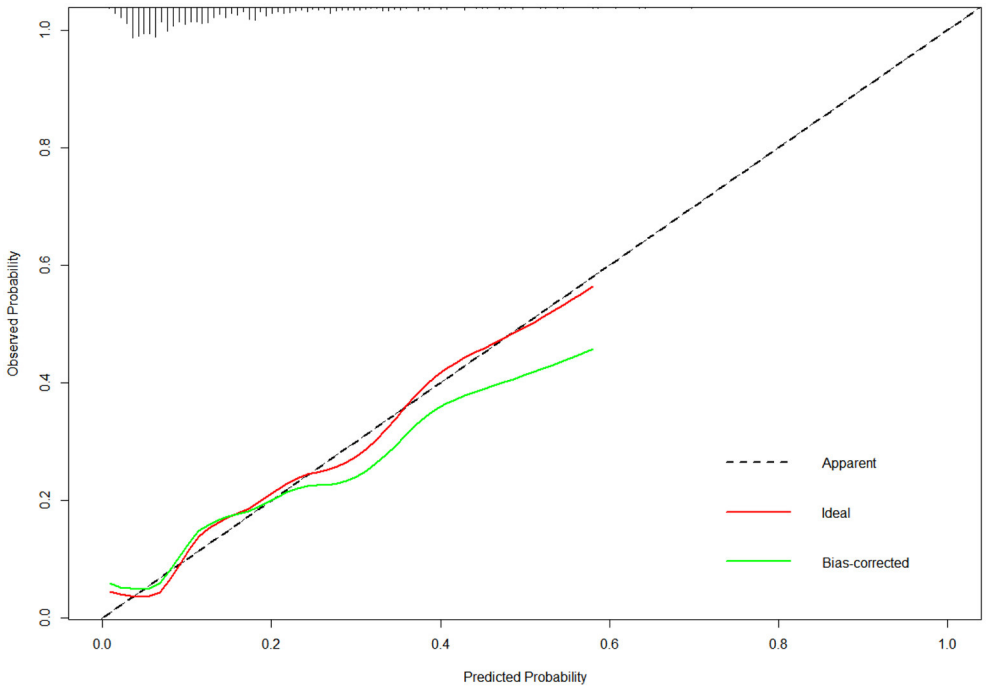

FIGURE 3
The calibration curves of the nomogram. The x-axis represents the predicted risk of HIV infection. The y-axis represents the actual diagnosed HIV incidence. The diagonal dotted line represents a perfect prediction by an ideal model. The green line represents the performance of the nomogram, of which a closer fit to the diagonal dotted line represents a better prediction.

infection among IMMSM. In terms of MSM with higher economic status, they were more willing to participate in HIV testing and counseling services, possibly because they were more capable of affording the cost of these services (20, 58, 59). What's more, individual with higher incomes tend to have better educational background and have better access to health information. As for MSM with low incomes (60, 61), it was reported by two studies conducted in China that they were more likely to take pre-exposure prophylaxis, which is an efficient way to prevent HIV infection. Additionally, MSM with lower incomes were less likely to report UAI (62). ADDIN EN.CITE (63) ADDIN EN.CITE (64, 65) our findings suggest that the mechanism how individual's economic status play a role on their HIV infection risk among IMMSM is warranted in the future studies.

In China, some MSM would marry women due to widespread social rejection and pressure from their parents (66). Being married to a woman does not completely preclude them from having sex with men (37, 67), but they might reduce the frequency of homosexual sex to avoid disclosure of sexual orientation. In addition, the responsibilities of maintaining a family consumed so much time and energy that they were unable to engage in homosexual behavior as they once did. The vast majority of IMMSM in this study were unmarried, which is consistent with most studies (68–70). Unmarried IMMSM might be more assertive about their sexual orientation and take advantage of their migrant status to escape the discrimination and pressure from society and family. They also changed their homosexual partners and engaged in risky sexual behaviors more frequently (71, 72).

Psychometric measurements in the prediction nomogram

The lower score of RSES contributed to the higher risk value. Self-esteem serves as a protective buffer against negative emotions that arise from disruptive or threatening experiences. For MSM, self-esteem acted as a sexual risk buffer for MSM (73). But the widespread stigmatization and marginalization of MSM could continue destroying their self-esteem. On the one hand, MSM with low self-esteem tended to engage in less self-care behaviors and was more likely to be involved in high-risk sexual behaviors (74, 75). On the other hand, the desire for self-esteem drove them to seek validation and stronger social relationships among homosexual partners, which might lead to more sexual partners and more frequent high-risk sexual behavior (76, 77).

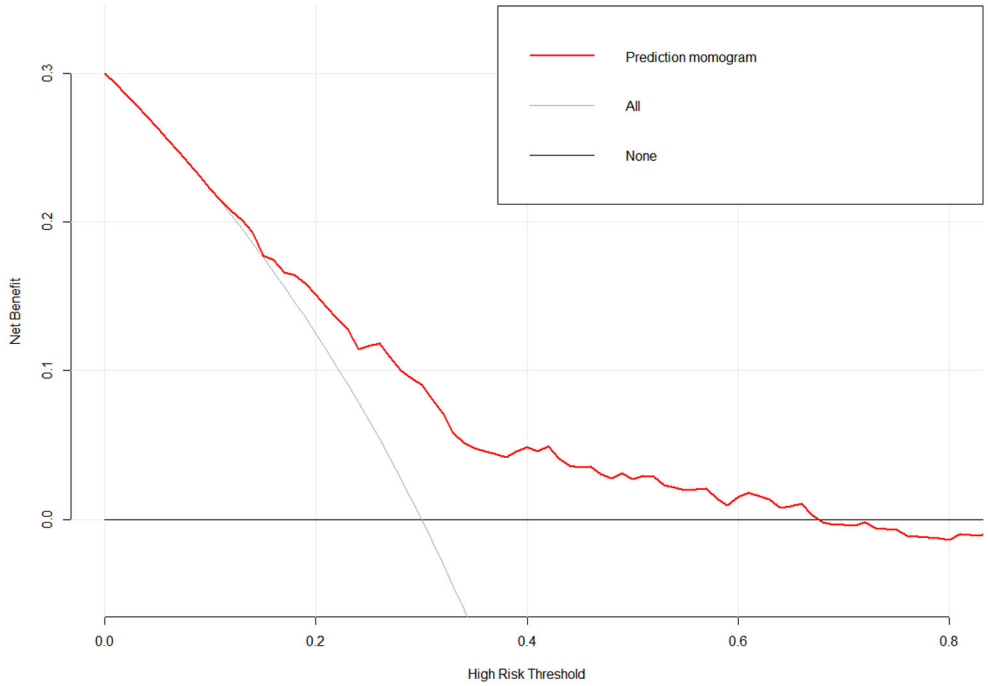

FIGURE 4
Decision curves of the nomogram. The y-axis measures the net benefit. The red line represents the HIV incidence risk nomogram. The light black solid line represents the assumption that all patients are diagnosed as DN. Deep black solid line represents the assumption that no patients are diagnosed as HIV.

In the prediction nomogram, lower ULS scores contributed to higher risk values for HIV infection. Higher scores of ULS indicated stronger feelings of loneliness. Loneliness has been defined as the distress that exists between actual and desired relationships (78, 79). For internal migrant MSM, what they expect was to build a good social relationship with other MSM (80). Higher scores of ULS indicated higher levels of loneliness and a greater likelihood of being in poor social relationships, which may lead to fewer homosexual partners and less risky sexual behaviors, thus reducing the risk of HIV infection.

Gilbert and Allen defined entrapment as a personal feeling that an individual was in an unfavorable state or situation and had a strong motivation to escape or get rid of the stressor, but was not capable to escape (81). Compulsive sexual behavior, sexual abuse, promiscuity and commercial sexuality are common among MSM and can increase the risk of HIV infection (82–85). Internal migrant MSM with higher ES scores might be trapped by these behaviors and unable to escape. ADDIN EN.CITE (86–89).

Defeat can arise from a loss or reduction in one's perceived ability to compete for social status (81, 90). For internal migrant MSM, defeat might stem from being rejected due to sexual orientation, feeling inferior to others, or feeling incompetent in various roles. Defeat involved a loss of emotional autonomy and a sense of being broken, expressed through statements such as "I feel like a loser" (91). To cope with the defeat, they might reduce their exploration and involvement in homosexual relationships, and thus indirectly reduce the risk of HIV infection (86, 92).

Behavior, experiences and STDs in the prediction nomogram

MSM were often subjected to verbal violence because their sexual orientation was not accepted by mainstream society (93–95). Prolonged exposure to verbal violence might have a negative impact on their behavior and mental health. Experiences of verbal violence were reported to be associated with high-risk sexual behaviors and substance use which were also risk factors for HIV infection (96–98). In addition, verbal violence might indirectly increase the risk of HIV infection by promoting the occurrence of anxiety and depression (99–101).

It is well known that condoms are one of the most effective HIV prevention methods, and condom use skills can directly affect MSM's consistent use of condoms (102–104). Higher scores of CUSS represent stronger condom use negotiation skills and unprotected sex refusal skills (39, 105). These skills can help MSM protect themselves from HIV infection by promoting them to use condoms consistently when they engage in high-risk sexual behaviors.

Syphilis is another highly prevalent sexually transmitted disease among MSM and it shares common risk factors with HIV (106–108). If an IMMSM was infected with syphilis, it means that he might also has some risk factors for HIV infection. More importantly, syphilis infection can directly increase the risk of HIV infection. Strong epidemiologic studies have provided substantial evidence that syphilis infection, one of the causes of genital ulcer disease, facilitates HIV transmission (109). Syphilitic ulcers disrupt epithelium and mucosa, which provides a portal of entry for HIV virus (110).

Conclusion

Our study screened the risk factors related to HIV infection among IMMSM through three variable-selection methods (Boruta, stepwise selection and univariable selection). The model established by stepwise selection methods incorporating 11 risk factors (age, education, marriage, monthly income, verbal violence, syphilis, score of CUSS, score of RSES, score of ULS, score of ES and score of DS) was the optimal model that achieved the best predictive power by comparing the NRI and IDI between three models. The risk nomogram based on the optimal model had relatively good efficacy, accuracy and clinical utility in identifying IMMSM at high-risk for HIV infection, which is helpful for developing targeted intervention for them.

Limitations

Some limitations of the study should be noted. First, snowball sampling was used to recruit participants, and those who participated in the study might share some similar characteristics. Second, many of the scales and questions were made into questionnaires that were filled out subjectively by the participants, which made the objectivity of the study insufficient. Finally, the entire study was cross-sectional based, and results need to be further confirmed by cohort studies.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of School of Public Health, Shanghai Jiao Tong University School of Medicine. The patients/participants provided their written informed consent to participate in this study.

Author contributions

YC and YiW: designed the study. SL, DY, and LX: designed and completed the questionnaire production. RC and RW: created the research database and entered research data. AL: assisted in data collection. SL, YL, and HC: completed the statistical analysis of the data. SL and DX: wrote the first draft of the article. FH, YC, and YiW: have revised the first draft into the final draft. All authors contributed to the article and approved the submitted version.

Funding

This study was supported by Shanghai Jiao Tong University School of Public Health Local High-level University Achievement-oriented Top-notch Cultivation Programme for Undergraduate Students (Grant No. 18ZYGW20), the National Natural Science Foundation of China (Grant No. 71603166), and the fifth round of Shanghai public health three-year action plan key disciplines construction (Grant No. GWV-10.1-XK18).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1015699/full#supplementary-material

References

1. Chen Y, Tang W, Chen L, Shi L, Liu X, Xu J, et al. Changing epidemic of HIV and syphilis among resident and migrant men who have sex with men in Jiangsu, China. *Sci Rep.* (2017) 7:9478. doi: 10.1038/s41598-017-08671-x

2. Dong M-J, Peng B, Liu Z-F, Ye Q-N, Liu H, Lu X-L, et al. The prevalence of HIV among MSM in China: a large-scale systematic analysis. *BMC Infect Dis.* (2019) 19:1000. doi: 10.1186/s12879-019-4559-1

3. Mi G-D, Zhang B-B, Yu F, Ren X-L, Ong JJ, Fan Y-Q, et al. HIV incidence among men who have sex with men using geosocial networking smartphone application in Beijing, China: an open cohort study. *Infect Dis Poverty.* (2021) 10:27. doi: 10.1186/s40249-021-00814-7

4. Lau JTF Li D, Wang Z, Lai CHY. Repeated HIV voluntary counseling and testing increased risk behaviors among men who have sex with men in China: a prospective cohort study. *AIDS Behav.* (2015) 19:1966–77. doi: 10.1007/s10461-015-1034-x

5. Huang W, Wang Y, Lu H, Wu D, Pan SW, Tucker JD, et al. High HIV incidence among men who have sex with men in 8 Chinese cities: results from a trial. *Open Forum Infect Dis.* (2020) 7:ofaa147. doi: 10.1093/ofid/ofaa147

6. Kuhn R. Internal migration: developing countries. In: Wright JD, editor. *International Encyclopedia of the Social & Behavioral Sciences (Second Edition).* Oxford: Elsevier (2015). p. 433–42. doi: 10.1016/B978-0-08-097086-8.31120-5

7. Hu J, Gu X, Tao X, Qian Y, Babu GR, Wang G, et al. Prevalence and trends of HIV, syphilis, and HCV in migrant and resident men who have sex with men in Shandong, China: results from a serial cross-sectional study. *PLoS ONE.* (2017) 12:e0170443. doi: 10.1371/journal.pone.0170443

8. Qin Q, Tang W, Ge L, Li D, Mahapatra T, Wang L, et al. Changing trend of HIV, syphilis and hepatitis C among men who have sex with men in China. *Sci Rep.* (2016) 6:31081. doi: 10.1038/srep31081

9. Shi T-X, Zhang B-C, Li X-F, Xu J-X, Wang N, Yu Z-Z, et al. Study on the high risk behaviors related to aids among men who having sex with men in the floating population. *Zhonghua Liu Xing Bing Xue Za Zhi.* (2009) 30:668–71. doi: 10.3760/cma.j.issn.0254-6450.2009.07.004

10. Wu J, Wu H, Li P, Lu C. HIV/STIS risks between migrant MSM and local MSM: a cross-sectional comparison study in China. *PeerJ.* (2016) 4:e2169. doi: 10.7717/peerj.2169

11. Ruan S, Yang H, Zhu Y, Ma Y, Li J, Zhao J, et al. Hiv prevalence and correlates of unprotected anal intercourse among men who have sex with men, Jinan, China. *AIDS Behav.* (2008) 12:469–75. doi: 10.1007/s10461-008-9361-9

12. Liu Y, Vermund SH, Ruan Y, Liu H, Zhang C, Yin L, et al. HIV testing and sexual risks among migrant men who have sex with men: findings from a large cross-sectional study in Beijing, China. *AIDS Care.* (2018) 30:86–94. doi: 10.1080/09540121.2017.1381331

13. UNAIDS. *Understanding Fast Track: Accelerating Action to End the Aids Epidemic by 2030*. Available online at: https://www.unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf (accessed July 15, 2022).

14. Jiang H, Hong H, Dong H, Jiang J, He L. HIV testing and risks of sexual behavior among HIV-negative men who have sex with men in Ningbo, China. *Int J Environ Res Public Health.* (2020) 17:1322. doi: 10.3390/ijerph17041322

15. Haukoos JS, Lyons MS, Lindsell CJ, Hopkins E, Bender B, Rothman RE, et al. Derivation and validation of the denver human immunodeficiency virus (HIV) risk score for targeted hiv screening. *Am J Epidemiol.* (2012) 175:838–46. doi: 10.1093/aje/kwr389

16. Wahome E, Fegan G, Okuku HS, Mugo P, Price MA, Mwashigadi G, et al. Evaluation of an empiric risk screening score to identify acute and early HIV-1 infection among MSM in Coastal Kenya. *AIDS.* (2013) 27:2163–6. doi: 10.1097/QAD.0b013e3283629095

17. Hoenigl M, Weibel N, Mehta SR, Anderson CM, Jenks J, Green N, et al. Development and validation of the San Diego early test score to predict acute and early HIV infection risk in men who have sex with men. *Clin Infect Dis.* (2015) 61:468–75. doi: 10.1093/cid/civ335

18. Dong Y, Liu S, Xia D, Xu C, Yu X, Chen H, et al. Prediction model for the risk of HIV infection among MSM in China: validation and stability. *Int J Environ Res Public Health.* (2022) 19:1010. doi: 10.3390/ijerph19021010

19. Balaji AB, Bowles KE, Le BC, Paz-Bailey G, Oster AM. High HIV incidence and prevalence and associated factors among young MSM, 2008. *AIDS.* (2013) 27:269–78. doi: 10.1097/QAD.0b013e32835ad489

20. Torres TS, Coelho LE, Konda KA, Vega-Ramirez EH, Elorreaga OA, Diaz-Sosa D, et al. Low socioeconomic status is associated with self-reported HIV positive status among young MSM in Brazil and Peru. *BMC Infect Dis.* (2021) 21:726. doi: 10.1186/s12879-021-06455-3

21. Vergara-Ortega DN, López-Gatell H, Bautista-Arredondo S, Colchero A, Sosa-Rubí SG, Morales-Vazquez M, et al. Regional disparity of HIV incidence and prevalence among men who have sex with men. *BMC Infect Dis.* (2021) 21:917. doi: 10.1186/s12879-021-06582-x

22. Hu HY, Chen YH, Zhou Y, Zhang Z, Lu J, Liu XY, et al. Recent hiv infection and associated factors among men who have sex with men in Jiangsu Province. *Zhonghua Liu Xing Bing Xue Za Zhi.* (2021) 42:1989–93. doi: 10.3760/cma.j.cn112338-20210601-00441

23. Oldenburg CE, Perez-Brumer AG, Reisner SL, Mimiaga MJ. Transactional sex and the HIV epidemic among men who have sex with men (MSM): results from a systematic review and meta-analysis. *AIDS Behav.* (2015) 19:2177–83. doi: 10.1007/s10461-015-1010-5

24. Mimiaga MJ, O'Cleirigh C, Biello KB, Robertson AM, Safren SA, Coates TJ, et al. The effect of psychosocial syndemic production on 4-year HIV incidence and risk behavior in a large cohort of sexually active men who have sex with men. *J Acquir Immune Defic Syndr.* (2015) 68:329–36. doi: 10.1097/QAI.0000000000000475

25. Xu C, Shi Y, Yu X, Chang R, Wang H, Chen H, et al. The syndemic condition of psychosocial problems related to depression among sexually transmitted infections patients. *PeerJ.* (2021) 9:e12022. doi: 10.7717/peerj.12022

26. Semple SJ, Zians J, Strathdee SA, Patterson TL. Sexual marathons and methamphetamine use among HIV-positive men who have sex with men. *Arch Sex Behav.* (2009) 38:583–90. doi: 10.1007/s10508-007-9292-y

27. Luo M, Zhu L, Dong Y, Wang Z, Shen Q, Mo D, et al. Sexual compulsivity and its relationship with condomless sex among unmarried female migrant workers in Shanghai, China: A Cross-Sectional Study. *BMC Womens Health.* (2018) 18:181. doi: 10.1186/s12905-018-0670-5

28. Liao W, Lau JT, Tsui HY, Gu J, Wang Z. Relationship between sexual compulsivity and sexual risk behaviors among Chinese sexually active males. *Arch Sex Behav.* (2015) 44:791–8. doi: 10.1007/s10508-014-0317-z

29. Ye Z, Chen L, Lin D. The relationship between posttraumatic stress disorder symptoms and posttraumatic growth among HIV-infected men who have sex with men in Beijing, China: The Mediating Roles of Coping Strategies. *Front Psychol.* (2018) 9:1787. doi: 10.3389/fpsyg.2018.01787

30. Wang S, Ni Y, Gong R, Shi Y, Cai Y, Ma J. Psychosocial syndemic of suicidal ideation: a cross-sectional study among sexually transmitted infection patients in Shanghai, China. *BMC Public Health.* (2020) 20:1314. doi: 10.1186/s12889-020-09404-y

31. Wei D, Hou F, Hao C, Gu J, Dev R, Cao W, et al. Prevalence of intimate partner violence and associated factors among men who have sex with men in China. *J Interpers Violence.* (2021) 36:NP11968–NP93. doi: 10.1177/0886260519889935

32. Jiang D, Hou Y, Chen X, Wang R, Fu C, Li B, et al. Interpersonal sensitivity and loneliness among Chinese gay men: a cross-sectional survey. *Int J Environ Res Public Health.* (2019) 16:2039. doi: 10.3390/ijerph16112039

33. Xu C, Yu X, Tsamlag L, Zhang S, Chang R, Wang H, et al. Evaluating the validity and reliability of the Chinese entrapment scale and the relationship to depression among men who have sex with men in Shanghai, China. *BMC Psychiatry.* (2021) 21:328. doi: 10.1186/s12888-021-03333-9

34. Arends RM, Grintjes KJT, van den Heuvel TJ, Foeken-Verwoert EGJ, Schene AH, van der Ven A, et al. Effectiveness of a group intervention to reduce sexual transmission risk behavior among MSM Living with HIV: a non-randomized controlled pilot study. *AIDS Care.* (2022) 34:515–26. doi: 10.1080/09540121.2021.2002252

35. Luo R, Silenzio VMB, Huang Y, Chen X, Luo D. The disparities in mental health between gay and bisexual men following positive HIV diagnosis in China: a one-year follow-up study. *Int J Environ Res Public Health.* (2020) 17:3414. doi: 10.3390/ijerph17103414

36. Aunon FM, Simoni JM, Yang JP, Shiu C, Chen WT, Edmunds SR, et al. Depression and anxiety among HIV-positive men who have sex with men and men who have sex with women in China. *AIDS Care.* (2020) 32:362–9. doi: 10.1080/09540121.2019.1683803

37. Yang Z, Li S, Zhang R, Na J, Li Y, Mu H, et al. Current heterosexual marriage is associated with significantly decreased levels of anxiety symptoms among Chinese men who have sex with men. *BMC Psychiatry.* (2020) 20:151. doi: 10.1186/s12888-020-02563-7

38. Grov C, Rendina HJ. Parsons JT. Comparing three cohorts of msm sampled via sex parties, bars/clubs, and craigslistorg: implications for researchers and providers. *AIDS Educ Prev.* (2014) 26:362–82. doi: 10.1521/aeap.2014.26.4.362

39. Wang Y, Jia M, Yuan D, Liang A, Zhang Z, Jiang X, et al. assessing consistent condom use among migrant men who have sex with men in Shanghai, China: validation of an information-motivation-behavioural skills model. *BMC Infect Dis.* (2019) 19:462. doi: 10.1186/s12879-019-4090-4

40. Vu NTT, Holt M, Phan HTT, La LT, Tran GM, Doan TT, et al. Amphetamine-type-stimulants (ATS) use and homosexuality-related enacted stigma are associated with depression among men who have sex with men (MSM) in two major cities in Vietnam in 2014. *Subst Use Misuse.* (2017) 52:1411–9. doi: 10.1080/10826084.2017.1284233

41. Yang Y, Green SB. Coefficient alpha: a reliability coefficient for the 21st century? *J Psychoeduc Assess.* (2011) 29:377–92. doi: 10.1177/0734282911406668

42. Moret L, Mesbah M, Chwalow J, Lellouch J. Internal validation of a measurement scale: relation between principal component analysis, cronbach's alpha coefficient and intra-class correlation coefficient. *Rev Epidemiol Sante Publique.* (1993) 41:179–86.

43. Shrestha N. Factor analysis as a tool for survey analysis. *Am J Appl Mathem Statistics.* (2021) 9:4–11. doi: 10.12691/ajams-9-1-2

44. Kursa MB, Rudnicki WR. Feature selection with boruta package. *J Stat Softw.* (2010) 36:1–13. doi: 10.18637/jss.v036.i11

45. Austin PC, Tu JV. Automated variable selection methods for logistic regression produced unstable models for predicting acute myocardial infarction mortality. *J Clin Epidemiol.* (2004) 57:1138–46.

46. Paul P, Pennell ML, Lemeshow S. Standardizing the power of the hosmer-lemeshow goodness of fit test in large data sets. *Stat Med.* (2013) 32:67–80. doi: 10.1002/sim.5525

47. Newman TB, Escobar GJ. Frequency of neonatal bilirubin testing and hyperbilirubinemia in a large health maintenance organization. *Ambul Pediatr.* (2001) 1:126. doi: 10.1367/1539-4409

48. Cole TJ, Hey E, Richmond S. The PREM score: a graphical tool for predicting survival in very preterm births. *Archf Dis Childhood Fetal Neonatal Ed.* (2010) 95:F14–9. doi: 10.1136/adc.2009.164533

49. Lai X, Liu L, A. Simple test procedure in standardizing the power of hosmer–lemeshow test in large data sets. *J Stat Comput Simul.* (2018) 88:2463–72. doi: 10.1080/00949655.2018.1467912

50. Fan C, Ding X, Song Y, A. New prediction model for acute kidney injury in patients with sepsis. *Ann Palliat Med.* (2021) 10:1772–8. doi: 10.21037/apm-20-1117

51. Cao Z, Xu J, Zhang H, Song D, She M, Wang J, et al. Risk factors for syphilis among married men who have sex with men in China. *Sex Transm Dis.* (2014) 41:98–102. doi: 10.1097/OLQ.0000000000000074

52. Le TM, Lee PC, Stewart DE, Long TN. Quoc CN. What are the risk factors for HIV in men who have sex with men in Ho Chi Minh City, Vietnam?. *Cross-Sec Study BMC Public Health.* (2016) 16:406. doi: 10.1186/s12889-016-3088-8

53. Li Y-Z, Xu J-J, Qian H-Z, You B-X, Zhang J, Zhang J-M, et al. High prevalence of HIV infection and unprotected anal intercourse among older men who have sex with men in China: a systematic review and meta-analysis. *BMC Infect Dis.* (2014) 14:531. doi: 10.1186/1471-2334-14-531

54. Jiao K, Wei R, Li H, Chow EPF, Piqueiras E, Lewis T, et al. HIV testing frequency and associated factors among five key populations in ten cities of China: a cross-sectional study. *BMC Infect Dis.* (2022) 22:195.

55. Li R, Pan X, Ma Q, Hui W, Xia S. Prevalence of prior hiv testing and associated factors among MSM in Zhejiang Province, China: a cross-sectional study. *BMC Public Health.* (2016) 16:1152. doi: 10.1186/s12889-016-3806-2

56. Yang Z, Huang Z, Dong Z, Zhang S, Han J, Jin M. Prevalence of high-risky behaviors in transmission of HIV among high school and college student MSM in China: a meta-analysis. *BMC Public Health.* (2015) 15:1272. doi: 10.1186/s12889-015-2614-4

57. Ye M, Giri M. Prevalence and correlates of HIV infection among men who have sex with men: a multi-provincial cross-sectional study in the southwest of China. *HIV AIDS (Auckl).* (2018) 10:167–75. doi: 10.2147/HIV.S176826

58. Yang J, Xu H, Li S, Cheng W, Gu Y, Xu P, et al. The characteristics of mixing patterns of sexual dyads and factors correlated with condomless anal intercourse among men who have sex with men in Guangzhou, China. *BMC Public Health.* (2019) 19:722. doi: 10.1186/s12889-019-7082-9

59. Sun Y, Li G, Lu H. Awareness and use of nonoccupational HIV post-exposure prophylaxis and factors associated with awareness among MSM in Beijing, China. *PLoS ONE.* (2021) 16:e0255108. doi: 10.1371/journal.pone.0255108

60. Zhang Y, Peng B, She Y, Liang H, Peng HB, Qian HZ, et al. Attitudes toward HIV pre-exposure prophylaxis among men who have sex with men in western China. *AIDS Patient Care STDS.* (2013) 27:137–41. doi: 10.1089/apc.2012.0412

61. Jackson T, Huang A, Chen H, Gao X, Zhong X, Zhang Y. Cognitive, psychosocial, and sociodemographic predictors of willingness to use HIV pre-exposure prophylaxis among Chinese men who have sex with men. *AIDS Behav.* (2012) 16:1853–61. doi: 10.1007/s10461-012-0188-z

62. Wang X, Wang Z, Jiang X, Li R, Wang Y, Xu G, et al. A cross-sectional study of the relationship between sexual compulsivity and unprotected anal intercourse among men who have sex with men in Shanghai, China. *BMC Infect Dis.* (2018) 18:465. doi: 10.1186/s12879-018-3360-x

63. He L, Pan X, Yang J, Ma Q, Jiang J, Wang W, et al. HIV risk behavior and HIV testing among rural and urban men who have sex with men in Zhejiang Province, China: a respondent-driven sampling study. *PLoS ONE.* (2020) 15:e0231026.

64. Long JE, Montao M, Cabello R, Sanchez H, Lama JR, Duerr A. Brief report: comparing sexual risk behavior in a high-risk group of men who have sex with men and transgender women in Lima, Peru. *JAIDS J Acquired Immune Deficiency Syndr.* (2019) 80:522. doi: 10.1097/QAI.0000000000001966

65. Whittle HJ, Palar K, Napoles T, Hufstedler LL, Ching I, Hecht FM, et al. Experiences with food insecurity and risky sex among low-income people living with HIV/AIDS in a resource-rich setting. *J Int AIDS Soc.* (2015) 18:20293. doi: 10.7448/IAS.18.1.20293

66. Liu Z, Chen Y, Yao T, Zhang T, Song D, Liu Y, et al. Factors related to HIV testing frequency in MSM based on the 2011–2018 survey in Tianjin, China: a hint for risk reduction strategy. *BMC Public Health.* (2021) 21:1900. doi: 10.1186/s12889-021-11948-6

67. Wu W, Yan X, Zhang X, Goldsamt L, Chi Y, Huang D, et al. Potential HIV transmission risk among spouses: marriage intention and expected extramarital male-to-male sex among single men who have sex with men in Hunan, China. *Sex Transm Infect.* (2020) 96:151–6. doi: 10.1136/sextrans-2018-053906

68. Mao H, Ma W, Lu H, Wang L, Zheng H, Zhu Y, et al. High incidence of HIV and syphilis among migrant men who have sex with men in Beijing, China: a prospective cohort study. *BMJ Open.* (2014) 4:e005351. doi: 10.1136/bmjopen-2014-005351

69. Mi G, Ma B, Kleinman N, Li Z, Fuller S, Bulterys M, et al. Hidden and mobile: a web-based study of migration patterns of men who have sex with men in China. *Clin Infect Dis.* (2016) 62:1443–7. doi: 10.1093/cid/ciw167

70. He X, Ren Y, Ma Z, Guo W, Jin C, Xing W. (2021). *Evaluatiing the Effects of HIV Self-testing used Professional Rapid Test Kits among MSM in Some Areas of China*. doi: 10.21203/rs.3.rs-1019127/v1

71. Dai W, Luo Z, Xu R, Zhao G, Tu D, Yang L, et al. Prevalence of HIV and syphilis co-infection and associated factors among non-commercial men who have sex with men attending a sexually transmitted disease clinic in Shenzhen, China. *BMC Infect Dis.* (2017) 17:86. doi: 10.1186/s12879-017-2187-1

72. Wei L, Chen L, Zhang H, Yang Z, Zou H, Yuan T, et al. Use of gay app and the associated HIV/syphilis risk among non-commercial men who have sex with men in shenzhen, china: a serial cross-sectional study. *Sex Transm Infect.* (2019) 95:496–504. doi: 10.1136/sextrans-2018-053902

73. De Santis JP, Colin JM, Provencio Vasquez E, McCain GC. The relationship of depressive symptoms, self-esteem, and sexual behaviors in a predominantly hispanic sample of men who have sex with men. *Am J Men's Health.* (2008) 2:314–21. doi: 10.1177/1557988307312883

74. Pharr JR, Lough NL, Ezeanolue EE. Barriers to HIV testing among young men who have sex with men (MSM): experiences from clark county, Nevada. *Glob J Health Sci.* (2015) 8:9–17. doi: 10.5539/gjhs.v8n7p9

75. Maatouk I, Jaspal R. Increasing PREP uptake in MSM at risk of HIV in lebanon: some social psychological insights. *Acad Lett.* (2021). doi: 10.20935/AL2529

76. Jayawardena M, Pepping CA, Lyons A, Hill AO. Geosocial networking application use in men who have sex with men: the role of adult attachment. *Sex Res Social Policy.* (2021) 19:85–90. doi: 10.1007/s13178-020-00526-x

77. Zervoulis K, Smith DS, Reed R, Dinos S. Use of 'Gay Dating Apps' and its relationship with individual well-being and sense of community in men who have sex with men. *Psychol Sex.* (2019) 11:88–102. doi: 10.1080/19419899.2019.1684354

78. Greene M, Hessol NA, Perissinotto C, Zepf R, Hutton Parrott A, Foreman C, et al. Loneliness in older adults living with HIV. *AIDS Behav.* (2018) 22:1475–84. doi: 10.1007/s10461-017-1985-1

79. West DA, Kellner R, Moore-West M. The effects of loneliness: a review of the literature. *Compr Psychiatry.* (1986) 27:351–63. doi: 10.1016/0010-440X(86)90011-8

80. Giano Z, Hubach RD, Deboy K, Meyers H, Currin JM, Wheeler DL, et al. Comparative analysis of rural and urban MSM depressive

symptomology: the mediating effects of loneliness. *Psychol Sex.* (2019) 10:200–11. doi: 10.1080/19419899.2019.1593885

81. Gilbert P, Allan S. The role of defeat and entrapment (arrested flight) in depression: an exploration of an evolutionary view. *Psychol Med.* (1998) 28:585–98. doi: 10.1017/S0033291798006710

82. Parsons JT, Grov C, Golub SA. Sexual compulsivity, co-occurring psychosocial health problems, and HIV risk among gay and bisexual men: further evidence of a syndemic. *Am J Public Health.* (2012) 102:156–62. doi: 10.2105/AJPH.2011.300284

83. Amaral ML, Abdo CH. Tavares H, Scanavino Mde T. Personality among sexually compulsive men who practice intentional unsafe sex in São Paulo, Brazil. *J Sex Med.* (2015) 12:557–66. doi: 10.1111/jsm.12761

84. Esser S, Krotzek J, Dirks H, Scherbaum N, Schadendorf D. Sexual risk behavior, sexually transmitted infections, and HIV transmission risks in HIV-positive men who have sex with men (MSM)—approaches for medical prevention. *J Dtsch Dermatol Ges.* (2017) 15:421–8. doi: 10.1111/ddg.13217

85. Coleman CL. Physical and psychological abuse among seropositive African American MSM 50 aged years and older. *Issues Ment Health Nurs.* (2018) 39:46–52. doi: 10.1080/01612840.2017.1397828

86. Griffiths AW, Wood AM, Maltby J, Taylor PJ, Tai S. The prospective role of defeat and entrapment in depression and anxiety: a 12-month longitudinal study. *Psychiatry Res.* (2014) 216:52–9. doi: 10.1016/j.psychres.2014.01.037

87. Siddaway AP, Taylor PJ, Wood AM, Schulz J, A. Meta-analysis of perceptions of defeat and entrapment in depression, anxiety problems, posttraumatic stress disorder, and suicidality. *J Affect Disord.* (2015) 184:149–59. doi: 10.1016/j.jad.2015.05.046

88. Sun S, Pachankis JE Li X, Operario D. Addressing minority stress and mental health among men who have sex with men (MSM) in China. *Curr HIV/AIDS Rep.* (2020) 17:35–62. doi: 10.1007/s11904-019-00479-w

89. Tao J, Qian HZ, Kipp AM, Ruan Y, Shepherd BE, Amico KR, et al. Effects of depression and anxiety on antiretroviral therapy adherence among newly diagnosed HIV-infected Chinese MSM. *AIDS.* (2017) 31:401–6. doi: 10.1097/QAD.0000000000001287

90. Lincoln SH, Johnson T, Laquidara JR, Wilt J, Obeid R. Increased rates of social defeat and schizotypy in racial minorities. *Person Ind Diff.* (2022) 186:111324. doi: 10.1016/j.paid.2021.111324

91. Nagata S, Seki Y, Shibuya T, Yokoo M, Murata T, Hiramatsu Y, et al. Does cognitive behavioral therapy alter mental defeat and cognitive flexibility in patients with panic disorder? *BMC Res Notes.* (2018) 11:23. doi: 10.1186/s13104-018-3130-2

92. Gilbert P, Allan S, Brough S, Melley S, Miles J. Relationship of anhedonia and anxiety to social rank, defeat and entrapment. *J Affect Disord.* (2002) 71:141–51. doi: 10.1016/S0165-0327(01)00392-5

93. Gyamerah AO, Taylor KD, Atuahene K, Anarfi JK, Fletcher M, Raymond HF, et al. Stigma, discrimination, violence, and HIV testing among men who have sex with men in four major cities in Ghana. *AIDS Care.* (2020) 32:1036–44. doi: 10.1080/09540121.2020.1757020

94. Sun S, Sun X, Wei C, Shi L, Zhang Y, Operario D, et al. Domestic violence victimization among men who have sex with men in china during the COVID-19 lockdown. *J Interpers Violence.* (2022):8862605211072149. doi: 10.1177/08862605211072149

95. Micheni M, Rogers S, Wahome E, Darwinkel M, van der Elst E, Gichuru E, et al. Risk of sexual, physical and verbal assaults on men who have sex with men and female sex workers in coastal Kenya. *AIDS.* (2015) 29 Suppl 3:S231–6. doi: 10.1097/QAD.0000000000000912

96. Brown MJ, Serovich JM, Kimberly JA. Depressive symptoms, substance use and partner violence victimization associated with hiv disclosure among men who have sex with men. *AIDS Behav.* (2016) 20:184–92. Msm N. 2011. *AIDS Behav.* (2017) 21:227–37. doi: 10.1007/s10461-015-1122-y

97. Balaji AB, Bowles KE, Hess KL, Smith JC, Paz-Bailey G, Group NS. Association between enacted stigma and HIV-related risk behavior among MSM, national HIV behavioral surveillance system, 2011. *AIDS Behav.* (2017) 21:227–37. doi: 10.1007/s10461-016-1599-z

98. Murphy EC, Segura ER, Lake JE, Huerta L, Perez-Brumer AG, Mayer KH, et al. Intimate partner violence against transgender women: prevalence and correlates in Lima, Peru (2016–2018). *AIDS Behav.* (2020) 24:1743–51.

99. Ali NS, Azam IS, Ali BS, Tabbusum G, Moin SS. Frequency and associated factors for anxiety and depression in pregnant women: a hospital-based cross-sectional study. *SciWorldJ.* (2012) 2012:653098. doi: 10.1007/s10461-019-02728-w

100. Keiley MK, Keller PS, El-Sheikh M. Effects of physical and verbal aggression, depression, and anxiety on drinking behavior of married partners: a prospective and retrospective longitudinal examination. *Aggress Behav.* (2009) 35:296–312. doi: 10.1100/2012/653098

101. Teicher MH, Samson JA, Sheu YS, Polcari A, Mcgreenery CE. Hurtful words: association of exposure to peer verbal abuse with elevated psychiatric symptom scores and corpus callosum abnormalities. *Am J Psychiatry.* (2010) 167:1464–71. doi: 10.1176/appi.ajp.2010.10010030

102. Morell-Mengual V, Gil-Llario MD, Fernadez-Garcia O, Ballester-Arnal R. Factors associated with condom use in anal intercourse among spanish men who have sex with men: proposal for an explanatory model. *AIDS Behav.* (2021) 25:3836–45. doi: 10.1007/s10461-021-03282-0

103. Nydegger LA, Walsh JL. Strength of implementation intentions to use condoms among men who have sex with men. *AIDS Behav.* (2018) 22:3491–9.

104. Nwaosu U, Raymond-Williams R, Meyrick J. Are psychosocial interventions effective at increasing condom use among black men? *A Syst Rev Int J STD AIDS.* (2021) 32:1088–105.

105. Hu L, Luo Y, Zhong X, Lu R, Wang Y, Sharma M, et al. Condom use and related factors among rural and urban men who have sex with men in western china: based on information-motivation-behavioral skills model. *Am J Mens Health.* (2020) 14:1557988319899799.

106. Wu MY, Gong HZ, Hu KR, Zheng HY, Wan X, Li J. Effect of syphilis infection on hiv acquisition: a systematic review and meta-analysis. *Sex Transm Infect.* (2021) 97:525–33. doi: 10.1177/1557988319899799

107. Branger J, van der Meer JT, van Ketel RJ, Jurriaans S, Prins JM. High incidence of asymptomatic syphilis in hiv-infected msm justifies routine screening. *Sex Transm Dis.* (2009) 36:84–5. doi: 10.1136/sextrans-2020-054706

108. Chen L, Yang J, Ma Q, Pan X. Prevalence of active syphilis infection and risk factors among HIV-positive MSM in Zhejiang, China in 2015: a cross-sectional study. *Int J Environ Res Public Health.* (2019) 16:1507. doi: 10.3390/ijerph16091507

109. Karp G, Schlaeffer F, Jotkowitz A, Riesenberg K. Syphilis and HIV co-infection. *Eur J Intern Med.* (2009) 20:9–13.

110. Lynn WA, Lightman S. Syphilis and HIV: a dangerous combination. *Lancet Infect Dis.* (2004) 4:456–66. doi: 10.1016/S1473-3099(04)01061-8

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 10 November 2022
DOI 10.3389/fpubh.2022.1030828

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 29 August 2022
ACCEPTED 26 October 2022
PUBLISHED 10 November 2022

CITATION
Zhang H, Chen S and Dong D (2022) Association of migration status with quality of life among rural and urban adults with rare diseases: A cross-sectional study from China. *Front. Public Health* 10:1030828. doi: 10.3389/fpubh.2022.1030828

Association of migration status with quality of life among rural and urban adults with rare diseases: A cross-sectional study from China

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Background: A considerable proportion of rare disease patients decide to migrate to access a definitive diagnosis or appropriate care, which could affect their quality of life in a long term.

Objective: To compare quality of life (QoL) between migrants and residents and explore the possible mechanism of how migration influence the QoL among rural and urban adults with rare diseases, respectively.

Methods: A cross-sectional study at national level was conducted in a study sample of 1,150 adult patients in China. Migration was defined as being away from one's original place of residence for at least 12 months. Patients who remained in their place of residence in the past 12 months ("resident") were treated as a comparison group for "migrants". Original area of residence (rural vs. urban) for both residents and migrants was used for comparison. The brief version of the World Health Organization Quality of Life instrument was used to measure QoL. Multiple linear regression analyses were adopted to assess the direct association between migration status and QoL after controlling for the confounders that affect QoL. The indirect associations between migration status and QoL, mediated by potential mediators including number of family members living together, individual income, catastrophic health expenditure, and social support, were estimated using the mediation model.

Results: Among the group of rural participants, migration was directly associated with physical QoL ($\beta = 5.07$, 95% CI 2.01–8.13) and environmental QoL (3.95, 1.37–6.53), indirectly associated with physical QoL (0.58, 0.05–1.28) and social QoL (0.50, 0.01–1.16) *via* individual income, and also indirectly associated with environmental QoL (−0.47, −1.12 to −0.50) *via* tangible support. On the other hand, neither direct nor indirect associations of migration with four domain scores of QoL were significant among the group of urban participants.

Conclusion: Among rural adults with rare diseases, migration was found to have positive direct effect on physical and environmental QoL, positive indirect effect on physical and social QoL through increased individual income, and

negative indirect effect on environmental QoL *via* reduced tangible support. By contrast, neither direct nor indirect associations of migration with QoL were significant among the group of urban participants.

KEYWORDS

migration, rare diseases, quality of life, rural, urban

Background

Rare diseases affect 6–8% of the global population (1, 2). While each rare disease represents unique experience, individuals with rare diseases could have some common issues, one of which is difficulty in accessing an accurate diagnosis. Based on the results of a survey published in 2013, it took 7.6 years in the United States and 5.6 years in the United Kingdom for a patient with a rare disease to receive an accurate diagnosis, with an average of two to three misdiagnoses along the way (3). Misdiagnoses or diagnostic delays can cause the worsening of clinical status of rare disease patients, thus leading to inefficient medical treatments and additional health costs (4, 5).

Another common issue that rare disease patients could experience is barriers to appropriate care. There are a limited number of specialists, who have expertise in a given rare disease nationally or even globally. In addition, lack of awareness and knowledge with rare diseases among health professionals leads to inability to provide appropriate referral recommendations (6–8).

Due to difficulties in accessing a definitive diagnosis or appropriate treatment, patients with rare diseases have been traveling long distances to access proper medical care. Even, a considerable proportion of individuals has to relocate to access medical care related to their rare disease on a permanent or longer-term basis. A survey conducted by the National Organization for Rare Disorders in 2019 revealed that 17% of the 1,108 investigated adults, who were affected by a rare disease or the caregiver or a family member of someone with a rare disease, have already relocated or were considering it in the United States (9). A survey conducted in Europe showed that 16% of the 5,995 involved patients affected by rare diseases had to move house motivated by their disease-related needs (10).

Migration is deemed as an important factor affecting health-related quality of life (HRQoL). Previous studies have revealed that compared with individuals of the host population, migrants generally enjoy better quality of life (QoL) related to the increase of income and better services and resources in the migration destination at early stages of migration, however, this advantage tends to diminish over time (11, 12). Nonetheless, selecting those native to the host communities as a comparison group might not allow us to differentiate the effects of migration on QoL from pre-existing health and socioeconomic disparities between the often poor sending locales and the more developed receiving locales (13, 14). Hence, the more appropriate approach is to compare the QoL of migrants with those who remain in the sending locale for they share similar attributes. In China, QoL of migrants is closely related to the household registration system (*hukou* in Chinese), which is very difficult to transfer from rural to urban areas (13, 15). Compared with rural residents, urban residents usually enjoy better public welfare and social services in terms of education, housing, healthcare, and retirement benefits (12, 13). Due to the differences in access to health and social services between rural and urban residents, it is of interest to look into the impact of migration on QoL among these two populations, separately.

Unlike the referral systems in many other countries, patients in mainland China can directly access healthcare services in any hospital without a referral recommendation. This encourages rare disease patients to migrate to urban areas with high-quality healthcare in China (16, 17). Although this healthcare-seeking process may or may not be covered by patients' medical insurance, the coverage of medical insurance for the care of rare disease patients in China is quite limited (18). Furthermore, a previous study conducted by our research team showed that the coverage of medical insurance had no significant effect on trans-provincial diagnosis in China (17). Therefore, whether having insurance coverage from the government only played a limited role in affecting the willingness of rare disease patients to migrate in China, and thus was not considered in the current study.

Previous studies have shown that the effect of migration on QoL was complicated through multiple immediate and offsetting pathways, with some factors beneficial and others being harmful (13, 14). Nonetheless, few studies have focused on the influence of migration on QoL among rare disease patients at population level to the best of our knowledge. Clear evidence and possible mechanisms are of great significance for the development of customized interventions for rural and urban migrants with rare diseases, separately. Therefore, in this study, we hypothesized that disparities existed between rural and urban populations on the association between migration and QoL. Our primary aim is to compare the HRQoL between migrants and residents among adults with rare diseases, with a

Abbreviations: HRQoL, health-related quality of life; QoL, quality of life; CHE, catastrophic health expenditure; MOS-SSS-CM, Medical Outcomes Study Social Support Survey; WHOQOL-BREF, World Health Organization Quality of Life-Brief Version; IQR, interquartile ranges.

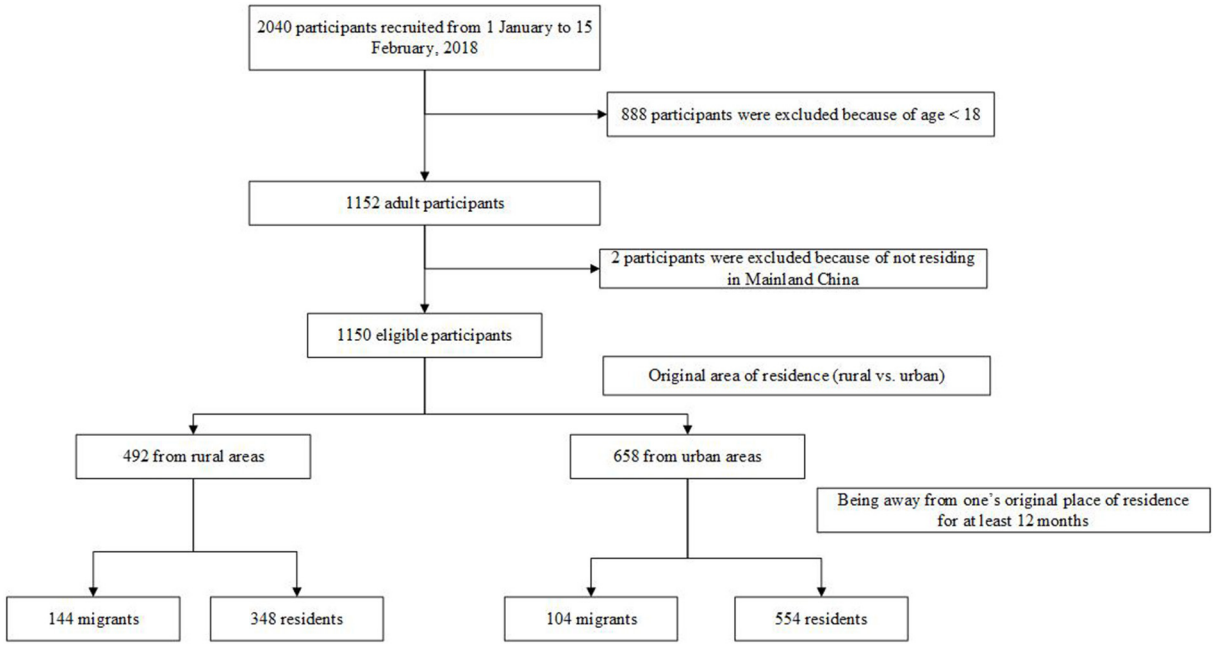

FIGURE 1
Construction of the study sample.

separate attention to rural and urban populations. Our second aim is to explore the possible mechanism of how migration influence the QoL among adults with rare diseases.

Methods

Study sample and data collection

A cross-sectional study at national level was conducted from 1 January through 15 February, 2018. Since the epidemiological information of patients affected by rare diseases in China is absent, a non-probability convenience sampling method was employed to recruit participants in collaboration with Illness Challenge Foundation, a national umbrella organization working together with 29 multiple rare disease patient organizations in China. With the support of the Foundation's network, an online survey was used to reach a population of rare disease patients as widely as possible across the country. Before the survey was officially conducted, we'd invited representatives from patient organizations as well as experts in the areas of medicine and social science to review the structure and contents of the questionnaire. A pilot study was also conducted in a small sample of rare disease patients to examine if they could understand each question. When the online survey was formally distributed among the study sample, participants followed a link to the questionnaire website and must click "consent to participate" button before they could access the complete questionnaire. In total, 2,040 valid responses were collected, from which 1,152 were adults (aged 18 years and older). We excluded two adults for they had not resided in Mainland China. Finally, a sample of 1,150 adult patients, affected by 75 different rare diseases across 31 provinces in Mainland China, was included in the current study. The construction of the study sample was presented in Figure 1.

Measurements

Migration status assessment

The minimum migration time have not been consistently defined in prior studies conducted in China (14, 19). In this study, to examine the effect of migration on health in a relatively longer term, being away from one's original place of residence for at least 12 months was defined as migration. Correspondingly, the remained residents were treated as a comparison group for migrants. To differentiate the effects of migration on health from the pre-existing health disparities between the rural and urban populations, both migrants and their comparisons were defined within their original area of residence (rural vs. urban) (Figure 1).

Demographic and socioeconomic characteristics

We investigated the following sociodemographic and economic characteristics, including age, gender (male vs. female), marital status (married or cohabiting vs. others),

number of family members living together, education (primary school or lower, middle school, high school, 3-year college, and bachelor or above), employment (unemployed, employed, and no working capacity), and annual individual income (per 1,000 RMB).

Considering the potential predictors of QoL among people with rare diseases and their families (18, 20, 21), we also investigated the disease economic burden (yes or no, measured by catastrophic health expenditure [CHE]), dependence on assistive devices (yes or no), and social support. CHE was a commonly used indicator to measure the economic burden. The criterion for defining CHE is not commonly accepted, which varies from 10% of family income (22), 10% of household consumption (23), to 40% of disposable income (24, 25). In this study, we selected the criterion for measuring CHE as out-of-pocket health expenditures in excess of 10% of annual family income (22). The reason why we choose this criterion is because it is less sensitive to individuals' behavior of saving and consuming compared with the other two criteria, and thus more adapted to the Chinese context. In China, as a precaution, people are more inclined to save money by avoiding unnecessary consumptions, while they are relatively generous when they seek medical help for their loved ones (26, 27). Therefore, we used the 10% of family income as the criterion for CHE in the current study. Information on dependence on assistive devices (yes or no) was collected by asking the degree to which the participants needed to rely on assistive devices in their daily lives with five responses including "don't need at all, occasionally need, sometimes need, often need, and completely need". The latter four responses were coded as "yes". Social support was measured by the Chinese Mandarin version of the Medical Outcomes Study Social Support Survey (MOS-SSS-CM) (28). The 19-item MOS-SSS-CM comprises four subscales, i.e., 4-item tangible support, 8-item emotional/ informational and support, 4-item positive social interaction, and 3-item affectionate support. The scores of four subscales are transformed to a standardized 0–100 scale, with higher scores indicating better perceived support (29).

Quality of life

The brief version of the World Health Organization Quality of Life (WHOQOL-BREF) instrument was used to measure QoL in this study. The WHOQOL-BREF is a multi-dimensional instrument to assess individuals' perceptions of their goals, expectations, standards, and concerns in the context of specific culture and value systems (30). The Chinese translation of WHOQOL-BREF has been widely used to measure QoL in multiple populations, including rare disease patients (18, 31). The instrument is constructed by the following four domains, namely, physical (7 items), psychological (6 items), environmental (8 items), and social relationships (3 items). The physical domain is represented by pain, energy, sleep, mobility, daily activities, medical treatment, and work. The psychological domain is constituted by positive/negative feelings, concentration, self-esteem, bodily appearance, and spirituality. The environment domain refers to physical safety and security, living conditions, finance, access to health/social services, leisure, physical environment, and transportation. The domain of social relationships emphasizes patients' personal relationships, sex activities, and support from friends. Each domain score is transformed to a scale of 0–100 according to the guideline published by the WHO, with higher scores denoting higher levels of QoL (30).

Analytical strategies

Descriptive analyses were conducted between migrants and local residents among rural and urban participants, respectively. Continuous variables were reported as medians (interquartile ranges [IQRs]) and tested by Wilcoxon test. Categorical variables were reported as frequencies (percentages) and tested by Fisher's Exact test.

To assess the direct association between migration status and QoL, we adopted multiple linear regression analyses, by the four dimensions of QoL and original area of residence, controlling for age, gender, marital status, family number, education, annual individual income, CHE, dependence on assistive devices, and social support (Equation 1). Where Y_{QoL} is physical QoL, psychological QoL, environmental QoL, or social QoL; *migration* is a binary variable (yes or no) indicating the migration status of an individual; $x_1 + \ldots + x_n$ are the covariates controlled. Since the variable of employment is associated with annual individual income, to avoid multicollinearity, employment was not included in the multiple linear regression models.

$$Y_{QoL} = \alpha + \beta * migration + \gamma_1 * x_1 + \ldots + \gamma_n * x_n + \varepsilon \quad (1)$$

To further control for possible unbalances between migrants and residents, the models fitted by Equation 1 were adjusted by inverse probability weights (IPWs). Inverse probability weighting is an extension of the propensity score method used to handle the unbalance among intervention groups (32). We derived IPWs from propensity scores generated by a logistic regression with migration status as the outcome, controlling for the same covariates included in the Equation 1.

We further estimated the indirect association between migration status and QoL, also by the four dimensions of QoL and original area of residence. To do this, we firstly conducted a series of regressions between migration status and possible mediators (Equation 2). Where $Y_{Mediator}$ is a possible mediator; *migration* is a binary variable (yes or no) indicating

FIGURE 2
Mediation model in estimating the indirect association between migration status and QoL.

the migration status of an individual; $x_1 + \ldots + x_n$ are the covariates controlled.

$$Y_{Mediator} = \alpha + \beta * migration + \gamma_1 * x_1 + \ldots + \gamma_n * x_n + \varepsilon \quad (2)$$

The mediators that we selected in our datasets may have potential implications for future interventions on improving QoL of migrants, including the number of family members living together, individual income, CHE, and social support. For the family number, individual income, and social support, Equation 2 were fitted by linear regressions, controlling for the remaining factors. For CHE, Equation 2 were fitted by logistic regression, controlling for the remaining factors. Secondly, the mediation model (Figure 2) was used to estimate the indirect association based on the results from the regression between migration status and QoL (Equation 1) and regression between migration status and possible mediator (Equation 2). Only mediators that had significant association with both QoL and migration status were further included in the mediation model. Mediation model in Figure 2 was implemented by function "mediate" in package mediation (version 4.5.0) in R [Ref "mediation: R Package for Causal Mediation Analysis"].

All statistical analyses were performed using the R software (version 4.0.4). Statistical significance was defined as $p < 0.05$.

Results

Of the 1,150 participants included, 492 (42.8%) originally lived in rural areas, and 537 (46.7%) were males, with a median age of 34.0 (IQR 28.0–43.0). Nearly 60% of the study sample were married or cohabiting. Only 39.8% of the participants were employed, and 45.2% had to depend on assistive devices. More detailed information on demographics of the participants is shown in Table 1.

Of the 492 rural participants, 144 (20.3%) were designated as migrants, while this number was 104 (15.8%) among the 658 urban respondents in this study. For both groups of rural and urban participants, migrants were significantly younger ($p = 0.023$ vs. 0.002), had a higher level of education ($p < 0.001$ vs. $p = 0.010$), and less likely to depend on assistive devices compared with resident counterparts ($p < 0.001$ vs. $p = 0.024$). On the other hand, rural migrants had a significantly fewer number of family members living together ($p = 0.028$), more likely to be employed ($p < 0.001$), a higher individual income ($p < 0.001$), and more positive social interactions compared with rural residents ($p = 0.011$), whereas no significant differences were found in these aspects between urban migrants and residents ($p > 0.05$). In the group of urban participants, migrants were found to have a significantly higher probability of suffering from CHE ($p = 0.025$), and less likely to receive tangible support compared with resident counterparts ($p = 0.029$).

Table 2 presented four domain scores of QoL among urban and rural participants by migration status. Compared with resident counterparts, rural migrants had a significantly higher score in the domains of physical (57.1 vs. 42.9, $p < 0.001$), psychological (45.8 vs. 37.5, $p = 0.001$), and environmental QoL (43.8 vs. 35.9, $p < 0.001$), whereas no significant difference was found in the domain of social QoL (50.0 vs. 50.0, $p = 0.07$). By contrast, in the group of urban participants, the scores of physical (53.6 vs. 50.0, $p = 0.064$), psychological (45.8 vs. 45.8, $p = 0.356$), environmental (46.9 vs. 43.8, $p = 0.266$), and social QoL (50.0 vs. 50.0, $p = 0.507$) between migrants and residents were not significantly different.

After controlling for confounders, among the group of rural participants, migration was directly associated with physical QoL ($\beta = 5.07$, 95% CI 2.01–8.13) and environmental QoL ($\beta = 3.95$, 95% CI 1.37–6.53), while the direct associations between migration and psychological QoL ($\beta = 3.16$, 95% CI −0.20–6.53) and social QoL ($\beta = 0.88$, 95% CI −2.18–3.94) were not significant, as shown in Table 3. Furthermore, migration indirectly associated with physical QoL ($\beta = 0.58$, 95% CI 0.05–1.28) and social QoL ($\beta = 0.50$, 95% CI 0.01–1.16) *via* individual income, and also indirectly negatively associated with environmental QoL ($\beta = -0.47$, 95% CI −1.12 to −0.05) *via* tangible support, as shown in Table 4.

On the other hand, among the group of urban participants, neither direct nor indirect associations of migration with four domain scores of QoL were significant, as shown in Tables 5, 6.

10.3389/fpubh.2022.1030828

TABLE 1 Descriptive characteristics of urban and rural adults with rare diseases by migration status.

	Total	Rural, $n = 492$		p-value	Urban, $n = 658$		p-value
	$N = 1,150$	Migrants, $n = 144$	Resident, $n = 348$		Migrants, $n = 104$	Resident, $n = 554$	
Age	34.0 (28.0–43.0)	31.0 (26.0–37.0)	32.0 (28.0–39.0)	**0.023**	32.0 (27.8–40.0)	37.0 (30.0–46.0)	**0.002**
Gender				0.092			0.747
Male	537 (46.7%)	81 (56.3%)	165 (47.4%)		44 (42.3%)	247 (44.6%)	
Female	613 (53.3%)	63 (43.8%)	183 (52.6%)		60 (57.7%)	307 (55.4%)	
Married/Cohabiting				0.093			0.123
No	485 (42.2%)	77 (53.5%)	157 (45.1%)		47 (45.2%)	204 (36.8%)	
Yes	665 (57.8%)	67 (46.5%)	191 (54.9%)		57 (54.8%)	350 (63.2%)	
Number of family members living together	3 (2–4)	3 (2–4)	4 (3–5)	**0.028**	3 (2–4)	3 (2–4)	0.164
Education				**<0.001**			**0.010**
Primary school or lower	141 (12.3%)	20 (13.9%)	72 (20.7%)		4 (3.8%)	45 (8.1%)	
Middle school	253 (22.0%)	37 (25.7%)	136 (39.1%)		11 (10.6%)	69 (12.5%)	
High school	274 (23.8%)	39 (27.1%)	85 (24.4%)		18 (17.3%)	132 (23.8%)	
3-year college	203 (17.7%)	23 (16.0%)	33 (9.5%)		18 (17.3%)	129 (23.3%)	
Bachelor or above	279 (24.3%)	25 (17.4%)	22 (6.3%)		53 (51.0%)	179 (32.3%)	
Employment				**<0.001**			0.747
Unemployed	490 (42.6%)	63 (43.8%)	175 (50.3%)		41 (39.4%)	211 (38.1%)	
Employed	458 (39.8%)	64 (44.4%)	81 (23.3%)		51 (49.0%)	262 (47.3%)	
No working capacity	202 (17.6%)	17 (11.8%)	92 (26.4%)		12 (11.5%)	81 (14.6%)	
Individual income (per 1,000 RMB)	14 (0–40)	20 (0–40)	2 (0–20)	**<0.001**	20 (0–60)	20 (0–50)	0.859
Catastrophic health expenditure				0.280			**0.025**
No	365 (31.7%)	49 (34.0%)	102 (29.3%)		42 (40.4%)	172 (31.0%)	
Yes	750 (65.2%)	89 (61.8%)	234 (67.2%)		54 (51.9%)	373 (67.3%)	
Missing	35 (3.0%)	6 (4.2%)	12 (3.4%)		8 (7.7%)	9 (1.6%)	
Dependence on assistive devices				**<0.001**			**0.024**
No	630 (54.8%)	95 (66.0%)	166 (47.7%)		69 (66.3%)	300 (54.2%)	
Yes	520 (45.2%)	49 (33.0%)	182 (52.3%)		35 (33.7%)	254 (45.8%)	
Social support							
Tangible support	65.0 (50.0–80.0)	60.0 (45.0–75.0)	65.0 (50.0–80.0)	0.075	65.0 (50.0–80.0)	70.0 (55.0–85.0)	**0.029**
Emotional/informational support	55.0 (40.6–67.5)	51.2 (40.0–62.5)	47.5 (37.5–62.5)	0.100	57.5 (47.5–70.0)	57.5 (45.0–70.0)	0.924
Positive social interaction	55.0 (40.0–65.0)	55.0 (40.0–65.0)	45.0 (35.0–60.0)	**0.011**	57.5 (45.0–70.0)	55.0 (40.0–70.0)	0.842
Affectionate support	56.7 (40.0–73.3)	53.3 (40.0–66.7)	46.7 (33.3–60.0)	0.131	60.0 (46.7–73.3)	60.0 (46.7–73.3)	0.657

Data are reported as median (IQR) for continuous variables and number (percentage) for categorical variables. Bold values indicate statistical significance which is defined as p-value < 0.05.

Discussion

This study firstly assessed the associations of migration with QoL among adults with rare diseases to our best knowledge. Among those who originally lived in rural areas, migration had positive direct associations with physical QoL and environmental QoL, and positive indirect associations with physical QoL and social QoL *via* individual income, as well as a negative indirect association with environmental QoL *via* tangible support. Among those who originally lived in urban areas, neither direct nor indirect associations of migration with QoL were found.

In this study, the proportion of migrants among rural participants with rare diseases was 20.3%, which was slightly higher than that reported among urban participants (15.8%) as well as that reported in the United States (9) (17%) and Europe (10) (16%). This finding was consistent with the situation in China that high-quality health care was primarily located in economically developed cities (16, 17). In our study samples, participants who were younger and had no dependence on assistive devices were more likely to migrate among both rural and urban groups of adults with rare diseases. This finding was consistent with the previous finding on general populations that younger

TABLE 2 Quality of life scores among urban and rural adults with rare diseases by migration status.

	Rural, $n = 492$		p-value	Urban, $n = 658$		p-value
	Migrants, $n = 144$	Residents, $n = 348$		Migrants, $n = 104$	Residents, $n = 554$	
Physical QOL	57.1 (42.9–67.9)	42.9 (28.6–57.1)	**<0.001**	53.6 (39.3–64.3)	50.0 (32.1–64.3)	0.064
Psychological QOL	45.8 (33.3–58.3)	37.5 (25.0–50.0)	**0.001**	45.8 (33.3–58.3)	45.8 (29.2–58.3)	0.356
Environmental QOL	43.8 (33.6–53.1)	35.9 (25.0–46.9)	**<0.001**	46.9 (37.5–56.2)	43.8 (31.2–58.6)	0.266
Social QOL	50.0 (41.7–58.3)	50.0 (33.3–58.3)	0.070	50.0 (41.7–66.7)	50.0 (35.4–66.7)	0.507

Data are presented as median(IQR). Bold values indicate statistical significance which is defined as p-value < 0.05.

TABLE 3 Direct effects of migration on the four dimensions of QoL for rural adults with rare diseases.

Variables	Physical QoL	Psychological QoL	Environmental QoL	Social QoL
Migration status (Ref = No)	**5.07 (2.01, 8.13)**	3.16 (−0.20, 6.53)	**3.95 (1.37, 6.53)**	0.88 (−2.18, 3.94)
Age	−0.04 (−0.21, 0.13)	0.11 (−0.08, 0.30)	0.06 (−0.08, 0.20)	0.01 (−0.15, 0.18)
Gender (Ref = Male)	**3.35 (0.38, 6.31)**	−0.96 (−4.22, 2.30)	1.23 (−1.27, 3.73)	**7.31 (4.35, 10.28)**
Education (Ref = Primary school or lower)				
Middle school	−0.03 (−4.18, 4.13)	−0.07 (−4.64, 4.49)	0.73 (−2.77, 4.23)	0.10 (−4.05, 4.25)
High school	1.35 (−3.12, 5.82)	1.48 (−3.43, 6.39)	1.39 (−2.37, 5.16)	2.00 (−2.47, 6.47)
3-year college	3.12 (−2.30, 8.53)	1.40 (−4.55, 7.35)	3.99 (−0.57, 8.55)	1.78 (−3.63, 7.20)
Bachelor or above	−5.79 (−12.00, 0.42)	**−7.95 (−14.78, −1.13)**	−2.91 (−8.14, 2.31)	−5.64 (−11.85, 0.57)
Married/Cohabiting (Ref = No)	−3.00 (−6.48, 0.48)	**−5.76 (−9.59, −1.93)**	−1.52 (−4.45, 1.41)	−0.28 (−3.76, 3.20)
Family number	0.00 (−0.88, 0.89)	0.53 (−0.44, 1.50)	0.26 (−0.48, 1.01)	−0.03 (−0.91, 0.85)
Individual income	**0.09 (0.03, 0.16)**	0.04 (−0.03, 0.11)	0.02 (−0.04, 0.07)	**0.06 (0.00, 0.12)**
CHE (Ref = No)	**−6.01 (−9.07, −2.95)**	−2.55 (−5.91, 0.81)	**−3.04 (−5.61, −0.46)**	0.85 (−2.21, 3.90)
Dependence on assistive devices (Ref = No)	**−15.34 (−18.32, −12.36)**	**−3.22 (−6.49, −0.06)**	**−6.12 (−8.63, −3.61)**	**−3.10 (−6.08, −0.12)**
Social support				
Tangible support	−0.02 (−0.11, 0.07)	0.02 (−0.08, 0.12)	**0.10 (0.03, 0.18)**	−0.04 (−0.13, 0.05)
Emotional/informational support	0.09 (−0.08, 0.27)	0.02 (−0.17, 0.21)	**0.22 (0.07, 0.36)**	0.14 (−0.03, 0.31)
Positive social interaction	**0.40 (0.23, 0.56)**	**0.35 (0.17, 0.53)**	**0.20 (0.06, 0.35)**	**0.35 (0.18, 0.52)**
Affectionate support	−0.01 (−0.15, 0.13)	**0.23 (0.08, 0.39)**	0.04 (−0.08, 0.16)	**0.14 (0.00, 0.29)**

Data are presented as coefficients and their 95% confidence intervals. Bold values indicate statistical significance which is defined as p-value < 0.05.

and healthier individuals have more health capital to migrate (11, 15).

Among our samples who originally lived in rural areas, migrants had a higher individual income, while no such difference was found among those who originally lived in urban areas. On the contrary, among those who originally lived in urban areas, migrants had a higher proportion of CHE, while no such difference was found among those who originally lived in rural areas. This could because that even if rural migrants with rare diseases tend to seek better health services, they could have better job opportunities than their counterparts since they may need to receive better education or learn more professional skills in order to live in the urban areas from the very beginning. Whereas for urban migrants, they may lose their original capital resources, such as social capital contributed by their personal social network or family connections, and have to find a new job or to accumulate their social capital from scratch. Another possible explanation is that urban migrants may migrate mainly for the purpose of diagnosis and treatment of the disease, while rural migrants may be for other financial purposes as well. If so, this difference may imply more unmet health needs among urban migrants.

After controlling the confounders that may affect QoL, migration was found to have positive direct associations with physical and environmental QoL among the group of rural participants. The possible explanations of these findings could be that migration could bring people from rural areas more job opportunities and recreational activities that suit them, and may also enhance their accessibility to high-quality healthcare facilities and community-based resources (33). This could also explain to some extent why we also identified a positive indirect association of migration with social QoL *via* individual income. However, we did not identify significant direct associations of migration with psychological and social QoL. This may be

TABLE 4 Indirect effects of migration on the four dimensions of QoL for rural adults with rare diseases.

Mediators	Migration status	Physical QoL	Psychological QoL	Environmental QoL	Social QoL
Family number	−0.25 (−0.59, 0.10)	–	–	–	–
Individual income	**7.29 (3.00, 11.59)**	**0.58 (0.05, 1.28)**	–	–	**0.50 (0.01, 1.16)**
CHE	−0.01 (−0.46, 0.45)	–	–	–	–
Tangible support	**−4.89 (−8.05, −1.73)**	–	–	**−0.47 (−1.12, −0.05)**	–
Emotional/informational support	0.34 (−1.39, 2.07)	–	–	–	–
Positive social interaction	0.19 (−1.66, 2.04)	–	–	–	–
Affectionate support	1.06 (−1.05, 3.17)	–	–	–	–

Data are presented as coefficients and their 95% confidence intervals. Column 2 presents the results from "migration status – mediator", controlling for other variables listed in Table 1. Column 3–6 presents the results from "migration status – mediator ~ corresponding QoL", controlling for other variables listed in Table 1. "–" indicates that the potential mediators have no significant associations with the corresponding QoL or migration status has no significant associations with mediators. Bold values indicate statistical significance which is defined as p-value < 0.05.

TABLE 5 Direct effects of migration on the four dimensions of QoL for urban adults with rare diseases.

Variables	Physical QoL	Psychological QoL	Environmental QoL	Social QoL
Migration status (Ref = No)	−0.28 (−3.77, 3.20)	−0.19 (−3.73, 3.34)	−0.46 (−3.39, 2.47)	−0.81 (−4.04, 2.41)
Age	−0.06 (−0.20, 0.08)	−0.03 (−0.17, 0.11)	0.06 (−0.05, 0.18)	−0.02 (−0.15, 0.11)
Gender (Ref = Male)	**−2.81 (−5.48, −0.13)**	**−3.95 (−6.66, −1.25)**	−1.16 (−3.41, 1.09)	0.80 (−1.67, 3.28)
Education (Ref = Primary school or lower)				
Middle school	2.02 (−3.93, 7.96)	1.95 (−4.07, 7.97)	0.05 (−4.95, 5.05)	2.05 (−3.45, 7.55)
High school	1.36 (−4.06, 6.78)	3.32 (−2.17, 8.82)	1.66 (−2.90, 6.22)	2.94 (−2.08, 7.96)
3–year college	2.35 (−3.24, 7.94)	**5.46 (0.20, 11.12)**	4.56 (−0.14, 9.26)	4.99 (−0.19, 10.16)
Bachelor or above	4.10 (−1.37, 9.57)	**6.33 (0.79, 11.87)**	**5.00 (0.40, 9.60)**	**5.99 (0.92, 11.05)**
Married/Cohabiting (Ref = No)	−0.24 (−3.72, 3.23)	1.78 (−1.74, 5.30)	−0.51 (−3.43, 2.41)	**2.84 (0.37, 6.06)**
Family number	−0.16 (−1.21, 0.89)	−0.46 (−1.52, 0.60)	−0.72 (−1.60, 0.16)	−0.19 (−1.16, 0.78)
Individual income	**0.03 (0.00, 0.06)**	0.02 (−0.01, 0.06)	**0.04 (0.01, 0.06)**	**0.03 (0.00, 0.06)**
CHE (Ref = No)	**−6.22 (−8.98, −3.47)**	**−3.45 (−6.24, −0.67)**	**−3.64 (−5.96, −1.33)**	0.37 (−2.18, 2.91)
Dependence on assistive devices (Ref = No)	**−16.58 (−19.29, −13.86)**	**−4.77 (−7.52, −2.01)**	**−8.20 (−10.48, −5.92)**	**−5.75 (−8.27, −3.24)**
Social support				
Tangible support	−0.05 (−0.15, 0.05)	−0.02 (−0.12, 0.08)	0.10 (−0.02, 0.18)	−0.02 (−0.11, 0.06)
Emotional/informational support	0.08 (−0.08, 0.24)	**0.29 (0.12, 0.45)**	**0.20 (0.06, 0.33)**	**0.20 (0.04, 0.35)**
Positive social interaction	**0.43 (0.27, 0.58)**	**0.30 (0.15, 0.46)**	**0.23 (0.11, 0.36)**	**0.44 (0.30, 0.58)**
Affectionate support	−0.05 (−0.18, 0.08)	0.06 (−0.07, 0.19)	−0.01 (−0.12, 0.10)	−0.01 (−0.13, 0.11)

Data are presented as coefficients and their 95% confidence intervals. Bold values indicate statistical significance which is defined as p-value < 0.05.

because the positive influence brought by migration were offset by its negative outcomes such as social exclusion, discrimination, and disengagement with original social network (12, 13, 34).

The positive indirect association *via* individual income for rural migrants identified in this study suggested a possible intervention for those with rare diseases and still live in the original rural areas, by offering them more job opportunities and hence higher incomes. The negative indirect association between migration status and environmental QoL *via* tangible support could because of the aforementioned disengagement with original social network, and suggested a possible intervention for those with rare diseases and migrate to a new place, by enhancing their connection with people in new communities, including patient organizations for rare diseases at the local level.

Among the group of urban participants, neither direct nor indirect associations of migration with QoL were found. This could arise from the aforementioned complicated pathways through multiple immediate and offsetting factors, with some factors detrimental and others being beneficial (14). Another explanation is that migrants from urban places are more familiar with the living habits in cities and are more likely to adapt to a new urban life easily. Future studies are needed to further explore the mechanism and pathways on how migration affect QoL among urban adults with rare diseases. Nevertheless, the different results indicate the necessity of customized interventions on rural and urban migrants, separately.

This study has some limitations. First, due to the cross-sectional study design, the casual links in this study

TABLE 6 Indirect effects of migration on the four dimensions of QoL for urban adults with rare diseases.

Mediators	Migration status	Physical QoL	Psychological QoL	Environmental QoL	Social QoL
Family number	−0.17 (−0.44, 0.09)	–	–	–	–
Individual income	−4.59 (−13.93, 4.75)	–	–	–	–
CHE	**−0.47 (−0.93, −0.01)**	0.65 (−0.08, 1.48)	0.38 (−0.05, 0.98)	0.33 (−0.04, 0.85)	–
Tangible support	**−3.70 (−6.62, −0.79)**	–	–	–	–
Emotional/informational support	0.94 (−0.77, 2.64)	–	–	–	–
Positive social interaction	−1.47 (−3.31, 0.37)	–	–	–	–
Affectionate support	1.65 (−0.49, 3.79)	–	–	–	–

Data are presented as coefficients and their 95% confidence intervals. Column 2 presents the results from "migration status – mediator", controlling for other variables listed in Table 1. Column 3–6 presents the results from "migration status – mediator – corresponding QoL", controlling for other variables listed in Table 1. "–" indicates that the potential mediators have no significant associations with the corresponding QoL or migration status has no significant associations with mediators. Bold values indicate statistical significance which is defined as p-value < 0.05.

were inconclusive and needs to be carefully examined in future studies. Second, a non-probability convenience sampling method with a limited number of respondents in this study may lead to biased results, which couldn't properly represent the situation at national level. Third, an online survey was used to collect data. Although this approach could maximize the coverage of rare disease patients as widely as possible, it was possible that the participants were not able to understand the questions correctly or could easily distort the answers. Nonetheless, previous studies showed that the online survey could yield a higher response rate than the mail survey and more accurate results than the telephone survey (35, 36). Hence, it is acceptable to use an online tool to collect information on rare disease patients in the current study. Fourth, although the majority of migrants with rare diseases tends to migrate to urban areas in China, the direction of migration to rural areas may also exist, which should be taken into account separately. Nonetheless, in China, approximately 70% of the migrant population migrate from rural to urban areas (37), thus the direction of migration to urban areas could represent most of the cases among migrants. Lastly, it is possible that the rarer the disease, the more likely that patients would like to migrate to access appropriate care. However, in previous studies that our research team conducted, we found that the rarity of the disease had no significant effect on healthcare utilization across cities among adult rare disease patients in China (16, 17). Hence, we paid more attention to the impact of socioeconomic characteristics of rare disease patients instead of the rarity of the disease in the current study. Future studies are needed to further assess the association between migration status and QoL depending on the disease type among rare disease patients.

Conclusion

Among rural adults with rare diseases, migration was found to have positive direct effect on physical and environmental QoL, positive indirect effect on physical and social QoL through increased individual income, and negative indirect effect on environmental QoL *via* reduced tangible support. By contrast, neither direct nor indirect associations of migration with QoL were significant among the group of urban participants. The different results may indicate the necessity of customized interventions on rural and urban migrants, separately. In addition, the mechanism and pathways on how migration affect QoL among urban adults with rare diseases need to be further explored in future studies.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Committee on the Use of Human and Animal Subjects in Teaching and Research, Hong Kong Baptist University (HASC no.: FRG2/15-16/052). The patients/participants provided their written informed consent to participate in this study.

Author contributions

DD developed the questionnaire, collected the data, conducted a preliminary analysis, and revised the manuscript. HZ and SC conducted the full data analysis and wrote the initial draft of the manuscript. All authors contributed to the article and approved the submitted version.

Funding

SC's research was supported by the UK Alzheimer's Society (grant AS-PG-16-006). The funding source had no role in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. All authors of the manuscript had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Acknowledgments

The authors would like to thank the Illness Challenge Foundation for their assistance and coordination in distributing questionnaires.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

1. Schieppati A, Henter J-I, Daina E, Aperia A. Why rare diseases are an important medical and social issue. *Lancet.* (2008) 371:2039–41. doi: 10.1016/S0140-6736(08)60872-7

2. Dawkins HJ, Draghia-Akli R, Lasko P, Lau LP, Jonker AH, Cutillo CM, et al. Progress in rare diseases research 2010–2016: an IRDiRC perspective. *Clin Transl Sci.* (2018) 11:11. doi: 10.1111/cts.12501

3. ISEBOX Ltd/Shire. *Rare Disease Impact Report.* (2013). Available online at: www.rarediseaseimpact.com (accessed May 20, 2022).

4. Engel PA, Bagal S, Broback M, Boice N. Physician and patient perceptions regarding physician training in rare diseases: The need for stronger educational initiatives for physicians. *J Rare Disord.* (2013) 1:1–15. Available online at: https://www.engagehealth.com/publications/insights-publications/physician-and-patient-perceptions-regarding-physician-training-in-rare-diseases-the-need-for-stronger-educational-initiatives-for-physicians/

5. Zhang H, Xiao Y, Zhao X, Tian Z, Zhang S. yang, Dong D. Physicians' knowledge on specific rare diseases and its associated factors: a national cross-sectional study from China. *Orphanet J Rare Dis.* (2022) 17:1–13. doi: 10.1186/s13023-022-02243-7

6. Budych K, Helms TM, Schultz C. How do patients with rare diseases experience the medical encounter? *Health Policy.* (2012) 105:154–64. doi: 10.1016/j.healthpol.2012.02.018

7. Miteva T, Jordanova R, Iskrov G, Stefanov R. General knowledge and awareness on rare diseases among general practitioners in Bulgaria. *Georgian Med News.* (2011) 193:16–9.

8. Ramalle-Gómara E, Domínguez-Garrido E, Gómez-Eguílaz M, Marzo-Sola ME, Ramón-Trapero JL, Gil-De-Gómez J. Education and information needs for physicians about rare diseases in Spain. *Orphanet J Rare Dis.* (2020) 15:1–7. doi: 10.1186/s13023-019-1285-0

9. NORD. *Barriers to Rare Disease Diagnosis, Care, and Treatment in the US: A 30-Year Comparative Analysis.* (2020). Available online at: https://rarediseases.org/wp-content/uploads/2020/11/NRD-2088-Barriers-30-Yr-Survey-Report_FNL-2.pdf (accessed May 20, 2022).

10. Eurordis. The voice of 12,000 patients. *Experiences and Expectations of Rare Disease Patients on Diagnosis and Care in Europe.* (2009). Available online at: https://www.eurordis.org/IMG/pdf/voice_12000_patients/EURORDISCARE_FULLBOOKr. pdf (accessed May 20, 2022).

11. Zhang L, Liu S, Zhang G, Wu S. Internal migration and the health of the returned population: a nationally representative study of China. *BMC Public Health.* (2015) 15:1–9. doi: 10.1186/s12889-015-2074-x

12. Xia Y, Ma Z. Relative deprivation, social exclusion, and quality of life among Chinese internal migrants. *Public Health.* (2020) 186:129–36. doi: 10.1016/j.puhe.2020.05.038

13. Deng Z, Law YW. Rural-to-urban migration, discrimination experience, and health in China: evidence from propensity score analysis. *PLoS ONE.* (2020)15:1–20. doi: 10.1371/journal.pone.0244441

14. Lu Y. Rural-urban migration and health: evidence from longitudinal data in Indonesia. *Soc Sci Med.* (2010) 70:412–9. doi: 10.1016/j.socscimed.2009.10.028

15. Hu X, Cook S, Salazar MA. Internal migration and health in China. *Lancet.* (2008) 372:1717–9. doi: 10.1016/S0140-6736(08)61360-4

16. Yan X, He S, Dong D. Determining how far an adult rare disease patient needs to travel for a definitive diagnosis: a cross-sectional examination of the 2018 national rare disease survey in China. *Int J Environ Res Public Health.* (2020) 17:1757. doi: 10.3390/ijerph17051757

17. Yan X, Dong D, He S, Webster C. Examining trans-provincial diagnosis of rare diseases in China: the importance of healthcare resource distribution and patient mobility. *Sustain.* (2020) 12:5444. doi: 10.3390/su12135444

18. Chen S, Wang J, Zhu J, Chung RYN, Dong D. Quality of life and its contributors among adults with late-onset Pompe disease in China. *Orphanet J Rare Dis.* (2021) 16:1–11. doi: 10.1186/s13023-021-01836-y

19. Chen J. Perceived discrimination and subjective well-being among rural-to-urban migrants in China. *J Sociol Soc Welf.* (2013) 40:131–56. Available online at: https://scholarworks.wmich.edu/jssw/vol40/iss1/8/

20. Kanters TA, Hagemans MLC, Van Der Beek NAME, Rutten FFH, Van Der Ploeg AT, Hakkaart L. Burden of illness of Pompe disease in patients only receiving supportive care. *J Inherit Metab Dis.* (2011) 34:1045–52. doi: 10.1007/s10545-011-9320-x

21. Hendriksz CJ, Lavery C, Coker M, Ucar SK, Jain M, Bell L, et al. Burden of disease in patients with Morquio a syndrome: results from an international patient-reported outcomes survey. *Orphanet J Rare Dis.* (2014) 9:1–8. doi: 10.1186/1750-1172-9-32

22. McIntyre D, Thiede M, Dahlgren G, Whitehead M. What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts? *Soc Sci Med.* (2006) 62:858–65. doi: 10.1016/j.socscimed.2005.07.001

23. Limwattananon S, Tangcharoensathien V, Prakongsai P. Catastrophic and poverty impacts of health payments: results from national household surveys in Thailand. *Bull World Health Organ.* (2007) 85:600–6. doi: 10.2471/BLT.06.033720

24. Yardim MS, Cilingiroglu N, Yardim N. Catastrophic health expenditure and impoverishment in Turkey. *Health Policy.* (2010) 94:26–33. doi: 10.1016/j.healthpol.2009.08.006

25. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJL. Household catastrophic health expenditure: a multicountry analysis. *Lancet.* (2003) 362:111–7. doi: 10.1016/S0140-6736(03)13861-5

26. Chen S, Zhang H, Pan Y, Long Q, Xiang L, Yao L, et al. Are free anti-tuberculosis drugs enough? An empirical study from three cities in China. *Infect Dis Poverty.* (2015) 4:47. doi: 10.1186/s40249-015-0080-y

27. Xiang L, Pan Y, Hou S, Zhang H, Sato KD Li Q, et al. The impact of the new cooperative medical scheme on financial burden of tuberculosis patients: evidence from six counties in China. *Infect Dis Poverty.* (2016) 5:1–12. doi: 10.1186/s40249-015-0094-5

28. Wang W, Zheng X, He HG, Thompson DR. Psychometric testing of the Chinese mandarin version of the medical outcomes study social support survey in patients with coronary heart disease in mainland China. *Qual Life Res.* (2013) 22:1965–71. doi: 10.1007/s11136-012-0345-x

29. Sherbourne CD, Stewart AL. The MOS social support survey. *Soc Sci Med.* (1991) 32:705–14. doi: 10.1016/0277-9536(91)90150-B

30. World Health Organization. *Division of Mental Health. WHOQOL-Bref: Introduction, Administration, Scoring and Generic Version of the Assessment: Field Trial Version.* (1996). Available online at: https://apps.who.int/iris/handle/10665/63529 (accessed May 20, 2022).

31. Dong D, Wang Y. Challenges of rare diseases in China. *Lancet.* (2016) 387:1906. doi: 10.1016/S0140-6736(16)30418-4

32. Chesnaye NC, Stel VS, Tripepi G, Dekker FW, Fu EL, Zoccali C, et al. An introduction to inverse probability of treatment weighting in observational research. *Clin Kidney J.* (2022) 15:14–20. doi: 10.1093/ckj/sfab158

33. Hou Z, Lin S, Zhang D. Social capital, neighbourhood characteristics and utilisation of local public health services among domestic migrants in China: a cross-sectional study. *BMJ Open.* (2017) 7:1–9. doi: 10.1136/bmjopen-2016-014224

34. Zhang J, Li X, Fang X, Xiong Q. Discrimination experience and quality of life among rural-to-urban migrants in China: the mediation effect of expectation–reality discrepancy. *Qual Life Res.* (2009) 18:291–300. doi: 10.1007/s11136-009-9454-6

35. Visser PS, Krosnick JA, Marquette J, Curtin M. Mail surveys for election forecasting? An evaluation of the Columbus dispatch poll. *Public Opin Q.* (1996) 60:181–227. doi: 10.1086/297748

36. Kaplowitz MD, Hadlock TD, Levine R. A comparison of Web and mail survey response rates. *Public Opin Q.* (2004) 68:94–101. doi: 10.1093/poq/nfh006

37. Migrant Population Service Center of China. *Statistical Data Sheet of Permanent Resident Population, Migrant Population, and Rural Migrant Workers From 1978 to 2017.* Available online at: https://www.chinaldrk.org.cn/wjw/#/data/classify/exist/detail2?path=%2FotherData%2Ffind.do%3FotherDataBean.title%3D1978-2017%E5%B9%B4%E5%B8%B8%E4%BD%8F%E4%BA%BA%E5%8F%A3%E3%80%81%E6%B5%81%E5%8A%A8%E4%BA%BA%E5%8F%A3%E3%80%81%E5%86%9C%E6%B0%91%E5%B7%A5%E7%BB%9F%E8%AE%A1%E6%95%B0%E6%8D%AE%E8%A1%A8%26otherDataBean.otherDataPath%3DL3dqdy9maWxlL290aGVyRGF0YS8wYmQ2ZTljNi04MmE1LTQ4MTYtYTg4OC1mNmJmMzYwNWJlMzUueGxzeA (accessed May 20, 2022).

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 21 November 2022
DOI 10.3389/fpubh.2022.1009274

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 01 August 2022
ACCEPTED 07 November 2022
PUBLISHED 21 November 2022

CITATION
Bao Y, Tao J and Liu Q (2022) "Embedding" and "pulling back": Spatial transformations and urban assimilation of migrant elderlies following their children. *Front. Public Health* 10:1009274. doi: 10.3389/fpubh.2022.1009274

"Embedding" and "pulling back": Spatial transformations and urban assimilation of migrant elderlies following their children

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Background: Due to the rapid acceleration of social mobility and the shrinking size of families, China has begun to enter a new form of aging society, with an increasing number of migrant elderlies following their children. How to adapt and assimilate into the new living space profoundly affects those migrant elderlies' mental health. Drawing on the spatial framework proposed by Henry Lefebvre, this paper explores the factors affecting urban assimilation of migrant elderlies following their children in China, and puts forward corresponding strategies to promote the urban assimilation.

Method: Using semi-structured interviews and participatory observation, this study conducted a qualitative study among migrant elderlies following their children who lived in a University Community in Wuhan city, Hubei Province from May 2022 to July 2022. During the survey period, we participated in the gathering activities of the migrant elderly five times a week, and conducted semi-structured interviews with 15 migrant elderlies following their children.

Results: Firstly, this study reveals that family assimilation is the foundation of urban assimilation of migrant elderly following their children; Secondly, we could conclude that the urban life of the migrant elderlies are mostly community-based, so it is especially important for them to reconstruct close neighborhood relations and regain the humanity affection of the traditional acquaintance society. Lastly, the fundamental institutional barrier is a significant factor that influences the ability of these migrant elderlies to live a stable urban life. The Chinese government needs to promote a nationwide unified pension and health insurance system, so that the migrant elderlies can enjoy the same benefits as the local elderly residents in the "inflow" area.

KEYWORDS

migrant elderly, urban assimilation, conceptual framework, health of the elderly, Spatial transformation

Introduction

According to the data of the seventh national population census, in 2020, the population aged above 60 years old will account for 18.70%, up 5.44 percentage points from a decade ago in China (1). We are witnessing a new phase of aging society, and many aging problems begin to emerge. For example, the difficulties encountered by left-behind elderly or the elderly citizens living alone in their lives have given rise to a series of social problems, such as suicide (2), fraud (3) and low social participation (4), which have imposed new requirements on China's welfare and social governance. Different from western countries, under the influence of the concepts of filial piety culture, raising children for old age, and generation-skipping care, it has become a cultural habitus for the elderlies to live with their children in China. Therefore, more and more elderly people follow their children to migrate to other places. According to *the China Migrant Population Development Report 2018* released by the National Health Commission of the People's Republic of China, the number of migrant elderlies in China has reached 17.784 million, and its proportion in the migrant population is ever growing (5). The "rural-urban" and "urban-urban" population movement have become the major migration patterns of migrant elderlies. Among them, migrant elderlies who move from rural areas with their children, suffer both physical and mental instability in their old age, and face "dual dis-embedding" of social relationships are more vulnerable to structural difficulties. This represents an epitome of today's "aging China".

As a relatively marginal group in the labor force system, the elderly population used to be of low mobility. Therefore, both Chinese and foreign academics have paid much less attention to migrant seniors than to other migrant populations. Researches on migrant seniors have only increased in recent years as aging societies are spreading globally. In general, studies by Western scholars involve the motivation, decision-making process, and behavioral characteristics of migrating seniors. The push-pull theory of migration (6), life course theory (7), and place-identity theory (8) constitute the main theoretical framework for them to explain the mobility of the elderly population. These studies suggest that the major motivations for the elderly to migrate are sound living environment (9), economic incentives (10), social relationships (11) and elderly services (12). However, under the influence of the urban-rural dual structure, traditional Eastern-style kinship, and the ideas of filial duty, the main drivers of migration for China's elderly population differ significantly from those of Western countries. Family reunion and raising their grandchildren are the most important reasons for them to move to the cities where their children work (13). That's why they are dubbed as "migrant elderlies following their children" and "elderly drifters" by Chinese mass media and sociological researchers, which can reflect their highly dependence on their families and separation from friends or contacts.

Due to changes in the location of elderly healthcare and the social security environment, Chinese migrant elderlies following their children face the problem of "spiritual empty nest" while lack a sense of belonging in the city. For example, studies have shown that low level of acculturation and intergroup contact in the inflow area significantly affect their mental health (14). The difference in the remote reimbursement rate of medical insurance and the electronic clinical consultation system makes it more difficult for the migrant elderlies following their children to seek medical treatment on their own. The expression "invisible men of the city" can best portray their urban life. In essence, all those similar problems can be attributed to the issue of "urban assimilation" of migrant elderlies following their children.

Currently, the Sustainable Development Goals featuring "universal health coverage" and "leaving no one behind" have become a global health issue. In this context, the urban assimilation of migrant elderlies following their children is also a significant dimension of "health". In the case of China, the problems of survival and spiritual and cultural life of the migrant elderlies following their children, an inevitable outcome of rapid urbanization, are distinctively different from those of other counties. The Chinese government must face these challenges if it aims to improve the assimilation of urbanization. Focusing on the migrant elderlies following their children during the urban assimilation, this study examines the impacts of the institutional space represented by China's basic medical insurance system and the network space based on social interactions from the aspect of spatial theory, and puts forward corresponding strategies to improve the urban assimilation of migrant elderlies to enhance their medical and health care.

Literature review

Spatial transformations and mobile society

"Space" is one of the central concepts of social theory and has been discussed for generations. However, early thinkers, represented by Descartes, regarded "space" as one of the absolute "things" (15). It was not until late twenteeth century, with the publication of *the Production of Space* by the French neo-Marxist philosopher Henri Lefebvre, that the social sciences witnessed a remarkable "turn of space". "Space" becomes a social product and a field with practical significance (16), and plays an important role in modern society. Henri Lefebvre, one of the first scholars to systematically address the sociological theory of space, argues that space is at least three-dimensional, comprising a hollowed-out physical space, a social space stuffed with relationships, and a symbolic mental space. To be specific, physical space mainly refers to the place where people live, the place where functional activities are realized,

and the real field that exists objectively. It is visible and tangible, and has geometric scale, clear geographical location and clear boundaries. A few neighborhoods and a community can be classified into physical space. But the boundaries of social space are more blurred. It is the space perceived and utilized by social groups, and also the space dominated by social activities and social organizations. Social space originates from collective life (17), where unique social institutions and regulations, interests, power and contradictions exist. People have to interact within the scope prescribed and allowed by the social institutions, and also have to interact socially within the framework of power fields in order to construct different categories of social relationships and satisfy their own social, spiritual and emotional needs. Spiritual space is the most abstract and subjective category of space with the most blurred boundaries. As the highest level of the space layer, it is the place of personal spiritual and emotional belonging and concerns individual identification. On the whole, these three levels of space do not exist independently, but are embedded and interpenetrated with each other. Together, they constitute the specific fields of human life.

In the twenty first century, with the acceleration of globalization and rapid development of information technology, the intensity of the flow of capital, goods, services, people, information and other factors has surpassed that of most historical periods. And the "social as society" has been gradually constructed into a "social as mobility" (18). The sociologist Zygmunt Bauman (19) summed up this change in social form with the term "liquid modernity" (19), which suggests that the fluid, indeterminate, and dynamic time-space relations brought about the separation of capital from labor and the shift from a sedentary to a nomadic way of living. Manuel Castells (20), discussing the "rise of the network society", points out that our society is constructed around mobility, which is not only an element of social organization, but also a manifestation of the processes that govern our economic, political and symbolic life (20). The network has become a fundamental component of the reinterpretation of territorial space. These discourses constitute and drive the notable "mobility turn" in social science research, and "mobility" has become a key term for many scholars to describe and capture the features of contemporary society and the characteristics of the times. How to realize the "re-embedding" of social relations in the modernity of high-speed mobility and how to transcend geographical and social boundaries to achieve relationship expansion, resource acquisition and subject competence enhancement has become the core issue of contemporary social science research.

The reconstruction of social relations, the assimilation of regional culture, and the transformation of power fields closely link "space" and "mobility". Spatial theory provides an appropriate analytical framework for studying the urban assimilation of migrant elderlies following their children. Taking spatial theory as the research framework, this paper studies the urban assimilation of migrant elderlies following their children from three dimensions: physical, social, and spiritual space, and explores the factors that affect the urban assimilation of migrant elderlies following their children and the necessary measures to make them "feel at home" in in-flow cities.

Urban assimilation of migrant population

Social assimilation is a classic sociological topic that originates from studies on ethnic immigration in the United States and social integration in Europe, and aims to explore how immigrants from different cultural backgrounds can dissolve cultural differences in order to reach cultural consensus (21, 22). Their research focuses on analyzing the identification mechanisms of immigrant cultures. Western researchers have developed a series of influential social assimilation theories (23), such as the melting-pot theory, segmented assimilation theory and selective assimilation theory, and explored a number of indicators for examining the social assimilation of migrant groups from economic, political, and cultural dimensions. Some representative models are Gordon's (24) two-dimensional model of structure and culture (24), Junger-Tas's (25) three-dimensional model of structural, socio-cultural and political-legal integration (25), and Entzinger's (26) four-dimensional model of socio-economic integration, political integration, cultural integration and attitudes toward migrants in in-flow areas (26). The aforementioned studies have laid the foundation for subsequent explorations on the social assimilation of migrant groups. However, due to the institutional and cultural differences between China and the West, it is difficult for Western societies to find a comparable object that matches the actual situation of China's migrant population. Chinese scholars have combined traditional social assimilation theories with Chinese realities and put forward several influential domestic theoretical hypotheses, such as the "re-socialization" hypothesis which covers economy, society, psychology and culture proposed by Tian Kai (27), the "assimilation progression" theory proposed by Zhang Wenhong and Lei Kaichun (28), and the economic, social, cultural and identity "assimilation interaction" theory proposed by Yang Juhua (29). The subjects of these studies mainly involve migrant workers. Recently, studies on migrant population of ethnic minorities, migrant females and migrant elderlies following their children have gradually increased as other migrant groups become known to wider public.

To be specific, studies on social assimilation of migrant elderlies following their children reveal that, unlike the retirement migration in the west that results from rational-thinking and independent choice (30, 31), the migrant elderlies following their children in China are most passive migrants. In most cases, they migrate for promoting family development and raising their grandchildren. Therefore, family assimilation

is the basis of urban assimilation of China's migrant elderlies following their children. Some researchers use the common framework of social assimilation of migrant population to analyze the urban assimilation of migrant elderlies following their children. They suggest that compared to other types of migrant population, it is more difficult for migrant elderlies following their children to realize urban assimilation and the "people-environment fits", which may exacerbate such health risks as depression and the lack of subjective happiness (32). The factors that affect their assimilation include not only such macroscopic elements as institutional obstructions and social exclusion (33), but also such microscopic elements as language barriers, loss of active interaction and insufficient learning ability (34). However, while applying the analysis framework of social assimilation of migrant population to examine the features of urban assimilation of migrant elderlies following their children, these studies, more often than not, obscure the special needs of urban assimilation of migrant elderlies following their children, which may lead to inaccurate research findings. Meanwhile, these studies tend to emphasize on indicator measurement and phenomenon analysis, thus neglecting the colorful and diverse stories of urban life of migrant elderlies following their children and failing to gain a deeper insight into their urban assimilation. Therefore, this study focuses on the self-narratives of migrant elderlies following their children so as to present the basic patterns of their urban assimilation from their own perspective.

Spatial transformations and health

The health of migrant populations has been a key issue of social science research in recent years. Related studies show that compared to non-migrants, whereas temporary migrants were at higher risk of mental problems (35). Ren.et al (36) surveyed 915 migrant workers in two Chinese shoe-making factories and found that 31.7% of Assembly-line migrant workers were clinically depressed (36). As the core "mobile" unit in a mobile society, the spatial transformations brought about by the geographical mobility of the population, which have a deeply impact on the health condition of individuals. In physical space, the built environment, land-use patterns, housing conditions can have positive or negative impacts on quality of life and well-being of households and individuals (37). For example, the study by Perdue et al. (38) found that because of lacking adequate safe playgrounds and green spaces built environment of urban space does not promote healthy lifestyles (38), even has a close relationship with the incidence of chronic diseases. Li and Liu's survey of China's mobile population found that poor housing conditions are significantly associated with perceived stress (39). In social space, neighborhoods, social networks, and social support are all closely related to a person's physical and mental health (40). Studies show that social discrimination in the process of social integration of the migrant population not only affects their mental health status and access to health services (41), but has a persistent negative impact on their physiological health indicators such as high blood pressure (42).Social environment formed by neighborhoods, social networks significantly predicts both perceived stress and mental health (39).These studies argue that when promoting the social integration of immigrant groups, the government should not only focus on the geographical compartmentalization of policies, but on developing the social skills of immigrant groups.

For the elderly who move to the city with their children, migration first brings spatial transformations, which in turn brings the need for social integration. Specifically, they are detached from their original living field, dis-embedded from their established social relationships, separated from their acquaintance society, and enter a new space that is physically, socially, and spiritually unfamiliar. So they have to reconstruct their social capital, reshape their value system, and adapt their lifestyles and behavior patterns, re-integrating and integrating themselves into the new territorial space. In the process of social integration, the dilemmas faced by the migrant elderlies following their children and the behaviors of self-motivated adaptation to the new space, which are directly or indirectly related to their physical or mental health. Through a review of previous studies, we can find that previous studies on social integration and health issues of migrant populations, especially migrant elderly, have mostly focused on quantitative correlation analysis, ignoring the rich and diverse life stories of migrant elderly during the migration process, and failing to gain a deeper insight into their urban integration process and its impact on individual health. Therefore, this study takes the self-narratives of migrant elderlies following their children as the main research material under the perspective of spatial theory, presents the basic patterns of their urban integration from the standpoint of migrant elderlies following their children, and explores the impact of urban integration dilemma on the health of migrant elderlies following their children. The research questions are as follows:

(1) What kind of urban integration needs do the spatial transformations brought about by mobility create for the migrant elderlies following their children?
(2) What kind of integration difficulties do migrant elderlies following their children encounter in the process of urban integration, and how do these difficulties affect their physical and mental health?
(3) How to bring into play the subjectivity of the migrant elderlies following their children to solve the integration dilemma, which they face and the derived health problems.

Research methods and data collection

The authors chose the family residential area of the university (University C) where they are working in as the research site to collect data. The university is located in Wuhan, Hubei Province, China, and its main campus has three residential areas for staff and their families, with which, accordingly, three gathering areas are formed for migrant elderlies following their children. Compared to other communities, the composition of the university's family residential area is relatively simple, consisting mainly of the university's staff and their families. As a "double first-class" university in China, the staffs of University C all over China, and their families are not local residents in Wuhan. So, the selection of research subject can be representative.

After preliminary observation, the researcher finds that 9:30–10:30 a.m. and 7:00–9:00 p.m. are the time when the migrant elderlies following their children in the three residential areas do outdoor activities together. To be specific, 9:30–10:30 a.m. (after breakfast and before lunch preparation) is their free time and many preschool children need to do outdoor activities during this period of time. Therefore, those migrant elderlies following their children will take this opportunity to gather in their community for outdoor activities. And 7:00–9:00 p.m. is the time for children to do outdoor activities after dinner. The migrant elderlies following their children will take their kids to nearby playgrounds. Therefore, they will also get together for recreation. In addition, for some families, this period is also the time the young people take a break from daily work. Many young couples will take care of their children during this time and the migrant elderlies following their children will get the opportunities to enjoy their "vacation" and recreational activities. The most typical recreational activity is "square dancing". In university C, there are two fixed sites for square dancing around the residential area of migrant elderlies following their children. And they even have WeChat groups to facilitate daily communication.

Given the diversified life of the migrant elderlies following their children, this study adopts the participatory observation and semi-structural interview, so as to gain a better understanding of the life, socialization and local participation of the migrant elderlies following their children in University C. Participatory observation refers to researcher's participation in the gathering activities of the migrant elderlies following their children, including offline participation in the group chatting, square dancing and even taking the kids out for fun together with them. The researcher also joins two square dancing WeChat groups to do close observation and records of the socialization and recreational activities of the migrant elderlies following their children. The researcher has conducted the survey for two months since the study began in May 2022 until July 20, 2022. During this period, the researcher takes field notes to record the patterns and features of behavior of the migrant elderlies following their children to facilitate the subsequent study. In addition to focusing on socialization and recreational activities, the researcher also conducts semi-structured interviews with 15 migrant elderlies following their children (the sociodemographic profile of 15 interviewees are provided in Table 1), which covers multiple indicators such as health care system, urban identify, culture identity, sense of belonging in the city and psychological conditions.

TABLE 1 Sociodemographic profile of 15 interview.

Age categories	55–68 years
Gender distribution	Four men and eleven women
Outflow area	Four from the small city, eleven from the countryside

After the materials were collected, the researcher used NVIVO12 to code the qualitative data. The software has been used by a large number of researchers. They used it to code data for qualitative studies. First, the researcher used open coding, which could initially categorize the interview texts and observation notes in an abstract way, and then used the spindle coding to refine the open coding results again, integrated the social assimilation status and health status of the the migrant elderlies following their children into different spatial categories, it facilitated subsequent analysis.

We maintained standard ethical protocols to conduct this research. The study protocol was approved by the academic committee of the School of Journalism and Cultural Communication of Zhongnan University of Economics and Law. At the beginning of the interviews and observation, informed consent was sought from each participant after a briefing about purpose of the research was done. The identities of the respondents were kept confidential, all the names of the interviewees are replaced by English letters in this paper. We assured that the information provided by the participants would only be used for academic research.

Research findings

This study explores how the migrant elderlies following their children adapt to the spatial transformations brought by geographical movement, and how such spatial transformations influence the urban assimilation of the migrant elderlies which further affects their sense of belonging in the city and their psychological perceptions of their city life. Under the framework of spatial theory, this section explores the urban assimilation of migrant elderlies following their children in three dimensions: physical space, social space, and spiritual space.

Adaptation differences in physical space and health risks of migrant elderlies following their children under the urban-rural dual structure

The physical displacement from the outflow area to inflow area is accompanied by a changing of the space in different ways. So, the first change is the physical space, where it is the initial space to which the migrant elderlies following their children are exposed after entering the inflow area, and it is also the type of space that directly affects their life styles and physical health conditions. It mainly involves the area of the city, the climate, and the physical environment of living. This is directly related to the city pattern of the inflow city. Due to the "urban-rural dual structure" in China, the lifestyle and living environment in rural areas are fundamentally different from those in urban areas, and in the process of urbanization, the development between cities are also distinctively different. In terms of population size, economic indicators and modernization level, the indicators of developed cities in China are much higher than those of small and medium-sized cities. As a new first-tier city in China's urban hierarchy, Wuhan has a resident population of 13.649 million, and its economic development and modernization of urban governance are among the leading levels in China. Wuhan is also characterized by cold winters, hot summers and four distinct seasons due to its north subtropical monsoon climate. These external urban conditions affect the integration of the migrant elderlies following their children, in some ways, it even poses a health risk for the migrant elderlies following their children.

Firstly, in terms of natural space, urban-rural and regional differences in climate, which affect the urban integration of the migrant elderlies following their children. Relatively speaking, elderlies who migrated from Hubei Province and neighboring provinces in Hubei have a higher degree of adaptation to Wuhan's climate. Unlike other elderlies who migrated to Wuhan, complaining about the "cold winter and hot summer", these elderly people can basically accept Wuhan's winter climate. However, with the influence of urban effects and other factors, some of the elderly people who have moved in from other parts of the province also said in interviews, "Wuhan is hot in the morning, midday and evening, in the countryside, it is much cooler at night, and I am particularly unaccustomed to the summer in Wuhan".

The lack of adaptation to the climate directly adds difficulties to the urban assimilation of the migrant elderlies following their children, even directly affecting their health. As Ms. G, an interviewer from northwest China, says, "*I've been in Wuhan for four years, but I still can't stand the weather there. In my hometown, the maximum temperature in summer does not exceed 33 degrees, and there is a big temperature gap between day and night. It is very comfortable to live in a heated room in winter. But the summer in Wuhan is really uncomfortable, and the winter is the same. I have urticaria because I'm not used to the weather in Wuhan. So, as soon as my grandson goes on vacation, I take him back to hometown.*"

Secondly, in terms of the scope of urban space, most of the migrant elderlies following their children in the family residential area of University C come from small cities, counties, towns and other less densely populated "acquaintance society". Because the geographical scope is limited and they live in those places all year around, it is unlikely that they will get lost. And the situation when they don't know how to travel will not happen. However, these situations often happen in inflow areas. Especially for the migrant elderlies following their children who migrate from rural areas, it is more difficult for them to travel independently in the bustling city, which limits the possibility of participating in local practices and reinforces their dependence on family members.

> "*I have never received education and I cannot read. In my hometown, I know all the roads. However, I dare only to move around the campus now. Wuhan is such a big city. I'm afraid to travel far away by myself because I don't know how to take public transportation and I'm afraid of getting lost. There are times when I get nervous waiting for a traffic light because there are so many cars and I am afraid of getting hurt or violating traffic rules.*"

Interviewee Ms. A spoke frankly about the negative impact of the size of the city on her local participation. She thought that modern urban space has limited her range of activities, making it more difficult for her to get around. Similar to Ms. A's difficulty in traveling around, Mr. W, who moved from a small city, used the phrase "*instantly becoming a fool once arriving in this big city*" to tease his own city life. He says that in the face of Wuhan's complex traffic environment, he cannot drive, and if he wants to travel far away by himself, he has to ask his children to find out the bus route in advance.

Moreover, the development of information technology has promoted the construction of smart cities and has substantially improved working efficiency and speed in various industries. However, its penetration in urban life has greatly affected the urban adaptation of migrant elderlies following their children. For example, the use of electronic smart systems in medical institutions has made it necessary to register, examine, collect reports and take medication through "all-in-one machine". However, the low level of adaptation to new technologies of the elderly population has hampered their basic life in the city, such as medical care and shopping, which makes them to extremely miss their hometown.

> "*In Wuhan, if I go out to buy vegetables or take a bus, I have to pay by cell phone. During the COVID-19 pandemic, I even have to scan the code, which is really troublesome. Sometimes, when I'm in a hurry, I'm not even able to operate*

> *my phone. I still think it's good to live in my hometown, there is no such trouble, you can use cash for everything."* (Interviewee Ms. G)

This discomfort with the scale of modern urban space, as well as the complex transportation environment and technological equipment, directly affects the "sense of efficacy" of urban life for the migrant elderlies following their children, and reinforces their self-perception of being "strangers in urban space". More importantly, the dilemma of access to health care caused by the electronification of health care, which may affect the timing of medical care for the elderlies and increase their health risks.

Lastly, in terms of living space, most of the respondents in this study are from townships, and their living space before migration is mainly " quadrangle" type house, with activity areas in the courtyard and intervals between houses, so that they can meet friends when they go out. In the urban space of Wuhan, the living space is dominated by high-rise buildings, and one has to go downstairs for outdoor activities. Therefore, the first thing Ms. A, the interviewee, mentioned when referring to the discomfort of city life was that the "tube-shaped" urban commercial apartment limits the freedom of living.

> "*When I live in my rural house, with nature at my doorstep and a yard at home, I can do whatever I want. But in Wuhan, I spend most of my time inside the apartment building. If I want to sunbath I have to go downstairs. There is no way to feel the nature directly, I am bored and lonely. Unlike rural areas, each household is separated by a courtyard, it is easy to disturb each other when there is any noise.*"

It can be seen that the change of living space under the urban-rural dichotomy has changed the lifestyle of the elderly people. They are confined to the living space of commercial apartment and have to be careful not to disturb their children at all times, and their exercise has been greatly reduced as a result, creating a lifestyle that is not conducive to health.

"Invoking" and "pushing back" of social space transformations for migrant elderlies following their children

The second change is the social space, which is not only products of purposive practice, but also affects space practice of actors. As a type of space that embodies institutional hierarchies and forms of public life, social space can be further divided into institutional space and network space. These two types of space are important elements in classifying and categorizing social individuals, and they profoundly affect the urban assimilation and individual health of the migrant elderlies following their children.

"Spatial boundaries" of the migrant elderlies following their children prescribed by the basic medical insurance system

Compared to young people, elderly citizens have poorer health and greater need for medical resources as they age and have more underlying conditions. In the process of urbanization, high-quality medical resources continue to cluster in large cities. Large cities are significantly better than small and medium-sized cities in terms of both the technical level of medical care and hospitalization capacity. "Going to big cities for better medical treatment" once was the preferred choice of the general public in small and medium-sized cities when they were sick. Therefore, it is reasonable to assume that the level and convenience of medical services should be significantly improved for migrant elderlies following their children who move to big cities from small and medium-sized cities or even rural areas. However, in the research process, the interview of the migrant elderlies following their children showed totally different scenario.

> "*Last year, I had severe back pain and couldn't straighten up at all, so my son took me to the Union Hospital to have a check. I was shocked to see how much I spent that day just for the checkups and medication. I will definitely never see a doctor in Wuhan again, because I can't get reimbursed at all.*"

Ms. B, who moved to Wuhan from a village in Yichang, Hubei Province, has a new type of rural cooperative medical insurance within China's basic medical security system. The procedures for remote reimbursement of this insurance within Hubei region are complicated, requiring filing at the place of registration and choosing a designated hospital for medical treatment, and direct settlement of outpatient treatment is not available for the time being. The hospitalization procedures in Wuhan's class-A tertiary hospitals are very complicated, and it is difficult to be directly hospitalized for minor illnesses and pains, which directly affects their choice of medical treatment, so "going home for treatment" has become their preferred way of medical treatment.

> "*Common diseases such as lumbar spine and rheumatism can be treated in my hometown. It's easy to get hospitalized there, and many physical therapy costs can be reimbursed directly through hospitalization costs. In the future, I will go to the hospital in my hometown to treat these illnesses.*" (Ms. B)

Like Mrs. B, in the investigation, many interviewees pointed out the limitations of remote medical insurance reimbursement in inflow areas. Some migrant elderlies following their children with underlying and chronic illnesses even will purchase a large amount of common medications when they return to the

outflow area and take them to the inflow area. However, this type of access to care is likely to lead to delays in treating some of the underlying conditions of the elderly who move with them, thus posing health risks.

Lamont (43) points out that symbolic boundaries exist in various specific social contexts, political forces, institutional power, and cultural resources are constantly generating symbolic boundaries and classifying or categorizing individuals in society accordingly (43). In the same way that the household registration system divides the urban resident population into "local" and "migrant" populations, China's basic medical insurance system is constantly constructing boundaries between "local" and "migrant" populations. The medical insurance system, which is supposed to ease the medical burden of the elderly population, has reduced the compliance of the migrant elderlies following their children to receive medical services due to different settlement ratio of medical services, and also reinforced the perception of the migrant elderlies following their children as "drifter" and limited their urban assimilation process.

However, the supplement of commercial insurance for Chinese basic medical insurance system fills the gap caused by reimbursement for medical treatment, thus promoting urban assimilation of migrant elderlies following their children. For example, the interview of Ms. E shows the impact of "commercial insurance" on her urban life.

> "*I bought new rural cooperative medical insurance in my hometown. But since I have hyperlipidemia, hypertension and hyperglycemia, after I came to Wuhan, my daughter-in-law bought me a commercial insurance for my chronic diseases. In this way, even if I don't use the new rural cooperative medical insurance, I can still get 40% reimbursement for medical treatment in Wuhan. The medical conditions in Wuhan are much better than those in my hometown, so I am still willing to seek medical treatment in large hospitals in Wuhan*".

Embedding and pulling back: The dual role of the new social relationship

Cross-regional mobility of population is a process of "deviation of locality" and "dis-embedding", which implies both the transcending of the original geographical space and the detachment of social relations from the territoriality of mutual interaction (44). Although the migrant elderlies following their children who move from the "acquaintance society" in the countryside and small cities to the family residential areas of Wuhan University C in Wuhan can enjoy reunion with their children in the inflow area, the forced breakage of other social relationships makes them feel lonely when they have just entered the inflow area. The migrant elderlies following their children would use some common phrases to describe their living conditions and psychological states when they have just entered urban space: "*Every day goes by so slowly that I'm almost counting every minute*"; "*I don't know anyone else when I go out, so I have to stay at home all day and I feel that I am in a prison*"; "*It feels like a fishbone getting stuck in my throat and I almost stifled*". Rebuilding social ties and regaining the "humanity affection" of the traditional acquaintance society in the inflow area has become an important way to relieve loneliness and seek a sense of belonging and identity.

During the research, the author finds that all the rebuilding of social ties of migrant elderlies following their children in the family residential area of University C is almost related to other elder seniors in this community. Almost every day, at a specific time, the migrant elderlies following their children will get together in a "fixed" site of the community. Generally speaking, from 9:30–10:30 a.m., they are surrounded by their grandchildren, while from 7:00–9:00 p.m., some of the migrant elderlies following their children will be freed from the confinement of "raising grandchildren" and form square dancing teams with other seniors to build up their body. During the interviews, when asked about the process of getting acquainted with other migrant elderlies following their children, the interviewees basically said that "it is a natural process".

"*I came to Wuhan to help my daughter with her kids, and when the kids go out every day to sunbathe and play, I have to go out with them, so I can naturally come in contact with other seniors. Children like to play with children, we old people will also chat. The more times we chat, the more we will naturally get acquainted*". The interviewee, Mr. I, and his wife have come to Wuhan to help their daughter raise their children for 3 years, and he says that the friends he meets in Wuhan are all migrant elderlies following their children in the community.

Because they share the same life patterns, interactions between the migrant elderlies following their children can be called a "typological" result of "group-individual association", where they share a common language, face the same social and life problems. It will bring the possibility of intergroup support. The interviewee, Ms. F, has moved to Wuhan for 5 years, and she has known a relatively large group of migrant elderlies following their children, and has become "close friends" with 5 migrant elderly. They often help each other and go on trips to nearby scenic spots together in their free time. "*We often talk about where we can buy cheap vegetables and fruits. Occasionally, when we are too busy, we can leave the children to other elderly people because we all live in the same neighborhood and it is very reassuring to ask them to help*". Similar interactions and mutual support activities increase their sense of "control" over life,reducing the feeling of loneliness in unfamiliar spaces, and the frequency of participation in urban life. When interviewed, Ms. F says, "*Knowing other migrant elderlies following their children has given me a sense of happiness, and they are an important reason why I can stay in Wuhan for a long time*".

In the daily interactions among migrant elderlies following their children, there is a special way of interaction, namely "square dancing socialization". Studies in the field of journalism

and communication in China have pointed out that square dancing is an important way to rebuild interactions and reconstruct identities among the elderly in today's China. This is also true for the migrant elderlies following their children. There are two specific square dancing sites for the migrant elderlies following their children of three family residential areas in University C. When the task of taking care of grandchildren is undertaken by their adult children, the migrant elderlies following their children will get together in the two sites from 7:00–9:00 p.m. everyday to exercise by square dancing. During breaks, they will get together for a casual chatting. In recent years, with the penetration of smart phones and social media in the lives of the elderly, WeChat groups have also become popular among the migrant elderlies following their children. In order to enhance contact, spread messages of square dancing and stimulate each other to keep exercising, the two square dancing groups in the family residential area of University C have also created their WeChat groups. The existing square-dancing communities in the real space are transformed into a network, which is transplanted, maintained and extended in the cyberspace, thus forming an important space for them to interact and communicate with others in the inflow areas. More importantly, this interaction space enhances the psychological comfort of the migrant elderlies following their children at the same time, becomes an important tool to monitor their exercise, which is beneficial to their healthy life.

During the two months when the author has been observing the two square dancing groups, the two groups have new messages every day. The information content involves ritualized greeting messages, the release of square-dancing instruction videos, advice on household and the sharing of daily life. Occasionally, there are even topics that are difficult to discuss with children in the family space, such as 'how to spend our old age, whether we should return to our hometown in the future" and "the restrictions imposed by children on our lives". For the migrant elderlies following their children, interacting with others in WeChat groups has become an important "pastime" and "comfort" for them to spend the repetitive life after finishing household chores. As Ms. F says in the interview, "*Other migrant elderlies following their children will post videos of cooking and children playing in the WeChat groups. If I chat with them when I am free or bored, I will feel better and time would go by faster*".

It can be said that social media, represented by WeChat, has extended the social relationships of the migrant elderlies following their children in the real space through instant interaction, and made them more stable and closer. The "emotional comfort" function of interpersonal communication among the migrant elderlies following their children is also enhanced because of the information and communication technology.

Unlike the intergroup relationships in the inflow areas, which can promote the embedding of the migrant elderlies following their children into urban life, social media's "reconnection" to social relationships in the "outflow areas" of the migrant elderlies following their children causes a "pulling-back effect" on urban integration, limiting the migrant elderly's sense of belonging to the city. Before migration, the lives and social relations of migrant elderlies following their children are constructed over a long period of time and with a high level of territoriality. It is rooted in the network of human relationships and acquired normative knowledge in their hometowns, and is an important source of their sense of practice, belonging, and individual security. However, the mobile life has broken the entire set of social ties they used to have. The original social relations based on hometown and occupation have become difficult to maintain, and the homeland has become a "faraway home" to a certain extent. However, the intermediation of the Internet and mobile technologies has made "portable communities" possible (45). Therefore, mobile people can maintain social interactions and realize emotional connectedness in their original physical space through the Internet, whether they meet or not. This makes the community free from the physical space and become "portable". In order to keep in touch with their friends and relatives in the "outflow" area, most of the elderly who migrate to the family residential area of University C have the WeChat of their friends and relatives in the outflow area, and a small number of the elderly who do not use social media also maintain their past social relationships through phone calls. The life style of their hometown is clearly presented in front of them through social media, invoking and deepening their memory and emotion of the "outflow place".

Mr. D, who moved to Wuhan from Dazhou, Sichuan Province, was a village cadre in his village before moving to Wuhan, and after coming to Wuhan, he still follows various issues in his village through social media, and even acts as a "mediator" through social media when he hears about the conflicts in his village. "*I am now also very close to the villagers. A neighbor once took a picture of my old house and sent it to me, and I was extremely eager to go back*".

Homesickness is very common among migrant elderlies following their children, especially for those who move to Wuhan alone. Their spouses still live in their hometowns. When watching these videos, their "desire" for "returning hometown" will grow even stronger. Mr. D even said bluntly in the interview, "*We will definitely return home to spend our old days. We need to contact our friends and relatives in the hometown more frequently, so that it is convenient to go back. Friendships in Wuhan will not be as important as those in the hometown in the future*".

It can be concluded that although social media, represented by WeChat, have made social networks and physical patterns of "outflow area" "portable" and "viewable", and they have also, to a certain extent, limited the urgency and enthusiasm of social relationship construction in the inflow area, thus slowing down the generation of sense of belonging in the city.

The pull-back effect of "family view" and the mental health of migrant elderly

In addition to physical presence, space is a social and conceptual construct[6]. Geographical mobility is not merely "relocation", but is accompanied by changes in spiritual or cultural space. So, the third space is spiritual space, which is the decoding of cultural symbols, the identification of values, and the sense of belonging are all indicators of the reference to. When migrant elderlies following their children move from their familiar living space to the city where their children live, they are first exposed to and involved with the families their children have established in the city. The perception of their children's families directly affects their self-identity orientation and their sense of belonging to the city, as well as their behavioral norms and acquisition of urban culture.

Chinese traditional concept of clan and child-bearing have always emphasized the importance of "extended family". The most promising vision of family life used to be "children and grandchildren pervading the hall" because Chinese people used to think it's blessed to have a lot of offspring. However, with the development of urbanization and changes in social life, the family, which is the "origin" of individual existence, is also changing, and the family form is shrinking. The widely spread "nuclear family" among young couples excludes the presence of grandparents in the construction of the meaning of "family". However, in contradiction to the construction of the meaning of small families, the widespread phenomenon of "grandparents raising their grandchildren" in China shows the diversity and complexity of Chinese families in a substantive sense. Some studies use "Neo-familism" (46) to explain the new multigenerational family model that has emerged in China after 2000. They think such familism results from the pursuit of individual happiness and family wealth through intergenerational synergy, and it places family interests above individual interests. In this family model, the elderly constantly weakens individual rights and interests to ensure that the interests of the young couples are maximized. From the perspective of behavioral and emotional orientation, the migrant elderlies following their children consider themselves to be part of the "family" with their children and grandchildren. However, the researcher also finds that most of the migrant elderlies following their children do not consider themselves as part of their children's families in the inflow areas because of their homeland affection and because they consider the new living space established by their children in the city as an important sign of their children's individual accomplishment. For example, Mr. W, an interviewee, said bluntly during the interview, "*This is the home of my son and daughter-in-law, not my own, and I am here only to help them. This isn't my home, and I will definitely go back in the future.*"

There are many migrant elderlies following their children who share Mr. W's view of family. Under the influence of this family view, they position themselves as "temporary residents" in the urban space and insist that "the outflow area" is their ultimate home, so they are not interested in learning Wuhan dialect and cultural customs, which limits their spiritual assimilation in the inflow area, it also reinforces the "loneliness" of their life in Wuhan. Ms. H, who moved to Wuhan from Henan for 3 years, said that she still can't understand Wuhan dialect. "*I rarely talk with Wuhan locals, and I don't want to learn Wuhan dialect because it's not necessary. In a few years, when my grandchildren grow up and go to school, I'm going back to Henan. Although it is true that I will feel lonely, but it will be better when I go back to Henan.*"

In addition, under the influence of the concept of "small family", it is difficult for migrant elderlies following their children live with their sons and daughters-in-law to truly integrate into the family space in the place they move to. On the other hand, they feel that their sons and daughters-in-law are family members and that they can only play the role of "helper" and cannot make any important decisions in their small families. Therefore, "listening to my son and daughter-in-law and obeying their arrangements" is the code of conduct for family life in their self-reporting. In this context, some of the migrant elderlies following their children seldom make voice about their demands in the family space, and their subjective recreational and leisure needs are hardly satisfied, which to a certain extent reduces the sense of comfort in the life of the elderly. At the same time, due to the differences in living habits and child-rearing concepts, the elderly living in the same physical space will always have conflict points with the younger generation, while the conflicts between mothers-in-law and daughters-in-law, which are not mediated by blood relations and emotional bases, can easily be intensified, thus negatively affecting the psychological health of the elderly migrants. As Ms. K said in the interview.

> *"My daughter-in-law and I both have strong personalities, and we both often have conflicts because of bringing up children, although we don't really hold grudges, but frequent quarrels do affect the mood, and when the children are a little older, I still have to go back and can't live together all year round."*

As seen above, the "mother-in-law-daughter-in-law conflict" in Chinese family relationships also plays an important role in the urban integration of migrant elderlies following their children, which affects the length of urban life of migrant elderlies following their children, and may also bring the risk of depression and reduce their sense of wellbeing.

Discussion

Rapid population aging and unprecedented population mobility have been the main demographic features of Chinese society in the last 40 years. In the new historical context, migrant populations of different generations have also changed.

However, unlike the predictions of classical migration and mobility theories, the size of China's migrant elderly is becoming increasingly large, forming a unique normative phenomenon. As an important part of family migration in China, the geographical migration of the migrant elderlies following their children changes the physical, social and even spiritual and cultural spaces they are accustomed to, leading to adjustment and assimilation needs, and to some extent, increasing health risks. In this context, exploring the urban assimilation of China's migrant elderlies following their children is in line with the national reality and can be responsive to the UN Sustainable Development Agenda's call to promote the wellbeing of people of all ages. Unlike the previous studies on social assimilation, this study introduces the spatial theory of sociology and uses it as a framework to analyze the factors affecting the urban assimilation of the migrant elderlies following their children from three aspects: physical, social, and mental space. Theoretically, it is a beneficial supplement and expansion of social assimilation theory, and a practical test of the spatial theory.

This study finds that for the migrant elderlies following their children who are passively involved in the process of family mobility, family assimilation is the foundation of their urban assimilation and the beginning of a stable life in the city. Therefore, harmonious intergenerational relationships, a sound family atmosphere, and family-based urban practices are the basic strategies to promote urban assimilation of the migrant elderlies following their children. Secondly, the urban life of the migrant elderlies following their children is mostly community-based, and their activities are basically confined to the community. It is especially important for them to gradually adapt and assimilate into the new living space and develop a sense of belonging by reconstructing close neighborhood relations and regaining the humanity affection of the traditional acquaintance society. Currently, the horizontal organization of Chinese grass-root communities is poorly developed, and the reconstruction of social relationships of the migrant elderlies following their children basically relies on their own practices. The community does not provide any specific support. In the future, the functions of the community should be proactively explored in the process of promoting the social assimilation of the migrant elderlies following their children. Lastly, the fundamental institutional barrier is an significant factor that influences the ability of migrant elderlies following their children to live a stable urban life. The Chinese government needs to promote a nationwide unified pension and health insurance system, so that the migrant elderlies following their children can enjoy the same benefits as the local elderly residents in the "inflow" area, such as transportation, public facilities, and preferential pension costs. At the same time, the Chinese government needs to strengthen the "accessibility" of urban spaces for the elderly. In addition to infrastructure such as barrier-free facilities, the "accessibility" of modern technology to the elderly in urban spaces should be taken into consideration.

It is worth noting that this study also finds that the penetration of communication technologies into the elderly, represented by the social media, has improved ability of the migrant elderlies following their children to deal with their "drifting" life to a certain extent, and has expanded their social networks. However, its dual spatial connection between the outflow and inflow areas also creates a "two-way pulling" on the urban assimilation of the migrant elderlies following their children.

Conclusion

China entering a new form of aging society, face urban assimilation difficulties especially for migrant elderlies following their children. With discussion on the spatial framework, this paper explores the factors affecting urban assimilation of these migrant elderlies in a University Community in Wuhan city, Hubei Province from May 2022 to July 2022, researchers participated in their daily life for two months, and conducted 15 semi-structured interviews. The study reveals the following findings: first, family assimilation is the foundation of urban assimilation for these migrant elderlies; Second, urban life of these migrant elderlies is mostly community-based. Third, the fundamental institutional barrier is a significant factor that influences the ability of these migrant elderlies to live a stable urban life. Suggestions for governments to improve the urban assimilation are proposed including promoting a nationwide unified pension and health insurance system.

Due to the limitations of the study field and duration, this study only explores the urban assimilation of the elderly who move to the family residential area of university C. The composition and life patterns of the family residential area of university C are simple, and it cannot fully reflect all the situations of China's urban communities. Future studies could focus on the life patterns of migrant elderlies following their children in diversified communities to explore different aspects of their urban assimilation.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the academic committee of the School of Journalism and Cultural Communication of Zhongnan University of Economics and Law. The patients/participants

provided their written informed consent to participate in this study.

Author contributions

YB and QL designed the study. YB and JT collected the data. All authors contributed to the article and approved the submitted version.

Funding

Supported by the basic scientific research project of Zhongnan University of Economics and Law (No. 31512210305).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. China National Bureau of Statistics (2021). *Bulletin of the Seventh National Census*. Available online at: http://www.stats.gov.cn/xxgk/sjfb/zxfb2020/202105/t20210511_1817202.html

2. Li X, Xiao Z, Xiao S. Suicide among the elderly in mainland China. *Psychogeriatrics*. (2009) 9:62–6. doi: 10.1111/j.1479-8301.2009.00269.x

3. Zhang J, Gu XQ. On the prevention and fight against ageing population fraud crime question research. In *3rd International Conference on Applied Social Science Research (ICASSR 2015)*. Paris: Atlantis Press, 853–855 (2016).

4. Liu J, Rozelle S, Xu Q, Yu N, Zhou T. Social engagement and elderly health in China: evidence from the China health and retirement longitudinal survey (CHARLS). *Int J Environ Res Public Health*. (2019) 16:278. doi: 10.3390/ijerph16020278

5. National Health Commission of the People's Republic of China. The China Migrant Population Development Report 2018 (2018), Available online at: http://www.nhc.gov.cn/wjw/xwdt/201812/a32a43b225a740c4bff8f2168b0e9688.shtml (accessed July 15, 2022).

6. Lee ES. A theory of migration. *Demography*. (1966) 3:47–57. doi: 10.2307/2060063

7. Warnes T. Migration and the life course. In T Champion and T Fielding, editor. *Migration Processes and Patterns: Research Progress and Prospects* (London: Belhaven Press), pp.175–187 (1992).

8. Cuba L, Hummon DM. A place to call home: Identification with dwelling, community and region. *Sociol Q*. (1993) 34:111–31. doi: 10.1111/j.1533-8525.1993.tb00133.x

9. Poudyal NC, Hodges DG, Cordell HK. The role of natural resource amenities in attracting retirees: implications for economic growth policy. *Ecol. Econ*. (2008) 68:240–8. doi: 10.1016/j.ecolecon.2008.02.022

10. Conway KS, Houtenville AJ. Out with the old, in with the old: A closer look at younger versus older elderly migration. *Soc Sci Q*. (2003) 84:309–28. doi: 10.1111/1540-6237.8402006

11. Wiseman RF, Virden M. Spatial and social dimensions of intraurban elderly migration. *Econ. Geograph*. (1977) 53:1–13. doi: 10.2307/142802

12. Dorfman JH, Mandich AM. Senior migration: spatial considerations of amenity and health access drivers. *J Reg Sci*. (2016) 56:96–133. doi: 10.1111/jors.12209

13. Wang Y. Mobile connecting and "portable community": a study on the use of WeChat and the social re-embedding of "the old drifters". *Commun. Soc*. (2019) 47:87–133. doi: 10.30180/CS.201901_(47).0005

14. Song XX, Xin ZQ. The relationship between intergroup contact and happiness of migrant aged men and local aged men. *Psychol Dev Educ*. (2019) 35:615–23. doi: 10.16187/j.cnki.issn1001-4918.2019.05.13

15. Jammer M. *Concepts of Space: The History of Theories of Space in Physics*. North Chelmsford, MA: Courier Corporation (2013).

16. Lefevres H. *The Production of Space, Trans*. Manchester: Donald Nicholson-Smith. (1991).

17. Durkheim E. *Durkheim on Religion: A Selection of Readings With Bibliographies and Introductory Remarks*. Bristol, CT: ISD LLC (2011).

18. Urry J. *Sociology Beyond Societies: Mobilities for the Twenty-First Century*. New York, NY: Routledge (2012).

19. Bauman Z. *Liquid Modernity*. Cambridge: Polity Press (2000).

20. Castells M. *The Information Age: The Rise of the Network Society*. Oxford: Blackwell. (2000).

21. Hirschman C. America's melting pot reconsidered. *Annu Rev Sociol*. (1983) 397–423. doi: 10.1146/annurev.so.09.080183.002145

22. Habermann M, Stagge M. Indicators for monitoring the integration of elderly migrants in the municipal infrastructure for elder-care. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. (2015) 58:601–8. doi: 10.1007/s00103-015-2142-5

23. Portes A, Parker RN, Cobas JA. Assimilation or consciousness: perceptions of US society among recent Latin American immigrants to the United States. *Soc Forces*. (1980) 59:200–24. doi: 10.2307/2577841

24. Gordon MM. *Assimilation in American Life: The Role of Race, Religion, and National Origins*. Oxford: Oxford University Press. (1964).

25. Junger-Tas J. Ethnic minorities, social integration and crime. *Eur J Crim Policy Res*. (2001) 9:5–29. doi: 10.1023/A:1011210026339

26. Entzinger H, Biezeveld R. *Benchmarking in Immigrant Integration*. Rotterdam: Erasmus University (2003).

27. Tian K. Research analysis and reflections on the urban adaptability of rural migrant workers. *Soc Sci Res*. (1995) 5:90–5.

28. Zhang WH, Lei KC. Analysis of the structure, current situation and influencing factors of social integration of new urban immigrants. *Sociol Stud*. (2008) 5:117–41; 244–45. doi: 10.19934/j.cnki.shxyj.2008.05.006

29. Yang JH. From segregation, selective integration to integration: theoretical reflections on the social integration of migrant populations. *Pop Res*. (2009) 1:17–29.

30. Yaskevich RA, Derevyannikh EV, Polikarpov LS, Gogolashvili NG, Taptygina EV, Davidov EL, et al. Estimation of the quality of life in elderly migrants of the far north in the period of readaptation to new climatic conditions. *Adv Gerontol*. (2014) 4:213–7. doi: 10.1134/S2079057014030126

31. Hall K, Hardill I. Retirement migration, the 'other'story: caring for frail elderly British citizens in Spain. *Ageing Soc*. (2016) 36:562–85. doi: 10.1017/S0144686X14001342

32. Li Q, Zhou X, Ma S, Jiang M, Li L. The effect of migration on social capital and depression among older adults in China. *Soc Psychiatr Psychiatr Epidemiol*. (2017) 52:1513–22. doi: 10.1007/s00127-017-1439-0

33. Liu Q. Research on the urban social adaptation of "aged drifters"-the strategy of social work intervention. *Northwest Pop.* (2012) 33:23–31. doi: 10.15884/j.cnki.issn.1007-0672.2012.04.015

34. Li F, Li, ZH. Research on the concept and indicator system of social integration of migrant population. *Southern Pop.* (2016) 31:11–9.

35. Yang M, Dijst M, Helbich M. Mental health among migrants in Shenzhen, China: does it matter whether the migrant population is identified by hukou or birthplace? *Int J Environ Res Pub Health.* (2018) 15:2671. doi: 10.3390/ijerph15122671

36. Ren F, Yu X, Dang W, Niu W, Zhou T, Lin Y, et al. Depressive symptoms in C hinese assembly-line migrant workers: a case study in the shoe-making industry. *Asia-Pacific Psychiatr.* (2019) 11:e12332. doi: 10.1111/appy.12332

37. Lawrence RJ. Housing and health promotion: moving forward. *Int J Pub Health.* (2010) 55:145–6. doi: 10.1007/s00038-010-0118-7

38. Perdue WC, Stone LA, Gostin LO. The built environment and its relationship to the public's health: the legal framework. *Am J Pub Health.* (2003) 93:1390–4. doi: 10.2105/AJPH.93.9.1390

39. Li J, Liu, Z. Housing stress and mental health of migrant populations in urban China. *Cities.* (2018) 81:172–9. doi: 10.1016/j.cities.2018.04.006

40. Ell K. Social networks, social support and coping with serious illness: the family connection. *Soc Sci Med.* (1996) 42:173–183. doi: 10.1016/0277-9536(95)00100-X

41. Agudelo-Suárez A, Gil-Gonzalez D, Ronda-Pérez E, Porthe V, Paramio-Perez G, García AM, et al. Discrimination, work and health in immigrant populations in Spain. *Soc Sci Med.* (2009) 68:1866–74. doi: 10.1016/j.socscimed.2009.02.046

42. Borrell C, Muntaner C, Gil-González D, Artazcoz L, Rodríguez-Sanz M, Rohlfs I, et al. Perceived discrimination and health by gender, social class, and country of birth in a Southern European country. *Prev Med.* (2010) 50:86–92. doi: 10.1016/j.ypmed.2009.10.016

43. Lamont M, Molnar V. The study of boundaries in the social sciences. *Ann Rev Sociol.* (2002) 28:167–95. doi: 10.1146/annurev.soc.28.110601.141107

44. Giddens A. The consequences of modernity. Stanford, CA: Stanford University Press (1991).

45. Chayko M. *Portable Communities: The Social Dynamics of Online and Mobile Connectedness*. Albany, NY: State University of New York Press (2008).

46. Yan Y. *Introduction: The Inverted Family, Post-Patriarchal Intergenerationality and Neo-Familism in Chinese Families Upside Down: Intergenerational Dynamics and Neo-Familism in the Early 21st Century*. Leiden: Brill (2021).

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 24 November 2022
DOI 10.3389/fpubh.2022.1008720

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 01 August 2022
ACCEPTED 07 November 2022
PUBLISHED 24 November 2022

CITATION
Yao Q, Li H and Liu C (2022) Use of social health insurance for hospital care by internal migrants in China—Evidence from the 2018 China migrants dynamic survey. *Front. Public Health* 10:1008720. doi: 10.3389/fpubh.2022.1008720

Use of social health insurance for hospital care by internal migrants in China—Evidence from the 2018 China migrants dynamic survey

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Background: China's welfare system including social health insurance has been closely linked to its unique household registration system, despite high population mobility over the past few decades. This study aimed to determine the pattern of health insurance usage from internal migrants in mainland China for hospital care.

Methods: Data were extracted from the 2018 China Migrants Dynamic Survey. The respondents who enrolled in a social health insurance program and reported illness or injury over the past year were eligible for this study (n = 15,302). Two groups of outcome indicators were calculated assessing the use (incidence and settlement location) of insurance funds for hospital care and the burden of hospital expenditure (total hospital expenditure, out-of-pocket payments, and share of insurance reimbursement), respectively. Logit regression and Heckman's sample selection models were established to determine the predictors of insurance fund usage and the burden of hospital expenditure, respectively.

Results: Most respondents enrolled in a social health insurance program outside of their residential location (70.72%). About 28.90% were admitted to a hospital over the past year. Of those hospitalized, 72.98% were admitted to a hospital at their migration destination, and 69.96% obtained reimbursement from health insurance, covering on average 47% of total hospital expenditure. Those who had a local insurance fund aligned with residency (AOR = 2.642, 95% CI = 2.108–3.310, $p < 0.001$) and enrolled in employment-based insurance (AOR = 1.761, 95% CI = 1.348–2.301, $p < 0.001$) were more likely to use insurance funds for hospital care, and paid less out-of-pocket ($\beta = -0.183$ for local funds, $p = 0.017$; $\beta = -0.171$ for employment-based insurance, $p = 0.005$) than others. A higher share of insurance reimbursement as a proportion of hospital expenditure was found in the employment-based insurance enrollees ($\beta = 0.147$, $p < 0.001$). Insurance claim settlement at the residential location was associated with lower total hospital expenditure ($\beta = -0.126$, $p = 0.012$) and out-of-pocket payments ($\beta = -0.262$, $p < 0.001$), and higher share of insurance reimbursement ($\beta = 0.066$, $p < 0.001$) for hospital expenditure.

Conclusion: Low levels of health insurance benefits for hospital care are evident for internal migrants in mainland China, which are associated with the funding arrangements linked to household registration and inequality across different funds.

KEYWORDS

migrant, social health insurance, health service, China, Heckman model

Introduction

There has been a consensus that high population mobility has contributed significantly to the unprecedented economic growth in China (1, 2). However, China has still maintained its unique household registration system, also known as "Hukou" originally designed for limiting population mobility. Those who work or live outside of their household registration location were referred to as internal migrants (3). In 2021, the internal migrant population reached 384.67 million, accounting for 27.3% of the entire population in China (4). Compared to the long-term permanent local residents, the internal migrants face great challenges in accessing health care services due to barriers resulting from low socioeconomic status and the Hukou-linked social welfare arrangements (5, 6). A previous study found that more than one-third of internal migrants in China do not follow advice from doctors for hospital admissions (7). On the one hand, internal migrants are often exposed to higher health risks compared to their local counterparts by taking labor-intensive low-paid jobs such as construction, transportation, manufacturing, and catering (8). On the other hand, they experience a loss of social capital from their Hukou location (9) and face discrimination in job opportunities and social welfare entitlements in their migration destination (10).

Social health insurance is an important tool for ensuring accessibility of health care (11) and preventing financial risks associated with health care services (12). Empirical evidence shows that health insurance can not only increase the use of medical care services (13, 14), such as medical consultations (15–19) and hospital admissions (14, 20), but also increase the use of preventive care such as physical examinations (15, 20, 21), personal health records (22), and health education (23) in the internal migrants. Health insurance can also reduce the financial burden of medical care of the internal migrants (13, 17, 19), despite increased use of healthcare services and rise in medical expenses (24–26).

China has achieved almost universal coverage of social health insurance through three major schemes: Basic Medical Insurance for Urban Employees (BMIUE), Rural New Cooperative Medical Scheme (RNCMS), and Basic Medical Insurance for Urban Residents (BMIUR). The latter two were merged in 2016 and renamed to Basic Medical Insurance for Urban and Rural Residents (BMIURR). However, social health insurance coverage of internal migrants is significantly lower than that of the rest of the population in China (27). About 10% of internal migrants do not have any health insurance (8, 28). For those covered by health insurance, the vast majority (>76%) enrolled in a program at their Hukou location (28). There have been concerns that the misalignment between health insurance fund location and the residency of enrollees may have hindered the use of health insurance (29). Previous studies showed that 80% of internal migrants paid entirely out-of-pocket for their recent medical consultations (30), and 37.1% did not have access to the on-the-spot settlement of hospital bills from their insurance funds (31). These have led to significant inequalities between the migrant and non-migrant populations (32). In addition, most internal migrants (77%) are not covered by the more generous employment-based insurance program BMIUE (8), and their insurance entitlements are seriously restricted by the financial capacity of their insurance funds (13, 33, 34). Several studies showed that unlike the BMIUE, the RNCMS failed to effectively ease the financial burden of migrant patients (19, 35, 36), including the rural-to-urban older migrants (37).

China has made great efforts in reforming its social health insurance programs. However, there is a paucity in the literature documenting evidence of the benefits of various health insurance arrangements for internal migrants at the national level. This study aimed to address the gap in the literature by analyzing the pattern of health insurance usage in internal migrants for hospital care using the 2018 China Migrants Dynamic Survey (CMDS).

Materials and methods

Data sources

Data were extracted from the 2018 CMDS dataset. The CMDS is an annual nationwide survey of internal migrants conducted by the National Health Commission since 2009. The survey drew samples from community residents aged 15 years and above who did not have a Hukou in their residential location (city or county), but had lived there for at least 1 month. A stratified multistage probability proportional to size (PPS) sampling strategy was adopted to select participants from all of the 31 regions/provinces in mainland China. In the first stage, 66 municipalities were identified to cover both capital

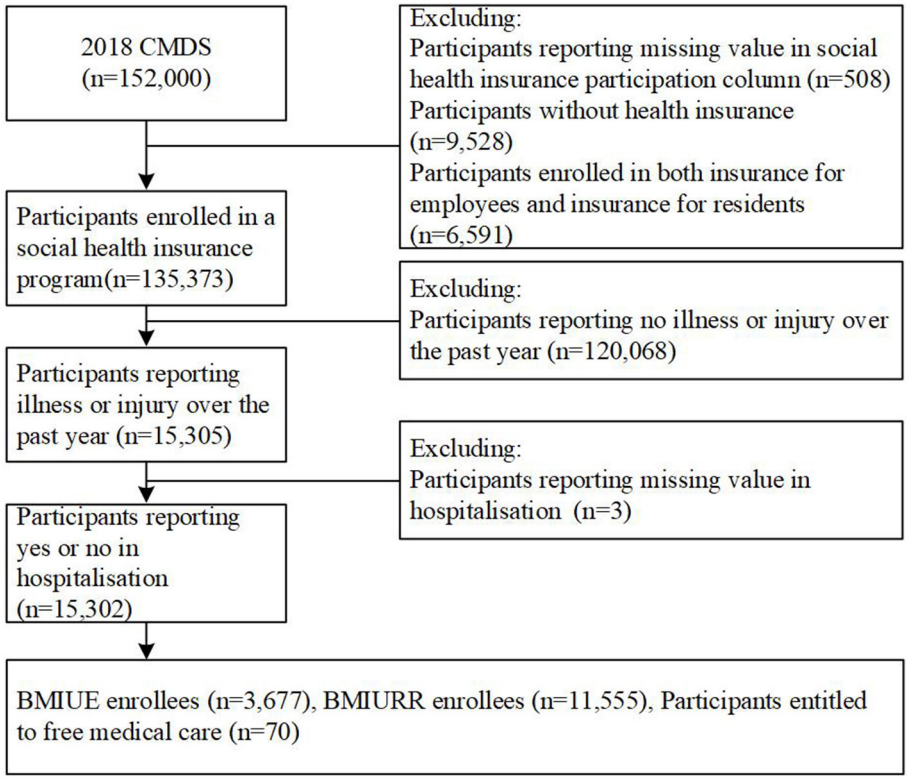

FIGURE 1
Screening flowchart of study participants.

and non-capital municipalities. This was followed by a selection of urban districts and rural counties in each municipality. Residential communities in each urban district and rural county (township) were subsequently identified. Finally, housing estates that accommodated migrants explicitly (e.g., factory dormitory) and inexplicitly (e.g., residential committee) were selected. All of the migrants residing in the selected housing estates were invited to participate in the study. This resulted in a total of 152,000 study participants in the 2018 CMDS. Further details of the sampling process have been published elsewhere (38).

Data were collected through household visits, tapping into the household structure, sociodemographic characteristics (age, gender, education, employment, income), health status (self-rating), health insurance enrolments, and use of healthcare services of the respondents (one member only from each household).

Eligible participants for the current study were restricted to those who enrolled in a social health insurance program and reported illness or injury over the past year. Those who did not enroll in any insurance, had missing values in insurance enrolments, and enrolled in both BMIURR and BMIUE were excluded (Figure 1). Overall, 135,280 (89%) of the 2018 CMDS respondents were eligible for this study. Of the eligible respondents, 15,302 (11.3%) reported hospital admissions over the past year and were included in the final data analyses.

Theoretical framework

The Andersen's health service utilization model guided the analytical framework in this study. The Andersen's model has been widely recognized as one of the best for explaining and predicting healthcare service behaviors (39, 40). Five broad factors (environment, predisposing, enabling, health needs, and mobility) were measured as predictors of hospital admissions in this study in line with the Andersen's model (Figure 2).

Data analysis

Dependent variables

Three groups of outcome indicators (dependent variables) in relation to hospital care were calculated. In China, social health insurance prioritizes coverage of hospital services (41). In Anhui, for example, the BMIURR reimburses 60–85% of hospital expenses, compared with 55% for outpatient care (42). On-the-spot settlement of medical expenditure across

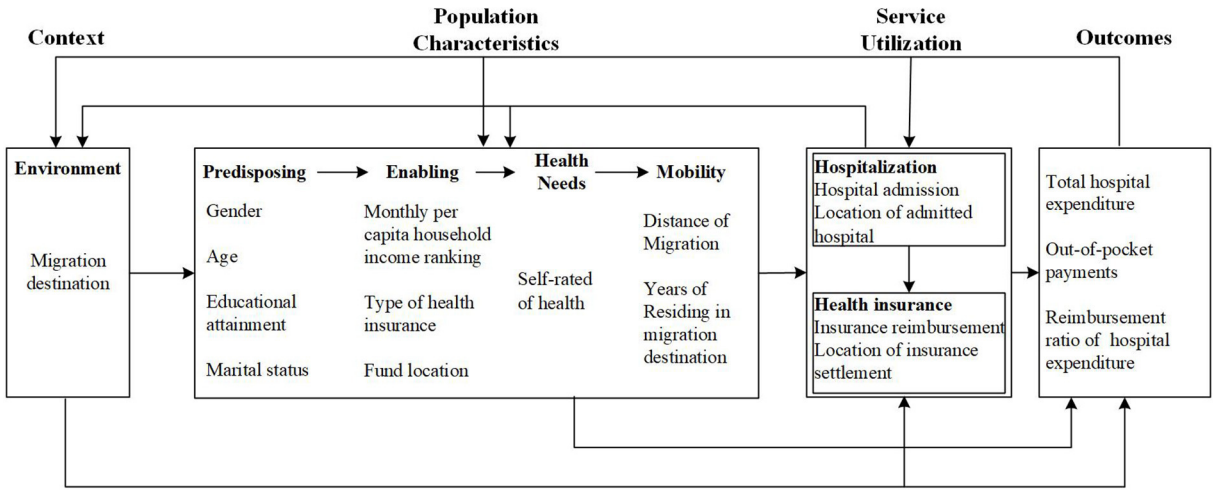

FIGURE 2
Theoretical framework of the study.

provinces is also focused on hospital expenses, except in a few regions (Yangtze River Delta, Beijing-Tianjin-Hebei, Yunnan-Guizhou-Sichuan-Chongqing-Tibet) that have recently (since 2019) expanded it to cover outpatient care (43).

(1) Hospital care usage: the 2018 CMDS asked respondents who reported illness or injury over the past year: "Were you ever admitted to a hospital over the past year?" (yes or no) and "Where were you hospitalized in the most recent hospital admission?" (residential location or non-residential location). We calculated the hospitalization rate of the study participants over the past year and the percentage share of local (residential location) hospitalization in the most recent admission of those hospitalized.

(2) Use of health insurance in hospital care: the 2018 CMDS asked the respondents who were admitted to hospitals: "Were you ever reimbursed from health insurance for your hospital expenditure over the past year" (yes or no) and "Where was your most recent insurance claim settled?" (residential location or non-residential location). We calculated the percentage of hospital admissions that were subsidized (partially or totally) by insurance funds and the percentage share of local (residential location) insurance settlements in those who enjoyed insurance reimbursement.

(3) Share of health insurance reimbursement in hospital expenditure: the 2018 CMDS asked the respondents who were admitted to hospitals: "How much was the total expenditure of your most recent hospitalization?" and "How much did you pay out-of-pocket for the most recent hospital care on top of those reimbursed and deducted from your individual medical saving account?". We calculated the share of health insurance reimbursement as a proportion of total hospital expenditure.

Independent variables

The use of health insurance is a major interest of this study. We assessed the pattern of health insurance usage through two indicators: type of insurance (BMIUE, BMIURR, free medical care) and insurance fund location (residential location vs. non-residential location).

Control variables

The Andersen's healthcare utilization model guided the selection of control variables in reference to previous studies (31, 33, 37, 44). The environmental factor was measured by the economic zone of migration destination classified by the Chinese government: Pearl river delta; Yangtze river delta, Circum-Bohai sea; and others. The predisposing factor was measured by gender (male vs. female), age (years), educational attainment (primary school or below, junior high school, and senior high school and above), and marital status (single, married, or cohabiting, and divorced or widowed). The enabling factor was measured by monthly per capita household income (ranked in quintile). The health needs factor was measured by self-rated health (poor, general, and good). The mobility factor was measured by the distance of migration (inter-county, inter-city, and inter-province), and years of residing in the migration destination.

Statistical analysis

The characteristics of study participants were described using frequency distributions and were compared between the BMIURR and BMIUE enrollees. The percentages of study participants hospitalized and their health insurance usage for hospital care were calculated and compared between those with

(residential) local and non-local insurance funds through Chi-square tests. Median values and interquartile ranges (IQR) of the hospital expenditure and means and standard deviations (SD) of the percentage share of insurance reimbursement in hospital expenditure were calculated and compared between those with (residential) local and non-local insurance funds by the type of insurance programs through two-sample Wilcoxon rank-sum (Mann-Whitney) tests and student *t*-tests, respectively.

Logit regression models were established: (1) for hospitalization rate using the entire sample with different types of health insurance programs; (2) for the percentage share of (residential) local hospitalization and the percentage share of insurance-subsidized hospital admissions using the sub-sample of hospitalized participants with different types of health insurance programs; (3) for the (residential) local settlement of insurance claims and the reimbursement ratio of hospital expenditure using the sub-sample of participants who were subsidized by different insurance funds for hospital care. We also performed subgroup analyses by household income (in quintiles: lowest, lower, middle, high, highest) to test the robustness of the modeling results.

The sample selection model proposed by Heckman (45) was adopted to establish the models predicting total hospital expenditure (natural logarithm transformed) and the share of insurance reimbursement in hospital expenditure. The Heckman model allowed us to use the entire sample, rather than the sub-sample of hospitalized patients, to address the endogeneity problem arising from sample selection: some unobservable confounders related to hospital admissions may be linked to the error terms of health insurance usage for hospital care in the modeling. The Heckman's approach involved two steps. A selection model was developed first.

$$\mathbf{p_i^*} = \alpha + \beta \mathbf{x_i} + \mu_\mathbf{i}, \mathbf{p_i} = \begin{cases} \mathbf{1} & \mathbf{if} \quad \mathbf{p_i^*} > \mathbf{0} \\ \mathbf{0} & \mathbf{if} \quad \mathbf{p_i^*} \leq \mathbf{0} \end{cases}$$

In the formula, $\mathbf{p}_i^*$ indicates the probability of the event occurrence (hospital admission or insurance reimbursement). $\mathbf{p_i}$ represents the observed individual behavior (hospital admission or insurance reimbursement). $\mathbf{x_i}$ refers to the independent and control variables. α is the intercept term. β is the parameters to be estimated. μ_i is the random disturbance term.

The selection model enabled the estimation of $\lambda_\mathbf{i}$, the Mills rate, which denotes the ratio of the cumulative distribution function to the density function.

The second step estimated the outcome indicators ($\mathbf{y_i}$) relating to hospital expenditure.

$$\mathbf{y_i} = \omega + \theta \mathbf{z_i} + \gamma \lambda_\mathbf{i} + \varepsilon_\mathbf{i}$$

In the formula, $\mathbf{y_i}$ represents total hospital expenditure (natural logarithm transformed), out-of-pocket payments for hospital care (natural logarithm transformed), or percentage share of insurance reimbursement in hospital expenditure. $\lambda_\mathbf{i}$ controls for the heterogeneity that leads to the sample selection bias. $\mathbf{z_i}$ refers to the independent variables and control variables, which should exclude at least one variable in $\mathbf{x_i}$ (45, 46). θ is the parameters to be estimated. ω is the intercept term.

We tested collinearity of the independent variables using variance inflation factor (VIF). A VIF value of higher than 5 or a tolerance below 0.2 is generally accepted as an indication of high multicollinearity that can negatively impact the regression model. Although none of the independent variables had a VIF exceeding 5 (Supplementary Table S1), we still established two types of modeling in line with the recommendations from Vatcheva et al. (47): one including "local fund" and "location of insurance settlement", respectively; another including both.

All analyses were performed using STATA version 16.0 (SE) for Windows (Stata Corp LLC, College Station, TX, USA). Missing values were treated through pairwise deletion. A two-sided p-value of <0.05 was considered statistical significance.

Results

Characteristics of study participants

More than half (57.08%) of the study participants who reported illness or injury were female. Most were younger than 60 years (89.73%). The vast majority received junior high school or above education (74.95%), were married or cohabiting (85.52%) at the time, self-rated general or good health (86.67%), migrated across cities or provinces (81.34%), and resided in the migration destination for more than 1 year (86.80%). Nearly four in ten migrated to the three major economic development zones in mainland China: Pearl River Delta, Yangtze River Delta, and Bohai Rim. Over 75% of study participants enrolled in BMIURR, and 70.72% enrolled in a health insurance program outside of their residential location.

Compared with the BMIUE enrollees, the BMIURR enrollees were older ($p < 0.001$), had lower education ($p < 0.001$), earned lower income ($p < 0.001$), and were more likely to migrate across counties ($p < 0.001$) but less likely to have a local insurance fund ($p < 0.001$) (Table 1).

Use of health insurance for hospital care

Almost 29% of the study participants who reported illness or injury were admitted to a hospital over the past year: 31.11% in those with a (residential) local fund compared with 27.99% in those without a local fund ($p < 0.001$). Of the hospitalized patients, 72.98% were admitted to a hospital at their migration destination; and 69.96% were subsidized by insurance funds, covering on average 47% of hospital expenditure. Again, those with a (residential) local insurance fund were more likely to be admitted locally (a gap of 19.23 percentage points, $p < 0.001$)

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TABLE 1 Characteristics of study participants ($n = 15,302$).

Variable	Coding of value	Sample size		BMIURR		BMIUE		*P*
		n	%	*n*	%	*n*	%	
Gender	0 = female	8,735	57.08	6,759	58.59	1,951	57.18	<0.001
	1 = male	6,567	42.92	4,796	41.51	41.51	46.94	
Age (years)	1 = 15–29	4,060	26.53	2,913	25.21	1,140	31.00	<0.001
	2 = 30–44	5,750	37.58	4,142	35.85	1,598	43.46	
	3 = 45–59	3,921	25.62	3,375	29.21	535	14.55	
	4 = 60 and above	1,571	10.27	1,125	9.74	404	10.99	
Educational attainment	1 = Primary school or below	3,833	25.05	3,567	30.87	261	7.10	<0.001
	2 = Junior high school	5,780	37.77	4,922	42.60	845	22.98	
	3 = Senior high school and above	5,689	37.18	3,066	26.53	2,571	69.92	
Marital status	1 = Single	1,589	10.38	1,020	8.83	565	15.37	<0.001
	2 = Married/cohabiting	13,087	85.52	10,016	86.68	3,009	81.83	
	3 = Divorced/widowed	626	4.09	519	4.49	103	2.80	
Monthly per capita household income ranking among the survey participants	1 = Lowest (<percentile 20)	4,300	28.10	3,873	33.52	420	11.42	<0.001
	2 = Lower (percentile 20–39)	3,214	21.00	2,611	22.60	591	16.07	
	3 = Middle (percentile 40–59)	2,855	18.66	2,113	18.29	734	19.96	
	4 = Higher (percentile 60–79)	2,548	16.65	1,667	14.43	861	23.42	
	5 = Highest (≥percentile 80)	2,385	15.59	1,291	11.17	1,071	29.13	
Type of health insurance	1 = BMIURR	11,555	75.51	–	–	–	–	
	2 = BMIUE	3,677	24.03	–	–	–	–	
	3 = Free medical care	70	0.46	–	–	–	–	
Local insurance	0 = No	10,821	70.72	10,021	86.72	748	20.34	<0.001
	1 = Yes	4,481	29.28	1,534	13.28	2,929	79.66	
Self-rated health	1 = Poor	2,137	13.97	1,873	16.21	253	6.88	<0.001
	2 = General	4,524	29.56	3,507	30.35	983	26.73	
	3 = Good	8,641	56.47	6,175	53.44	2,441	66.39	
Distance of migration	1 = Inter-county	2,855	18.66	2,322	20.10	521	14.17	<0.001
	2 = Inter-city	5,343	34.92	3,892	33.68	1,423	38.70	
	3 = Inter-province	7,104	46.43	5,341	46.22	1,733	47.13	
Years of residing in migration destination	1 = Below 1	2,020	13.20	1,574	13.62	443	12.05	<0.001
	2 = 1–4	5,577	36.45	4,140	35.83	1,407	38.26	
	3 = 5–9	3,843	25.11	2,842	24.60	984	26.76	
	4 = 10 and above	3,862	25.24	2,999	25.95	843	22.93	
Migration destination	1 = Pearl River Delta	1,164	7.61	780	6.75	384	10.44	<0.001
	2 = Yangtze River Delta	2,645	17.29	1,831	15.85	803	21.84	
	3 = Circum-Bohai Sea	2,021	13.21	1,258	10.89	745	20.26	
	4 = others	9,472	61.90	7,686	66.52	1,745	47.46	
Total	15,302	100.00	11,555	100.00	3,677	100.00		

BMIURR, Basic Medical Insurance for Urban and Rural Residents; BMIUE, Basic Medical Insurance for Urban Employees.

and be subsidized by insurance funds (a gap of 20.96 percentage points, $p < 0.001$) (Table 2). Similar results were found in the subgroup analyses of participants divided by household income (in quintiles) (Supplementary Table S2).

Overall, the BMIURR enrollees were less likely to be admitted to a hospital at their migration destination (70.19 vs. 81.67%), were less likely to be subsidized by insurance (64.37 vs. 84.07%), and enjoyed lower levels of insurance reimbursement (42 vs. 59%) than the BMIUE enrollees. Despite a similar level of hospitalization rate between the BMIURR and BMIUE enrollees, fund location played a different role. The BMIURR enrollees with a local fund were more likely to be hospitalized (36.90

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TABLE 2 Use of health insurance for hospital care in study participants.

Variable	Coding of value	With local insurance		With non-local insurance		Total		*P*
		n	%	*n*	%	*n*	%	
The entire sample ($n = 15,302$)								
Hospitalization	0 = No	3,087	68.89	7,792	72.01	10,879	71.10	<0.001
	1 = Yes	1,394	31.11	3,029	27.99	4,423	28.90	
Among those hospitalized ($n = 4,423$)								
Location of admitted hospital	0 = Non-residential location	193	13.85	1,002	33.08	1,195	27.02	<0.001
	1 = Residential location	1,201	86.15	2,027	66.92	3,228	72.98	
Insurance reimbursement	0 = No	201	16.90	756	37.86	957	30.04	<0.001
	1 = Yes	988	83.10	1,241	62.14	2,229	69.96	
Among those with insurance reimbursement ($n = 2,229$)								
Location of insurance settlement	0 = Non-residential location	15	1.52	743	59.87	758	34.01	<0.001
	1 = Residential location	973	98.48	498	40.13	1,471	65.99	
The BMIURR enrollees ($n = 11,555$)								
Hospitalization	0 = No	968	63.10	7,273	72.58	8,241	71.32	<0.001
	1 = Yes	566	36.90	2,748	27.42	3,314	28.68	
Among those hospitalized ($n = 3,314$)								
Location of admitted hospital	0 = Non-residential location	80	14.13	908	33.04	988	29.81	<0.001
	1 = Residential location	486	85.87	1,840	66.96	2,326	70.19	
Insurance reimbursement	0 = No	84	17.54	732	40.42	816	35.63	<0.001
	1 = Yes	395	82.46	1,079	59.58	1,474	64.37	
Among those with insurance reimbursement ($n = 1,474$)								
Location of insurance settlement	0 = Non-residential location	13	3.29	659	61.08	672	45.59	<0.001
	1 = Residential location	382	96.71	420	38.92	802	54.41	
The BMIUE enrollees ($n = 3,637$)								
Hospitalization	0 = No	2,107	71.94	479	64.04	2,586	70.33	<0.001
	1 = Yes	822	28.06	269	35.96	1,091	29.67	
Among those hospitalized ($n = 1,091$)								
Location of admitted hospital	0 = Non-residential location	111	13.50	89	33.09	200	18.33	<0.001
	1 = Residential location	711	86.50	180	66.91	891	81.67	
Insurance reimbursement	0 = No	117	16.57	24	13.41	141	15.93	0.301
	1 = Yes	589	83.43	155	86.59	744	84.07	
Among those with insurance reimbursement ($n = 744$)								
Location of insurance settlement	0 = Non-residential location	2	0.34	78	50.32	80	10.75	<0.001
	1 = Residential location	587	99.66	77	49.68	664	89.25	

BMIURR, Basic Medical Insurance for Urban and Rural Residents; BMIUE, Basic Medical Insurance for Urban Employees.

vs. 27.42%, $p < 0.001$) and subsidized by insurance (82.46 vs. 59.58%, $p < 0.001$) than those without a local fund. Whereas, the opposite held true for BMIUE enrollees: a lower hospitalization rate was found in those with a local fund (28.06 vs. 35.96%, $p < 0.001$), and no significant differences in insurance subsidies were found ($p = 0.301$) between local and non-local funds (Table 2).

Almost all (98.48%) of the insurance-subsidized patients with a (residential) local fund settled their insurance claims locally, compared with less than half (40.13%) in those without a local fund. The median total hospital expenditure reached 8,000 Yuan, with 4,000 Yuan paid out-of-pocket. Compared with the hospitalized patients without a local insurance fund, those with a local fund had lower total hospital expenditure (0.95 times, $p < 0.001$) and out-of-pocket payments (0.65 times, $p < 0.001$), and enjoyed a higher level of reimbursement ratio (a gap of 14% points, $p < 0.001$) (Tables 2, 3). Similar results were found in the subgroup analyses of participants divided by household income (in quintiles) (Supplementary Tables S2, S3).

Of those without a local fund, the BMIURR enrollees were less likely to settle insurance claims locally (38.92 vs. 49.68%), less likely to be subsidized by insurance (59.58 vs. 86.59%), and paid more out-of-pocket (4,200 vs. 3,000 Yuan) than the BMIUE

TABLE 3 Hospital expenses shared between insurance and out-of-pocket payments.

Variable	Measurement unit	With local insurance		With non-local insurance		Total		*P*
		Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	
The sub-sample of participants who were subsidized ($n = 2,186$)								
Total hospital expenditure	Yuan	7,600 (6,400)		8,000 (8,000)		8,000 (7,000)		<0.001
Out-of-pocket payments	Yuan	3,000 (3,500)		4,600 (5,500)		4,000 (5,000)		<0.001
Reimbursement ratio of hospital expenditure	%		0.55 (0.21)		0.41 (0.23)		0.47 (0.23)	<0.001
The sub-sample of participants who were subsidized by BMIURR ($n = 1,466$)								
Total hospital expenditure	Yuan	6,800 (7,900)		8,000 (7,000)		8,000 (7,100)		<0.001
Out-of-pocket payments	Yuan	3,000 (4,500)		4,800 (5,200)		4,200 (5,600)		<0.001
Reimbursement ratio of hospital expenditure	%		0.50 (0.22)		0.39 (0.22)		0.42 (0.22)	<0.001
The sub-sample of participants who were subsidized by BMIUE ($n = 711$)								
Total hospital expenditure	Yuan	8,000 (6,000)		10,000 (13,000)		8,000 (6,858)		<0.001
Out-of-pocket payments	Yuan	3,000 (3,400)		4,000 (6,000)		3,000 (3,400)		0.001
Reimbursement ratio of hospital expenditure	%		0.59 (0.19)		0.59 (0.21)		0.59 (0.20)	0.980

BMIURR, Basic Medical Insurance for Urban and Rural Residents; BMIUE, Basic Medical Insurance for Urban Employees.

enrollees, despite similar total hospital expenditure. Local funds were associated with lower total hospital expenditure (0.85 times, $p < 0.001$), lower out-of-pocket payments (0.625 times, $p < 0.001$), and higher reimbursement ratio (a gap of 11 percentage points, $p < 0.001$) in the hospitalized BMIURR enrollees. Similarly, local funds were associated with lower total hospital expenditure (0.80 times, $p < 0.001$) and lower out-of-pocket payments (0.75 times, $p = 0.001$) in the hospitalized BMUE enrollees (Tables 2, 3).

Predictors of hospitalization and use of health insurance for hospital care

Higher odds of hospitalization were found in those who were married (AOR = 4.375–6.062, 95% CI = 3.367–7.253, $p < 0.001$) and had higher educational attainment (AOR = 1.190–1.376, 95% CI = 1.073–1.549, $p < 0.01$). Whereas, lower odds of hospitalization were associated with male gender (AOR = 0.633, 95% CI = 0.585–0.684, $p < 0.001$), older age (AOR = 0.439–0.641, 95% CI = 0.387–0.754, $p < 0.001$), better self-rated health (AOR = 0.500–0.593, 95% CI = 0.444-0.670, $p < 0.001$), and longer distance of migration (AOR = 0.701–0.896, 95% CI = 0.630–0.992, $p < 0.05$). Having a local fund was a significant predictor of higher odds (AOR = 1.239, 95% CI = 1.118–1.372, $p < 0.001$) of hospitalization, although the type of insurance was not a significant predictor after adjustment for variations in other variables (Table 4). Similar results were found in the subgroup analyses of study participants divided by household income (in quintiles), although local funds were not a significant predictor of hospitalization rate in those with higher income (Supplementary Table S4a).

Higher odds of insurance subsidies were associated with older age (AOR = 1.787–2.528, 95% CI = 1.333–3.767, $p < 0.001$), and higher educational attainment (AOR = 1.409 for senior higher or above relative to primary, 95% CI = 1.079–1.839, $p < 0.05$). Whereas, lower odds of insurance subsidies were associated with good self-rated health (AOR = 0.627 relative to poor health, 95% CI = 0.467–0.843, $p < 0.01$), and longer distance of migration (AOR = 0.433–0.688, 95% CI = 0.342–0.862, $p < 0.01$). Those who had a local fund (AOR = 2.642, 95% CI = 2.108–3.310, $p < 0.001$) and enrolled in BMIUE (AOR = 1.761 relative to BMIURR, 95% CI = 1.348–2.301, $p < 0.001$) had higher odds of obtaining insurance subsidies (Table 4). Similar results were found in the subgroup analyses of study participants divided by household

TABLE 4 Health insurance use for hospital care: results of logit regression models.

Variable	Hospitalization ($n = 15,302$)				Local (residential) admission ($n = 4,423$)				Insurance reimbursement ($n = 3,186$)				Local (residential) settlement of insurance claims ($n = 2,229$)			
	OR	*P*	95% CI		OR	*P*	95% CI		OR	*P*	95% CI		OR	*P*	95% CI	
Type of health insurance (Ref: BMIURR)																
BMIUE	0.981	0.743	0.872	1.102	0.845	0.145	0.673	1.060	**1.761**	**<0.001**	**1.348**	**2.301**	**1.834**	**0.004**	**1.218**	**2.760**
Free medical care	0.823	0.495	0.471	1.439	0.408	0.084	0.147	1.128	–	–	–	–	0.299	0.251	0.038	2.349
Local fund (Ref: No)																
Yes	**1.239**	**<0.001**	**1.118**	**1.372**	3.089	<0.001	2.515	3.793	**2.642**	**<0.001**	**2.108**	**3.310**	**170.967**	**<0.001**	**95.923**	**304.722**
Gender (Ref: Female)																
Male	**0.633**	**<0.001**	**0.585**	**0.684**	0.959	0.611	0.818	1.126	1.034	0.732	0.853	1.255	1.052	0.723	0.794	1.394
Age (Ref: 15–29 years)																
30–44	**0.488**	**<0.001**	**0.440**	**0.541**	0.838	0.078	0.688	1.020	1.155	0.183	0.934	1.429	**1.649**	**0.006**	**1.152**	**2.361**
45–59	**0.439**	**<0.001**	**0.387**	**0.498**	0.858	0.226	0.670	1.099	**1.787**	**<0.001**	**1.333**	**2.396**	**1.786**	**0.011**	**1.145**	**2.786**
60 and above	**0.641**	**<0.001**	**0.545**	**0.754**	1.089	0.593	0.797	1.487	**2.528**	**<0.001**	**1.696**	**3.767**	**2.708**	**<0.001**	**1.578**	**4.648**
Educational attainment (Ref: Primary school or below)																
Junior high	**1.190**	**0.001**	**1.073**	**1.320**	1.171	0.109	0.966	1.420	1.159	0.232	0.910	1.475	0.937	0.708	0.665	1.319
≥Senior high	**1.376**	**<0.001**	**1.222**	**1.549**	1.429	0.002	1.145	1.784	**1.409**	**0.012**	**1.079**	**1.839**	1.002	>0.99	0.682	1.471
Marital status (Ref: Single)																
Married/cohabiting	**6.062**	**<0.001**	**5.067**	**7.253**	1.240	0.259	0.853	1.803	1.193	0.430	0.769	1.852	0.538	0.125	0.244	1.188
Divorced/widowed	**4.375**	**<0.001**	**3.367**	**5.685**	1.163	0.571	0.689	1.962	1.412	0.316	0.719	2.772	**0.287**	**0.017**	**0.102**	**0.803**
Monthly per capita household income ranking (Ref: Lowest)																
Lower	0.926	0.155	0.834	1.029	0.861	0.136	0.706	1.048	1.000	>0.99	0.792	1.262	1.172	0.379	0.823	1.668
Middle	0.913	0.109	0.816	1.021	0.874	0.212	0.708	1.080	1.258	0.076	0.976	1.620	0.759	0.151	0.520	1.106
Higher	0.935	0.268	0.829	1.053	1.008	0.944	0.803	1.266	1.000	>0.99	0.769	1.300	1.120	0.569	0.758	1.654
Highest	0.946	0.410	0.830	1.079	0.950	0.684	0.740	1.218	1.029	0.845	0.775	1.366	0.747	0.205	0.476	1.173
Self-rating of health (Ref: Poor)																
General	**0.500**	**<0.001**	**0.444**	**0.564**	1.350	0.006	1.091	1.671	0.833	0.223	0.620	1.118	1.068	0.724	0.740	1.542
Good	**0.593**	**<0.001**	**0.525**	**0.670**	1.739	<0.001	1.393	2.171	**0.627**	**0.002**	**0.467**	**0.843**	1.156	0.473	0.778	1.717
Distance of migration (Ref: Inter-county)																
Inter-city	**0.896**	**0.034**	**0.810**	**0.992**	0.749	0.004	0.618	0.910	**0.688**	**0.001**	**0.548**	**0.862**	**0.285**	**<0.001**	**0.215**	**0.377**
Inter-province	**0.701**	**<0.001**	**0.630**	**0.779**	0.618	<0.001	0.504	0.758	**0.433**	**<0.001**	**0.342**	**0.550**	**0.150**	**<0.001**	**0.103**	**0.218**

(Continued)

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TABLE 4 (Continued)

Variable	Hospitalization (n = 15,302)			Local (residential) admission (n = 4,423)			Insurance reimbursement (n = 3,186)			Local (residential) settlement of insurance claims (n = 2,229)		
	OR	P	95% CI	OR	P	95% CI	OR	P	95% CI	OR	P	95% CI
Years of residing in migration destination (Ref: <1)												
1–4	0.948	0.382	0.841 1.068	2.303	<0.001	1.870 2.836	0.978	0.872	0.742 1.287	0.950	0.812	0.622 1.451
5–9	0.897	0.097	0.789 1.020	2.604	<0.001	2.066 3.281	1.137	0.401	0.843 1.533	0.948	0.817	0.605 1.485
10 and above	0.916	0.195	0.801 1.046	2.420	<0.001	1.900 3.084	1.025	0.880	0.745 1.411	0.777	0.300	0.481 1.253
Migration destination (Ref: Pearl River Delta)												
Yangtze River delta	1.180	0.062	0.992 1.403	0.923	0.642	0.657 1.296	**0.652**	**0.037**	**0.437 0.974**	0.919	0.844	0.394 2.140
Circum-Bohai Sea	1.189	0.060	0.993 1.424	1.438	0.052	0.997 2.073	**0.500**	**0.001**	**0.333 0.750**	1.534	0.293	0.691 3.407
Others	1.437	<0.001	1.228 1.682	1.051	0.755	0.768 1.438	0.927	0.685	0.644 1.335	1.937	0.076	0.933 4.022
R^2		0.0665			0.0723			0.1062			0.4462	

BMIURR, Basic Medical Insurance for Urban and Rural Residents; BMIUE, Basic Medical Insurance for Urban Employees. Bold figures indicate results with statistical significance.

income (in quintiles), although BMIUE (relative to BMIURR) was only a significant predictor in those with lower or middle household income (Supplementary Table S4c).

Higher odds of (residential) local settlement on insurance claims were associated with older age (AOR = 1.649–2.708, 95% CI = 1.145-4.648, $p < 0.05$). Whereas, lower odds of local settlement on insurance claims were found in those who were divorced or widowed (AOR = 0.287 relative to single, 95% CI = 0.102–0.803, $p < 0.05$) and migrated across cities (AOR = 0.285 relative to cross-county, 95% CI = 0.215–0.377, $p < 0.001$) or across provinces (AOR = 0.150 relative to cross-county, 95% CI = 0.103–0.218, $p < 0.001$). Those who had a local fund (AOR = 170.967, 95% CI = 95.923–304.722, $p < 0.001$) and enrolled in BMIUE (AOR = 1.834 relative to BMIURR, 95% CI = 1.218–2.760, $p < 0.01$) had higher odds of settling insurance claims locally (Table 4). Similar results were found in the subgroup analyses of study participants divided by household income (in quintiles), although BMIUE (relative to BMIURR) was only a significant predictor in those with lower household income (Supplementary Table S4d).

Similar results were found in the logit modeling on hospitalization and use of health insurance for hospital care in the BMIURR enrollees (Supplementary Table S5) and the BMIUE enrollees (Supplementary Table S6).

Predictors of hospital expenditure

The Heckman two-step models revealed that BMIUE was associated with a 12.7% increase in total hospital expenditure ($p < 0.05$), a 14.7% increase in reimbursement ratio ($p < 0.001$), and a 17.1% decrease in out-of-pocket payments ($p < 0.01$) in comparison with BMIURR. Local insurance funds were associated with an 18.3% decrease in out-of-pocket payments ($p < 0.05$), despite insignificant differences in total hospital expenditure ($p = 0.124$) and reimbursement ratio ($p = 0.121$) in comparison without local insurance funds. Local settlement of insurance claims was associated with a 12.6% decrease in total hospital expenditure ($p < 0.05$), a 6.6% increase in reimbursement ratio ($p < 0.001$), and a 26.2% decrease in out-of-pocket payments ($p < 0.001$) in comparison without local settlement of insurance claims (Table 5). The subgroup analyses by household income (in quintiles) showed that BMIUE was associated with increased total hospital expenditure in those with the lower household income, increased reimbursement ratio, and decreased out-of-pocket payments in those with the lowest or the highest household income. Local funds were associated with decreased out-of-pocket payments in those with the middle household income. Local settlement of insurance claims was associated with decreased total hospital expenditure in those with the middle household income, increased reimbursement ratio, and decreased out-of-pocket

TABLE 5 The effect of health insurance: results of Heckman two-step model.

Variable	Natural logarithm of total hospital expenditure				Natural logarithm of out-of-pocket payments				Reimbursement ratio of hospital expenditure			
	Selection model (hospital admission, $n = 13,065$)		Outcome model ($n = 2,186$)		Selection model (hospital admission, $n = 13,065$)		Outcome model ($n = 2,186$)		Selection model (insurance reimbursement, $n = 3,186$)		Outcome model ($n = 2,229$)	
	Coef	*P*	Coef	*P*	Coef	*P*	Coef	*P*	Coef	*P*	Coef	*P*
Type of health insurance (Ref: BMIURR)												
BMIUE	0.020	0.625	**0.127**	**0.011**	0.020	0.625	**-0.171**	**0.005**	0.320	<0.001	**0.147**	**<0.001**
Free medical care	−0.133	0.511	0.504	0.075	−0.133	0.511	0.064	0.853	5.954	>0.99	**0.290**	**<0.001**
Local fund (Ref: no)												
Yes	0.439	<0.001	−0.096	0.124	0.439	<0.001	**−0.183**	**0.017**	0.574	<0.001	0.047	0.121
Location of insurance settlement (Ref: Non-residential location)												
Residential location			**0.126**	**0.012**			**0.262**	**<0.001**			**0.066**	**<0.001**
Gender (Ref: Female)												
Male	−0.268	<0.001	**0.145**	**0.007**	−0.268	<0.001	0.065	0.324	0.025	0.670	**0.031**	**0.004**
Age (Ref: 15–29 years)												
30–44	−0.386	<0.001	0.018	0.784	−0.386	<0.001	−0.075	0.346	0.090	0.164	**0.033**	**0.017**
45–59	−0.358	<0.001	0.100	0.185	−0.358	<0.001	−0.045	0.624	0.356	<0.001	**0.052**	**0.039**
60 and above	−0.052	0.392	0.053	0.498	−0.052	0.392	−0.120	0.211	0.549	<0.001	**0.066**	**0.050**
Educational attainment (Ref: Primary school or below)												
Junior high	0.139	<0.001	**0.166**	**0.004**	0.139	<0.001	**0.195**	**0.005**	0.094	0.202	−0.021	0.136
≥Senior high	0.270	<0.001	**0.184**	**0.007**	0.270	<0.001	**0.221**	**0.008**	0.210	0.009	−0.019	0.282
Marital status (Ref: Single)												
Married/ Cohabiting	1.010	<0.001	0.184	0.253	1.010	<0.001	0.359	0.068	0.116	0.386	**−0.062**	**0.021**
Divorced/ Widowed	0.823	<0.001	−0.084	0.628	0.823	<0.001	0.010	0.961	0.250	0.220	−0.025	0.503
Monthly per capita household income ranking (Ref: Lowest)												
Lower	−0.045	0.262	0.062	0.252	−0.045	0.262	0.041	0.539	0.002	0.982	0.002	0.912
Middle	−0.010	0.814	0.066	0.239	−0.010	0.814	0.031	0.653	0.137	0.073	0.008	0.600
Higher	−0.019	0.678	**0.120**	**0.040**	−0.019	0.678	0.127	0.075	0.011	0.890	−0.002	0.918
Highest	−0.015	0.760	**0.156**	**0.013**	−0.015	0.760	0.131	0.091	0.025	0.773	−0.002	0.919
Self-rated health (Ref: Poor)												
General	−0.341	<0.001	**−0.283**	**<0.001**	−0.341	<0.001	**−0.300**	**0.001**	−0.111	0.204	0.005	0.759
Good	−0.261	<0.001	**−0.484**	**<0.001**	−0.261	<0.001	**−0.505**	**<0.001**	−0.281	0.001	0.006	0.789
Distance of migration (Ref: Inter-county)												
Inter-city	−0.175	<0.001			−0.175	<0.001			−0.219	0.001	−0.009	0.562
Inter-province	−0.428	<0.001			−0.428	<0.001			−0.484	<0.001	−0.016	0.552
Years of residing in migration destination (Ref: <1)												
1–4	0.102	0.035			0.102	0.035			−0.010	0.909		
5–9	0.102	0.047			0.102	0.047			0.078	0.394		
10 and above	0.102	0.055			0.102	0.055			0.015	0.880		
Migration destination (Ref: Pearl River Delta)												
Yangtze River delta	0.002	0.980	**0.227**	**0.016**	0.002	0.980	**0.520**	**<0.001**	−0.256	0.037	**−0.073**	**0.007**
Circum-Bohai Sea	0.065	0.332	**0.195**	**0.039**	0.065	0.332	**0.465**	**<0.001**	−0.421	0.001	**−0.082**	**0.010**
Others	0.201	0.001	−0.041	0.652	0.201	0.001	**0.238**	**0.032**	−0.046	0.676	**−0.077**	**<0.001**
Mills	**Coef**		***P***		**Coef**		***P***		**Coef**		***P***	
λ_i	0.095		0.544		0.161		0.400		−0.009		0.937	

BMIURR, Basic Medical Insurance for Urban and Rural Residents; BMIUE, Basic Medical Insurance for Urban Employee. Bold figures indicate results with statistical significance.

payments in those with the lowest, the middle, and the highest household income (Supplementary Tables S7A–C).

Local funds and local settlement of insurance claims appeared to make a significant difference for the BMIURR enrollees (Supplementary Table S8), but not for the BMIUE enrollees (Supplementary Table S9).

Although both "local fund" and "location of insurance settlement" were significant predictors ($p < 0.05$) of total hospital expenditure, out-of-pocket payments, and reimbursement ratio of hospital expenditure when they were entered into the models separately, the effect of "local fund" became insignificant for total hospital expenditure and reimbursement ratio ($p > 0.05$) when both variables were entered into the models simultaneously (Supplementary Tables S10A–C).

Discussion

Principal findings

In this study, we found that the use of health insurance for hospital care is inadequate for internal migrants in mainland China. Overall, only about two-thirds (69.96%) of the hospitalized migrants were subsidized by insurance funds. The existence of multiple funds linked to the Hukou location has created great geographic and administrative barriers to fully realizing the benefits of the social health insurance programs. There exist significant inequalities in health insurance usage for hospital care in internal migrants in mainland China. Insurance benefits for hospital care vary by insurance funds, fund location, and where insurance claims are settled. BMIUE, local funds, and local settlement of insurance claims are associated with higher levels of health insurance usage and lower out-of-pocket payments. Longer distance of migration is a significant predictor of a lower likelihood of insurance subsidy and local settlement of insurance claims. The availability of local funds is beneficial to BMIURR enrollees, but not so much for BMIUE enrollees.

Comparisons and possible explanations

The level of use of health insurance, especially BMIURR, for hospital care was low in the insured internal migrants who reported illness or injury over the past year, despite a high hospitalization rate (28.9%). We found that <70% of the hospitalized migrants (64.37% of BMIURR enrollees) were subsidized by insurance funds, compared with an overall of 90% across all patient populations in the same year in mainland China (48). Meanwhile, only 59% of total hospital expenditure in BMIUE enrollees and 42% in BMIURR enrollees were paid by insurance funds, compared with an overall of 71.8% across all patient populations with BMIUE and 56.1% across all patient populations with BMIURR in the same year in mainland China (49). These findings provide evidence support to the concern of the government about the financial and administrative barriers for internal migrants to enjoy the benefits of social health insurance (50).

The design of the social health insurance programs presents a significant barrier for internal migrants to fully enjoy the insurance benefits. We found that the vast majority (75.51%) of internal migrants enrolled in BMIURR, and BMIURR (relative to BMIUE) is a significant predictor of lower odds of insurance subsidy, lower insurance reimbursement ratio, and higher out-of-pocket payments, despite lower total hospital expenditure. These results are consistent with the findings of previous studies (8, 19, 35–37). Compared with BMIUE, BMIURR usually has a smaller funding pool, resulting in a lower reimbursement ratio and lower use for hospital care. Although BMIURR funds cover a large number of internal migrants, the portability of fund benefits is low, which could lead to low use of insurance funds as revealed in our study and others (8, 19, 35–37).

Fund location is another significant determinant of insurance benefits. Our study showed that most (>70%) internal migrants had a fund outside of their residential location, and having a local fund is a significant predictor of health insurance usage for hospital care. Local fund is associated with higher odds of insurance subsidy, higher insurance reimbursement ratio, and lower out-of-pocket payments for BMIURR enrollees. These results are consistent with the findings of previous studies (16, 28, 51, 52). The location of funds has limited effects on BMIUE enrollees, but it makes a big difference in easing the financial burden of individual patients enrolled with BMIURR. It is important to note that there may be additional indirect costs (such as travel and loss of work income) associated with the use of non-local funds (53, 54). BMIURR enrollees without a local fund have to balance the needs of healthcare and insurance entitlements. Insurance funds often impose stricter conditions on the use of insurance for hospital services outside of the fund location. For example, the expenses have to incur in the designated hospitals (28). Meanwhile, higher levels of deductibles and co-payment requirements are set up to discourage the use of insurance funds for hospital care outside of the fund location (42, 54). Previous studies have shown that many internal migrants could not get their hospital expenditure reimbursed because their hospital care was not covered by their insurance funds; it was too inconvenient to travel to settle insurance claims; and the reimbursement procedure was too complex to navigate (31, 55–58). However, traveling to the fund location for hospital care is not necessarily a cheaper option. A previous study estimated that travel costs and income loss account for 27–35% of the total costs of internal migrants in China who sought hospital care outside of their residential location (56).

The Chinese government initiated the on-the-spot settlement of medical bills to address the above-mentioned

dilemma (59–61). However, the policy mainly targets relocated retirees and migrated long-term residents. BMIUE enrollees usually have higher access to on-the-spot settlement facilities than BMIURR enrollees, although BMIURR enrollees are those most in need of such facilities as indicated by the findings of our study. We found that local settlement on insurance claims is associated with lower hospital expenditure and lower out-of-pocket payments of the hospitalized BMIURR enrollees. These results are consistent with the findings of previous studies (17). On-the-spot settlement of hospital bills also reduces the deposit payments required, simplifies the procedure of insurance claims, and minimizes travel costs (62). However, the vast majority of internal migrants are covered by BMIURR and have difficulties accessing the already limited on-the-spot settlement facilities. By the end of June 2018, a total of 10,015 medical institutions participated in the cross-provincial on-the-spot insurance settlement program in China, with an average of only 2,491 claims settled on-the-spot per day (63). The lack of interconnections among the provincial information platforms adds an additional layer of obstacles to the on-the-spot settlement initiative (64).

We found that age, gender, educational attainment, income, self-rated health, and marital status are significant predictors of health insurance usage for hospital care. Older age is associated with a higher likelihood of insurance subsidy and local settlement of insurance claims, and a higher reimbursement ratio from insurance funds. Male gender is associated with higher total hospital expenditure and higher insurance reimbursement ratio. Higher levels of educational attainment are associated with a higher likelihood of insurance subsidy, and higher total hospital expenditure and out-of-pocket payments. Higher income is associated with higher total hospital expenditure. Good self-rated health is associated with a lower likelihood of insurance subsidy, but lower total hospital expenditure and out-of-pocket payments. Divorce or widowhood is associated with a lower likelihood of local settlement of insurance claims, but a higher insurance reimbursement ratio. These results are consistent with the findings of previous studies (30, 31) and align well with Andersen's model.

Distance of migration is another significant predictor of health insurance usage for hospital care. We found that a longer distance of migration is associated with lower odds of insurance subsidy and lower odds of local settlement on insurance claims. A previous study found that internal migrants may forfeit insurance entitlements due to the need for long-distance travel (65). These provide additional evidence to support the importance of addressing the geographic and administrative barriers for internal migrants to enjoy health insurance benefits (66). Internal migrants, in particular those who travel long-distance, may face challenges to navigate through the local health system and policies in their migration destination.

Strengths and weaknesses of the study

This study has several strengths. The dataset used in this study was derived from a nationally representative survey of internal migrants. This is the first study systematically analyzing the association between health insurance design and the use of health insurance for hospital care among internal migrants in mainland China.

There are several limitations in this study. It was focused on the use of social health insurance for hospital care only. Data were collected through self-report, which is subject to recall bias. The cross-sectional design of this study prevents us from drawing any causal conclusions. The analyses did not distinguish between rural-to-urban and urban-to-urban migrants, although the vast majority of internal migrants flew from rural to urban. Apart from self-rated health, data measuring illness severity were not available. Further studies should expand the scope of outcome indicators and examine fund transaction records.

Conclusion

Health insurance usage for hospital care for internal migrants in mainland China is inadequate, especially for those enrolled in BMIURR. The design of the current social insurance health programs cannot meet the needs of internal migrants. The existence of multiple funds linked to the Hukou location has created great geographic and administrative barriers to fully realizing the benefits of the social health insurance programs. The governmental initiative to allow the transfer of insurance funds and settle insurance claims on-the-spot represents a promising effort. However, the intended outcomes of such an effort can be jeopardized by the low level of the funding pool and the need to contain insurance costs. Meanwhile, there exist significant inequalities in health insurance usage for hospital care in internal migrants in mainland China across and within insurance funds. The gap between BMIUE and BMIURR remains to be a great concern. Increasing policy attention need to be paid to fund location and costs of claim settlement, in particular for those enrolled in BMIURR.

To improve health insurance usage for hospital care, internal migrants need to be empowered. The complicated healthcare and health insurance systems are very difficult to navigate. Adding to the complexity are the variations in insurance policies across regions and across funds. Higher levels of awareness of insurance fund transferability and on-the-spot settlement systems for hospital bills need to be ensured.

Although the fundamental solution for an effective and equitable insurance system rests on expanded funding pools (at higher levels) and better integration of insurance policies, governments, employers, and consumers all play an important role in improving the current system. The BMIURR programs should be prioritized for fund portability and on-the-spot

claim settlement initiatives. More health facilities should be encouraged to participate in the on-the-spot settlement program through policy incentives supported by interconnected information platforms.

Data availability statement

The datasets used in this study are publicly available and can be accessed *via* Migrant Population Service Center, National Health Commission of China. Requests to access these datasets should be directed to https://www.chinaldrk.org.cn/wjw/#/home.

Ethics statement

As this study was a secondary analysis of de-identified data collected by the government, ethics approval has been exempted. The 2018 China Migrants Dynamic Survey was approved by the China National Bureau of Statistics (No. Guotongzhi [2018] No. 45), and written informed consent was obtained from all participants at the time of data collection. The use of the data for this study was approved by the Migrant Population Service Centre, National Health Commission of China. All procedures performed in this study were in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Author contributions

QY contributed to the study design, data analyses, and drafting of the manuscript. HL contributed to data analyses, data interpretation, and drafting of the manuscript. CL contributed to the interpretation of the results and writing of the manuscript. All authors have read and approved the final version of the manuscript.

Funding

The study was funded by the National Natural Science Foundation of China (72174149 and 71603188), Humanity, and Social Science Foundation from the Ministry of Education of China (21YJAZH102), and the Key Research Institute Project of Humanity and Social Science of the Ministry of Education of China (1203-413100050).

Acknowledgments

We would like to thank all of the participants in the research.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1008720/full#supplementary-material

References

1. He X, Shi S. The impact of population mobility on regional economic growth: an empirical analysis based on panel data of prefecture-level cities in China. *J Finan Econ.* (2021) 3:63–70. doi: 10.19622/j.cnki.cn36-1005/f.2021.03.008

2. Shi G, Li Z. Research on the mechanism of population mobility promoting regional economic growth: based on panel data of the Yangtze River delta urban agglomeration. *East China Econ Manag.* (2020) 34:10–8. doi: 10.19629/j.cnki.34-1014/f.191125008

3. Zhang Z, Yang S. A review on the concepts, data and fields of floating population research. *Chin J Popul Sci.* (2013) 6:102–12.

4. Wang P. *The Total Population Has Maintained Growth and the Level of Urbanization Has Been Steadily Improved.* China Economic Net (2022). Available from: http://www.ce.cn/xwzx/gnsz/gdxw/202201/18/t20220118_37264987.shtml (accessed July 24, 2022).

5. Wang J, Zheng J, Wang P, Qi L. Migration and health in China: bridging the gaps in policy aims and the reality of medical services to migrants. *J Public Administr.* (2014) 9:29–45. doi: 10.3969/j.issn.1674-2486.2014.04.002

6. Website CNS. *China's Floating Population Exceeds 240 Million and How Access to Health Services Improves English Translation.* (2019). Available from: https://baijiahao.baidu.com/s?id=1652269305128071421&wfr=spider&for=pc (accessed July 24, 2022).

7. Zhang X. A study on the heterogeneity of multidimensional poverty in difficult families. *Stat Decis.* (2021) 37:78–81. doi: 10.13546/j.cnki.tjyjc.2021.04.017

8. Fan X. The health conditions and problems of the migrant population and countermeasures. *Macroecon Manag.* (2019) 42–7. doi: 10.19709/j.cnki.11-3199/f.2019.04.010

9. Yang J. Double-dual property of Hukou system and social integration of internal migrants in the context of new-blueprint urbanization in China. *J Renmin Univ China.* (2017) 31:119–28. doi: 10.3969/j.issn.1000-5420.2017.04.013

10. Niu J, Zheng Z, Zhang L, Zeng X. Labor migrants' working and living environments and the related health impacts—Evidences from Shenzhen. *Popul Res.* (2011) 35:64–75.

11. Baker DW, Sudano JJ, Albert JM, Borawski EA, Dor A. Lack of health insurance and decline in overall health in late middle age. *N Engl J Med.* (2001) 345:2887. doi: 10.1056/NEJMsa002887

12. Arrow KJ. Uncertainty and the welfare economics of medical care. *Bull World Health Organ.* (2004) 82:141–9.

13. Cai X, Yang F, Bian Y. Gap analysis on hospitalized health service utilization in floating population covered by different medical insurances ——Case Study from Jiangsu Province, China. *Int J Equity Health.* (2019) 18:84. doi: 10.1186/s12939-019-0992-4

14. Pan L, Wang C, Cao X, Zhu H, Luo L. Unmet healthcare needs and their determining factors among unwell migrants: a comparative study in Shanghai. *Int J Environ Res Public Health.* (2022) 19:5499. doi: 10.3390/ijerph19095499

15. Feng G, Qian N, Qu C, Zhang Y. The impact of medical insurance models on the accessibility of medical and health services among the migrating population. *J Dalian Univ Technol.* (2017) 38:144–50. doi: 10.19525/j.issn1008-407x.2017.01.022

16. Meng Y, Han J. The impact of medical insurance on the health service utilization of the floating population: empirical analysis based on the 2017 China migrants dynamic survey. *Chin J Popul Sci.* (2019) 5:110.

17. Zhang X, Zhang L. The impact of instant reimbursement of cross-regional medical services on hospitalization costs incurred by the floating population-evidence from China. *Healthcare.* (2022) 10:1099. doi: 10.3390/healthcare10061099

18. Chen S, Zhang Q, Yang D, Wang J, Chen M. Analysis on health service utilization and influencing factors of the young migrants in Guangdong Province. *Chinese Health Econ.* (2020) 39:77–81. doi: 10.7664/CHE20200918

19. Zhang F, Shi X, Zhou Y. The impact of health insurance on healthcare utilization by migrant workers in China. *Int J Environ Res Public Health.* (2020) 17:1852. doi: 10.3390/ijerph17061852

20. Lu X. Studying on the influence of medical insurance on health service utilization of floating elderly people based on counterfactual estimation of propensity score matching method. *Chin Health Serv Manag.* (2019) 36:657–60.

21. Tang D, Wang J. Basic public health service utilization by internal older adult migrants in China. *Int J Environ Res Public Health.* (2021) 18:270. doi: 10.3390/ijerph18010270

22. Wang X, Jianbo L, Yang Y. Status and influencing factors of receiving health education and personal health record establishment among elderly migrant population in China. *Chinese J Public Health.* (2021) 37:203–8. doi: 10.11847/zgggws1128961

23. Yan Q, Tong L. Utilization of basic public health services and its influence factors among young migrants. *Chinese J Public Health.* (2019) 35:680–4. doi: 10.11847/zgggws1119401

24. Ward L, Franks P. Changes in health care expenditure associated with gaining or losing health insurance. *Ann Intern Med.* (2007) 146:768–74. doi: 10.7326/0003-4819-146-11-200706050-00005

25. Wagstaff A, Lindelow M. Can insurance increase financial risk? The Curious Case of Health Insurance in China. *J Health Econ.* (2008) 27:990–1005. doi: 10.1016/j.jhealeco.2008.02.002

26. Zhou L, Zhu Z. A Study on the decision of medical insurance on the part of floating population and its impact on medical expenditures. *J Nanjing Audit Univ.* (2017) 4:66–75.

27. Wang C. The Effective coverage rate and distribution character-istics of China's basic medical insurance: analysis based on multi-source data. *Chinese Soc Sec Rev.* (2020) 4:67–84.

28. Meng Y, Zhang X, Wang J. "Lock-in" and "Pull-Back" : the lmpact of medical lnsurance on the residence lntention of floating population. *J Northeast Univ.* (2021) 23:67–75. doi: 10.15936/j.cnki.1008-3758.2021.04.009

29. Ma C, Zhang Y, Li Y, Wang Y, Jiang Y, Wang X, et al. Healthcare, insurance, and medical expenditure of the floating population in Beijing, China. *Front Public Health.* (2020) 8:375. doi: 10.3389/fpubh.2020.00375

30. Guo J, Zhou Q, Weng H, Wu Y. Analysis on multilevel logistic regression model of the utilization of health services for migrant population and influencing factors. *Chinese Health Econ.* (2015) 34:50–2. doi: 10.7664/CHE20150314

31. Yin Q, Xu Q, Zheng Y. Status and influencing factors of hospitalization service utilization among migrant population. *Chinese J Public Health.* (2017) 33:448–51. doi: 10.11847/zgggws2017-33-03-28

32. Zhou Q, Liu G. The difference of benefits from health insurance: based on the study of the local population and migrants. *Nankai Econ Stud.* (2016) 1:77–94. doi: 10.14116/j.nkes.2016.01.005

33. Gao J, Chu D, Ye T, Gong D. Empirical analysis of beneficial equality of the basic medical insurance for migrants in China. *Discrete Dyn Nat Soc.* (2021) 2021:1–11. doi: 10.1155/2021/7708605

34. Hao Y, Zhou J, Zhang J. Public health insurance, urbanization and rural-to-urban migrants' consumption. *Comp Econ Soc Syst.* (2022) 1:91–104. doi: 10.3969/j.issn.1003-3947.2022.01.010

35. Zhou Y, Huang Y. Can the basic medical insurance system improve the relative inequality of migrant workers? *Finan Econ.* (2021) 84–97. doi: 10.3969/j.issn.1000-8306.2021.10.008

36. Jiang H. Medical insurance and medical service utilization of floating population—Based on dynamic monitoring data of national floating population. *World Surv Res.* (2016) 7:14–20. doi: 10.13778/j.cnki.11-3705/c.2016.07.003

37. Li J, Huang Y, Nicholas S, Wang J. China's new cooperative medical scheme's impact on the medical expenses of elderly rural migrants. *Int J Environ Res Public Health.* (2019) 16:4953. doi: 10.3390/ijerph16244953

38. Migrant Population Service Center. *The 2018 China Migrants Dynamic Survey Technical Document.* National Health Commission P.R.China (2018). Available from: https://www.chinaldrk.org.cn/wjw/#/home (accessed July 24, 2022).

39. Li Y, Lu S. A Review of the development of the Anderson model's theoretical construction and analysis path. *Chinese Health Serv Manag.* (2017) 34:324–7+334.

40. Li Y, Lu S. The development, application and implications of the Anderson model in the field of healthcare. *Chinese J Health Policy.* (2017) 10:77–82. doi: 10.3969/j.issn.1674-2982.2017.11.013

41. Yao Q, Liu C, Sun J. Inequality in health services for internal migrants in China: A National Cross-Sectional Study on the Role of Fund Location of Social Health Insurance. *Int J Environ Res Public Health.* (2020) 17:6327. doi: 10.3390/ijerph17176327

42. People's Government of Anhui Provincial. *Policy Interpretation of Anhui Province Unified Basic Medical Insurance and Serious Disease Insurance Guarantee Treatment Plan (Trial).* (2019). Available from: https://www.ah.gov.cn/public/1681/7977961.html?ivk_sa=1024320u (accessed July 24, 2022).

43. Zhang L. The strategy and path of the "instant reimbursement of cross-provincial outpatient expenses": taking "Yangtze River Delta" region as an example. *Nanjing J Soc Sci.* (2021) 6:70–7. doi: 10.15937/j.cnki.issn1001-8263.2021.06.009

44. Zhu M, Shi X. The impact of medical insurance coverage on migrant population's catastrophic health expenditure. *Chin J Popul Sci.* (2016) 6:47–57.

45. Heckman JJ. Sample selection bias as a specification error. *Econometrica.* (1979) 47:153–61. doi: 10.2307/1912352

46. Tan Y, Lu Q. Risk Aversion, social learning and farmer's adoption of modern irrigation technology: an empirical analysis by heckman sample selection model. *Resourc Environ Yangtze Basin.* (2021) 30:234–45. doi: 10.11870/cjlyzyyhj202101022

47. Vatcheva KP, Lee M, McCormick JB, Rahbar MH. Multicollinearity in regression analyses conducted in epidemiologic studies. *Epidemiology.* (2016) 6:227. doi: 10.4172/2161-1165.1000227

48. National Center for Health Statistics. *The Report of National Health Service Survey in China, 2018.* Beijing: People's Medical Publishing House (2021).

49. National Healthcare Security Administration. *Statistical Bulletin on the Development of National Basic Medical Insurance.* (2018). Available from: http://www.nhsa.gov.cn/art/2019/6/30/art_7_1477.html (accessed July 24, 2022).

50. Qin X, Pan J, Liu GG. Does participating in health insurance benefit the migrant workers in China? An empirical investigation China. *Econ Rev.* (2014) 30:263–78. doi: 10.1016/j.chieco.2014.07.009

51. Yao Q, Chen A. Influencing paths of medical insurance enrollment location on the health conditions of elderly migrants in China: based on data from 2015 China migrants dynamic survey. *Chinese J Health Policy.* (2022) 15:57–63. doi: 10.3969/j.issn.1674-2982.2022.01.008

52. Bai L, Gu H, A. Study on the influence of the difference of medical insurance participating areas on the healthcare utilization of the elderly floating population under the background of medical settlement in different places. *Lanzhou Acad J.* (2021) 5:181–96. doi: 10.3969/j.issn.1005-3492.2021.05.013

53. Zhong H. Effect of patient reimbursement method on health-care utilization: evidence from China. *J Health Econ.* (2011) 20:1312–29. doi: 10.1002/hec.1670

54. Qiu F, Liu J, Zhan HJ. Migration and health—Freedom of movement and social benefits for Chinese migrant workers. *Sustainabilit.y.* (2021) 13:12371. doi: 10.3390/su132212371

55. Guo L, Bao Y, Liu X, Nie H, Sun W, Dai H. Analysis of quality of utilizing basic medical services by floating population in Shanghai. *J Shanghai Jiaotong Univ.* (2016) 36:105–9. doi: 10.3969/j.issn.1674-8115.2016.01.021

56. Tang Z. Intergenerational comparison of migrant workers' choice of public medical services—Based on the data of the 2014 National Floating Population Dynamic Monitoring Survey in Jiangsu, Shanghai and Zhejiang Provinces. *Jiangsu Soc Sci.* (2018) 3:117–23. doi: 10.13858/j.cnki.cn32-1312/c.2018.03.016

57. Tang Z. Intergenerational comparison of migrant workers' participation in medical insurance and their choice of medical treatment behavior——Based on the Data of the 2014 National Floating Population Health and Family Planning Dynamic Monitoring Survey in Nine Eastern Provinces and Cities. *Soc Sci Guangdong.* (2018) 1:210–7. doi: 10.3969/j.issn.1000-114X.2018.01.023

58. Qian Z, Lin S, Hou Z. Significantly improving local hospitalization rate of migrants under urban basic medical insurance: based on the evidence of national migrant dynamic supervision survey 2014. *Chinese Health Econ.* (2016) 35:44–6. doi: 10.7664/CHE20160912

59. National Healthcare Security Administration. *Notice on Further Carry out on-the-Spot Settlements of Medical Bills for across-Provincial Medical Treatment.* (2022). Available from: http://www.nhsa.gov.cn/art/2022/7/26/art_104_8629.html (accessed July 24, 2022).

60. Ministry of Human Resources and Social Security of the People's Republic of China. *Notice on Enabling on-the-Spot Settlements of Medical Bills for across-Provincial Medical Treatment.* (2016). Available from: http://www.mohrss.gov.cn/SYrlzyhshbzb/shehuibaozhang/zcwj/201612/t20161215_262040.html (accessed July 24, 2022).

61. Ministry of Human Resources and Social Security of the People's Republic of China. *Notice on Carry out on-the-Spot Settlements of Medical Bills for across-Provincial Medical Treatment.* (2017). Available from: http://www.mohrss.gov.cn/SYrlzyhshbzb/shehuibaozhang/zcwj/yiliao/201801/t20180108_286172.html (accessed July 24, 2022).

62. Zhen C, Wei J, Wan H, Zhao G. Reengineering and practice of direct settlement process of nonlocal hospitalization bills. *Chinese Hosp Manag.* (2019) 39:56–8.

63. National Healthcare Security Administration. *Public Service Information Release of Basic Medical Insurance for Cross-Provincial Medical Treatment in Different Places (the First Issue).* (2018). Available from: http://www.nhsa.gov.cn/art/2018/8/15/art_114_7166.html (accessed July 24, 2022).

64. Pan Y, Chen S, Chen M, Zhang P, Long Q, Xiang L, et al. Disparity in reimbursement for tuberculosis care among different health insurance schemes: evidence from three counties in central China. *Infect Dis Poverty.* (2016) 5:46–54. doi: 10.1186/s40249-016-0102-4

65. Wang H, Liang D, Zhang D, Hou Z. How does domestic migration pose a challenge in achieving equitable social health insurance benefits in China? A National Cross-Sectional Study. *BMJ Open.* (2022) 12:e060551. doi: 10.1136/bmjopen-2021-060551

66. Li H, Yang J. Regional disparities of medical insurance of urban employees of migrants. *Popul Soc.* (2017) 33:3–12. doi: 10.14132/j.2095-7963.2017.03.001

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 04 January 2023
DOI 10.3389/fpubh.2022.1030323

OPEN ACCESS

EDITED BY
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SPECIALTY SECTION
This article was submitted to
Public Health Policy,
a section of the journal
Frontiers in Public Health

RECEIVED 28 August 2022
ACCEPTED 06 December 2022
PUBLISHED 04 January 2023

CITATION
Zhang H, Wu Y, Sun W, Li W, Huang X, Sun T, Wu M, Huang Z and Chen S (2023) How does people-centered integrated care in medical alliance in China promote the continuity of healthcare for internal migrants: The moderating role of respect.
Front. Public Health 10:1030323.
doi: 10.3389/fpubh.2022.1030323

How does people-centered integrated care in medical alliance in China promote the continuity of healthcare for internal migrants: The moderating role of respect

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Background: Continuity is crucial to the health care of the internal migrant population and urgently needs improvements in China. Chinese government is committed to promoting healthcare continuity by improving the people-centered integrated care (PCIC) model in medical alliances. However, little is known about the driving mechanisms for continuity.

Methods: We created the questionnaire for this study by processes of a literature research, telephone interviews, two rounds of Delphi consultation. Based on the combination of quota sampling and judgment sampling, we collected 765 valid questionnaires from developed region and developing region in Zhejiang Province. Structural equation models were used to examined whether the attributes of PCIC (namely coordination, comprehensiveness, and accessibility of health care) associated with continuity, and explored the moderated mediating role of respect.

Results: The result of SEM indicated that coordination had direct effect on continuity, and also had mediating effect on continuity via comprehensiveness and accessibility. The hierarchical linear regression analysis showed that the interactive items of coordination and respect had a positive effect on the comprehensiveness ($\beta = 0.132$), indicating that respect has positive moderating effect on the relationship between coordination and comprehensiveness. The simple slope test indicated that in the developed region, coordination had a significant effect on comprehensiveness for both high respect group($\beta = 0.678$) and low respect group ($\beta = 0.508$). The moderated mediation index was statistically significant in developed areas($\beta = 0.091$), indicating that respect had moderated mediating effect on the relationship between coordination and continuity via comprehensiveness of healthcare in the developed region; however, the moderated mediation effect was not significant in the developing region.

Conclusion: Such regional differences of the continuity promoting mechanism deserve the attention of policy-makers. Governments and health authorities should encourage continuity of healthcare for migrants through improving the elements of PCIC—coordination, comprehensiveness and

accessibility of healthcare, shaping medical professionalism of indiscriminate respect, and empowering migrants to have more autonomy over selection of services and decisions about their health.

KEYWORDS

continuity, people-centered integrated care, medical alliance, China, internal migrant

1. Introduction

Internal migration is defined as human movement within a geopolitical unity. It is a common phenomenon in Europe, the US, and China (1). Evidence shown that internal migration could contribute to poverty reduction, achievements of the Millennium Development Goals (MDGs) and economic growth in developing countries (2). China, the largest developing country, seems to have the most extensive internal migration today (3). As a result of China's reform and opening-up, millions of Chinese farmers have migrated from their home villages and towns to cities that formed one of the largest internal migrations in recent Chinese history (4, 5). According to China's seventh national census, by the end of 2020, internal migrants amounted to 375.82 million, roughly 26.58% of the total population in China, which is considerably larger than most other social groups (6). Internal migration is considered a critical driving force in many sectors including agriculture, manufacturing, construction and services, thus the health of the migrants underpins the productivity of these sectors.

Evidence from internal migration in China revealed that these migrants risk multiple health problem, and continuity of healthcare may provide a crucial solution of the issue. Facing a different set of stressors from non-migrants, such as high-frequency relocation, high risks, low social economic status, and information isolation, the migrants are vulnerable to a wide range of health risks, including communicable and sexually transmitted diseases, occupational injuries and diseases, regeneration health problem and high maternal mortality (7, 8). There is a huge challenge to improve the migrants' health condition, fortunately, previous studies proposed that continuity of healthcare could optimize the health outcomes of migrants. Continuity of healthcare refers to the degree to which a series of discrete healthcare events are experienced as coherent and connected and consistent with the patient's healthcare needs and personal context (9). Continuity may overcome the challenges posed by migration, such as poor communication, information isolation, fragmented treatment and public healthcare (10). There are three aspects of continuity that includes relationship, management, and information. any aspect of continuity, regardless of the situation, can enhance the standard of care (9).

However, the continuity of healthcare for internal migrants calls for significant improvements in China, Firstly, the management continuity of internal migrants, such as the continuous public healthcare and medical service management, is relatively poor. For instance, in the past 20 years, the average full-dose coverage for tuberculosis, diphtheria, pertussis, tetanus, poliomyelitis, measles, and hepatitis B in the immigrant children was estimated to be $< 60\%$ in the Pearl River Delta region of Guangdong Province, much lower than their non-migrants counterparts (11). Secondly, the relationship continuity with healthcare provider for internal migrants is unsatisfactory. Zeng et al. proposed that migrants considered healthcare professionals from primary care institutions in their hometown to be more knowledgeable about their health situation, which corroborated that the patient-doctor relationship continuity should be improved in migrants' destinations (12). Zheng et al. also suggested that to improve the relationship of family physicians and internal migrants is an tough issue to face (13). Thirdly, the informational continuity of internal migrants is insufficient. Multiple internal migration management departments collect migrants' health information according to their specific management needs, without centralized platform to consolidate the information, resulting in the lack of continuous and consistent information needed in medical services and public healthcare (14).

In order to improve the continuity of healthcare, the Chinese government has been committed to establishing medical alliances for providing people-centered integrated care (PCIC). Evidence shown that the poor healthcare continuity for the migrants, on the one hand, caused by common characteristics of migration such as relocation, isolation and marginalization (15); and on the other hand, the fragmentation of healthcare (16). Deborah Schra (17), Anthony Shih (18) and other scholars all believed that the root cause of the overall poor performance of the healthcare system is fragmentation. To deal with the issue, a PCIC model in medical alliances has been developed in China. PCIC, which was promoted by WHO and jointly advocated by many health systems worldwide, refers to an innovative mode of integrated healthcare around the health needs of population (19). According to the PCIC frame proposed by WHO, the two core approaches of PCIC are the integration and the people-centeredness (20). First of all, an organizational integration of different providers with measures of multidisciplinary coordination, multiple resources accessibility, comprehensive services providing, ect., may provide the bedrock of integrate for PCIC (21). Meanwhile, people-centeredness with a focus

on responsiveness, that consciously adopts the individuals' as participants in, and beneficiaries of, trusted health systems, is another key approach of PCIC (20, 22). Respect is regarded as an important dimension of responsiveness which may play a key role for vulnerable groups welfare (23). In China, the medical alliance had been the main platform of PCIC, making effort to improve coordination, comprehensiveness, accessibility and respect, it may have some effect on continuity of healthcare for migrants.

Nowadays, China has taken steps in practicing PCIC in medical alliance. In the years of 2013, the Chinese Health Work Conference formally proposed to explore the establishment of medical alliances, from then on, medical alliances began to blossom across China (23). By 2021, more than 15,000 medical alliances had been established in 205 cities or counties (24). Above of all, these medical alliances were formed by tertiary hospitals, secondary hospitals, and primary institutions, with the horizontal or vertical integration measures of multidisciplinary collaboration, two-way referral, remote medical consultation (25), ect., Luohu, Anhui, Beijing and Zhejiang are typical mature medical alliances (24). Besides, a range of comprehensive services have been provided by multiple providers, with a combination of diagnosis, treatment, nursing, precausion, propaganda, and other services to provide diverse physical, psychological and social support. For instance, the chronic disease joint clinic in medical alliances of Hangzhou City provide a strong example of such integration (26). Meanwhile, individuals have had access to optimized devices, tests and examinations previously scarce at the primary institutions, through inter-institution sharing of resources and information; as well as access to better services by the down-allocation of skilled health personnel from hospitals to primary institutions (27, 28). In addition, respect have also been a part of the PCIC practicing in medical alliances, which establish face-to-face communication channels or online communication platforms to enhance provider-demander interaction and foster shared decision-making (10).

It seems that continuity of healthcare for migrants has been improved with the practice of PCIC in medical alliances, however, the mechanism behind it is unclear. For instance, in 2017, the Ganzhou Fifth People's Hospital Medical Alliance carried out promotion and education on standardized diagnosis and treatment of tuberculosis, resulting in 30% increase in the early detection rate of tuberculosis (29). Similarly, full-dose coverage of vaccination among children of migrant workers increased from 54.28 to 95.21% as a result of health education and follow-up services provided by community healthcare institutions in Beijing (30). The experience of Baoshan Community in Shanghai has proven that the diabetes care home model can effectively enhance health awareness, treatment follow-through and quality of life of diabetic patients among migrants (31). Previous studies proposed that the PCIC may improve continuity of healthcare for migrants (32, 33). We assume that, when accepting healthcare in medical alliances, migrants would have access to consistent medical services, well-connected information, long-term healthcare programs, trusting doctor-patient relationships, however, this assumption requires further verification. Getting insights into the factors contribute to the continuity of healthcare for migrants in the medical alliances context, may ultimately enhance the health status of migrants, and consequently improve social productivity. In this study, we measured the continuity of healthcare among migrants in Zhejiang, China, and analyzed the mechanism driving the continuity of healthcare, by PCIC in medical alliances., Our specific research questions were as follows: (1) What is the influential mechanism of the integration approach–coordination, comprehensiveness and accessibility on continuity? And, (2) what is the influential mechanism of the people-centredness approach–respect on the continuity?

2. Theoretical basis

2.1. Coordination of healthcare and continuity of healthcare

Coordination of healthcare means a proactive approach to bringing together care professionals and providers, to meet the needs of service users, to ensure that they receive integrated, person-focused care across various settings (10, 34). Recent studies suggest that coordination may influence continuity. For instance, Kuang proposed that coordination ensures that the general practice system to be an open and cooperative system, which establishes organic connection with the secondary and tertiary medical systems and other social service systems, so that patients can smoothly receive continuous diagnosis and treatments provided by different providers to reduce fragmented care and improve continuity (35). Wang proposed that the management of care components in accordance with the patient's demands throughout time and the development of dependable communication channels to support continuity are related to the coordination by the care team (36). Given that numerous empirical research have shown a connection between coordination of healthcare and continuity of healthcare, we propose the following hypothesis.

Hypothesis 1. Coordination of healthcare is positively related to continuity of healthcare.

2.2. The mediating roles of comprehensiveness of healthcare between coordination and continuity

Comprehensiveness of healthcare is refer to the degree to which the healthcare providers understand and address

the vast majority of their physical and common mental healthcare needs, including medical treatment, prevention and health propaganda of acute, chronic, and comorbid conditions (37). Previous studies shown that improved coordination is linked to comprehensiveness, presumably through information sharing, provider communication, and provider cooperation to develop a comprehensive healthcare plan (38). For instance, coordination might be necessary for who have multiple diseases because they usually have complex healthcare needs and require services from different providers (39). Evidence proved that coordination could help patients with multiple chronic diseases in accessing thorough and prompt healthcare services (40). Additionally, collaboration among healthcare professionals that could coordinate the comprehensive healthcare needs of individuals and avoid undertreatment of illnesses while solving competing of different providers (41).

In addition, comprehensiveness is positively related to continuity. Comprehensiveness strives to enhance health outcomes while effectively utilizing healthcare resources by enhancing the quality and continuity of healthcare (42). For instance, a family physician's role as a "gatekeeper" provides an choice for comprehensive care, so that individuals have to visit their doctors several times a year for multiple healthcare needs, which offer opportunities over time for increasing interpersonal continuity through communication (43). Kuang also proposed that general practitioners can implement comprehensiveness of healthcare integrating therapeutic and preventive services so that provide the basis for continuity in health management (44).

Integrating these findings, coordination of healthcare could positively influence continuity of healthcare through comprehensiveness of healthcare. In addition, the following hypotheses are proposed by this study:

Hypothesis 2. Coordination of healthcare has positive effects on comprehensiveness of healthcare.

Hypothesis 3. Comprehensiveness of healthcare has positive effects on continuity of healthcare.

2.3. The mediating roles of accessibility of healthcare between coordination and continuity

Access is the chance to recognize healthcare requirements, seek out healthcare services, locate, receive, or utilize healthcare services, as well as to actually have those needs met (45). Prior research has suggested that coordination of healthcare, which calls for collaboration from management, professionals, and society, can have positive effects on accessibility (46). For instance, Chandni proposed that interprofessional collaboration have a positive impact on individuals' accessibility of healthcare through culturally appropriate information so that led to better understanding and increased utilization of healthcare services (47). Yao et al. found that coordination of healthcare institutions, which encourage hospitals to support primary institutions with healthcare resources and collaborative health program may enable residents to gain high-quality healthcare equipment in grass-root from the higher level hospital and get the consultation of senior specialists (48).

In addition, evidence also proved that accessibility are prerequisite for continuity. Kuang et al. proposed that accessibility guarantees first contact which promote long-term stable doctor-patient relationship and the resulting mutual trust and cooperation (49). Li also proposed that interprofessional collaboration and two-way referral enable patients gain access to the green channel provided by hospital, so that reduce the segments of waiting time, and promote coherent information and health services (50). Gulnaz et al. proposed that poor continuity is usually associated with missing the opportunities for health promotion and disease prevention (51).

Meanwhile, there are also researches proved that accessibility can promote comprehensiveness as well. According to Brennan et al., in the care of heart disease, well-coordinated team may improve patients' access to multidisciplinary specialists, ehabilitation equipment, nutrition guidance courses, doctor-patient interaction platform, which may further promote the comprehensiveness of treatment and health interventions, including diagnosis, treatment, rehabilitation, and prevention (52).

Integrating these findings, coordination may have a positive effect on continuity through accessibility, and such positive effect may also occur through distal mediating effects of accessibility and comprehensiveness. As a result, the following hypotheses are proposed by this study:

Hypothesis 4. Coordination of healthcare has positive effects on accessibility of healthcare.

Hypothesis 5. Accessibility of healthcare has positive effects on continuity of healthcare.

Hypothesis 6. Accessibility of healthcare has positive effects on comprehensiveness of healthcare.

2.4. The moderating role of respect

Respect is essential to all human interactions and in the healthcare setting, it permits a certain degree of patient dependency without raising concerns about mistreatment or abuse. Respect for autonomy, as well as for one's own dignity, integrity, and vulnerability, are a few of the characteristics of respect that patients have endorsed (53). Evidence proved that respect can influence whether a patient heeds advice or postpones necessary treatment since it fosters favorable perceptions in the doctor-patient relationship. According to Blanchard et al., individuals who reported being treated disrespectfully were less likely to follow medical advice,

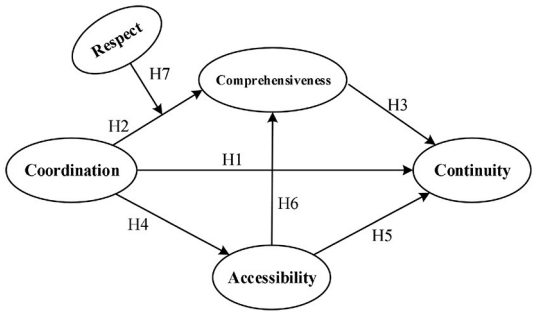

FIGURE 1
Research model diagram of medical alliances healthcare services quality.

undergo a routine physical examination, or receive the proper secondary preventive care for diabetes, heart disease, and hypertension (33). Koskenniemi have found that a strong positive correlation between perceived respect and satisfaction of comprehensiveness of care. According to Tickle et al., continuity—including the number of antenatal visits and post-natal contacts—was directly connected with the level of respect that women reported (54). We suggest that respect can boost the positive relationships between coordination and comprehensiveness, and further enhance the positive relationship between coordination and comprehensiveness.

In this research, we first examined the effects of coordination, comprehensiveness, accessibility of healthcare on continuity of healthcare, including direct and indirect effects. Then, we also examined the moderating effects of respect in the links between coordination, comprehensiveness and continuity. The hypothesized model is illustrated in Figure 1.

3. Materials and methods

3.1. Participants and data collection

The data used in this study were collected from Zhejiang Province, China, for two reasons: first, Zhejiang has a large number of migrants, totaling 25.5 million (55); second, Zhejiang, located in East China, has the largest number of medical alliances, accounting for 40% of the national total, which makes it a suitable location for this study. With a per capita GDP of 113,000 yuan in 2021, Zhejiang Province has an advanced economic status. The government has strived to explore measures to improve the migrants' health and promote health equity by providing adequate rights and health resources to the migrants, including basic medical insurance and work-related insurance, maternal and child healthcare projects, infectious disease precaution services, and health education. Participation in this study was voluntarily and the criteria of including participants in the analysis were as follows: (1) provided informed consent; (2) lived in Zhejiang Province and away from household registered location for more than 6 months; (3) had some experience or understanding of health services provided in the medical alliances; and (4) over 15 years old. The exclusion criteria of participant were as follows: (1) household registered location was within the same municipal jurisdiction as migrant's current home address; (2) separation from household registered location was no more than 6 months; (3) students and temporary residents in hotels, hospitals, airports, and railroad stations.

Sampling areas were chosen using an approach that combines quota sampling with judgment sampling based on level of economic development. Counties in Zhejiang Province were stratified into developed and developing regions through systematic clustering analysis, taking into consideration regional economic indicators (such as gross domestic product, total retail sales of consumer products, etc.), public finance indicators (such as total fiscal revenue, general public budget revenue, etc.) and medical and health services indicators (such as the number of medical institutions, the number of hospital beds, the number of health technicians, etc.), as well as indicators of resident income level that affect the utilization of medical and health services (such as household deposit balance at the end of the year, average disposable income of urban residents, average net income of rural residents, etc.).

Based on the above analysis, the developed region include Hangzhou and Ningbo and the developing region include the remaining counties in Zhejiang Province. We selected the questionnaire respondents using a proportionate quota method based on the proportion of the number of migrants in each region to the total migrants of Zhejiang Province. In this study, Hangzhou was selected as the representative county of the developed region, while Huzhou, Jiaxing and Lishui were selected to represent the developing region. Convenience sampling was then used to select 11 communities in Hangzhou, and 16 communities in the three representative counties in the developing region. Then, 30 representative samples were selected from migrants in each community based on geography, age, gender, and education. Accordingly, 810 questionnaires were distributed to migrants between July 1 and November 30, 2021, of which 765 qualifying questionnaires were retrieved, including 301 from developed areas and 464 from developing areas. Face-to-face interviews were conducted to gather the data after individuals were briefed on the goals of the study, provided their consent and received all relevant explanations. The criteria for excluding questionnaires from the study include: (1) inadequate answers; (2) identical answers to more than half of the questions that were answered; and (3) similar answers to obviously contradictory questions. A questionnaire would be excluded if it met any one of these criteria.

3.2. Measurement

The following processes were used to create the questionnaire for this study: (1) through a literature research, items evaluating indications of coordination, accessibility, continuity, comprehensiveness, and respect were selected; (2) telephone interviews were conducted with 107 residents, the interview records were coded and word frequency analysis was performed in NVIVO (version 11) according to the grounded theory; (3) two rounds of Delphi consultation were also conducted with 22 scholars, medical personnel or health administrators to inform the calculation of the average scores of importance and availability of each dimension and the screening and optimization of indicators; (4) A pre-survey was used to further modify and validate the questionnaire. The reliability of the questionnaire was assessed using internal consistency (Cronbach's alpha) and composite reliability (CR). And the measurement's validity was assessed using convergent validity and the heteroplasm-elemental ratio. The questionnaire included the following sections: general information, coordination scale, comprehensiveness scale, accessibility scale, respect scale and continuity scale.

3.2.1. General information

The general information section collected details about respondents' gender, age, marital status, level of education, occupation, income, and place of residence.

3.2.2. Coordination

The coordination scale aimed to evaluate vertical and horizontal collaboration and resource sharing among different healthcare providers. The initial indicators were extracted from literature, including the *Assessment of Interprofessional Team Collaboration Scale* (AITCS) developed by Carole Orchard (56), the findings of Giannoula Tsakitzidis (57) and the *Primary Care Assessment Tool* (PCAT) (58, 59). To optimize the indicators, we also extracted indicators through thematic analysis, with a total word frequency of 322. The indicators were vested through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators had two components: the vertical coordination and the horizontal coordination (3 items), a seven-point Likert scale was used to measure each item, with higher scores indicating more coordination. The scale ranged from 7 (total agreement) to 1 (total disagreement). The coordination scale's Cronbach's α coefficient was 0.788, its CR value was 0.829, and its AVE value was 0.620. When compared to other scales, the heteroplasm-elemental ratio was <0.90, demonstrating the scale's high reliability and validity (Tables 1, 2).

3.2.3. Comprehensiveness

The comprehensiveness scale aimed to evaluate whether migrants think that healthcare professionals can provide them with integrated services, mainly including physiological, psychological and social aspects. The initial indicators were extracted from literature, including the *Chiba Inter-Professional Cooperation Competency Scale* (CICS29) (60), *Inter-Professional Educational Collaboration Framework* (IPEC) (61), the *Assessment of Interprofessional Team Collaboration Scale* (AITCS) (56) and the *Primary Care Assessment Tool* (PCAT) (58, 59). To optimize the indicators, we also extracted indicators through thematic analysis, with a total word frequency of 222. The indicators were vested through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators had three components: physiological, psychological and social perspectives (3 items), a seven-point Likert scale was used to measure each item, with higher scores indicating more comprehensiveness. The scale ranged from 7 (total agreement) to 1 (total disagreement). The comprehensiveness scale's Cronbach's α coefficient was 0.843, its CR value was 0.856, and its AVE value was 0.673. When compared to other scales, the heteroplasm-elemental ratio was <0.90, demonstrating the scale's high reliability and validity (Tables 1, 2).

3.2.4. Accessibility

The accessibility scale aimed to evaluate migrants' access to medical and health services, including the accessibility of services and resources and culture acceptance. The initial indicators were extracted from literature, including the *Chiba Inter-Professional Cooperation Competency Scale* (CICS29) (60), *Inter-Professional Educational Collaboration Framework* (IPEC) (61), the *Assessment of Interprofessional Team Collaboration Scale* (AITCS)(56) developed by scholars from Japan, Canada and the United States and the *Primary Care Assessment Tool* (PCAT) (58, 62). To optimize the indicators, we also extracted indicators through thematic analysis, with a total word frequency of 261. The indicators were vested through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators had three components: service accessibility, resource accessibility and cultural acceptance (4 items), a seven-point Likert scale was used to measure each item, with higher scores indicating higher accessibility. The scale ranged from 7 (total agreement) to 1 (total disagreement). The accessibility scale's Cronbach's α coefficient was 0.783, its CR value was 0.789, and its AVE value was 0.485. When compared to other scales, the heteroplasm-elemental ratio was <0.90, demonstrating the scale's high reliability and validity (Tables 1, 2).

TABLE 1 Measurement items and results of reliability and validity analysis of the questionnaire ($N = 765$).

latent variable	Measurement items	Load[a]	Cronbach's α	CR	AVE
Coordination	A1 Different medical staff provide coordinate health services for me (the two-way referral, telemedicine, ect.)	0.757	0.788	0.829	0.62
	A2 Hospitals and primary healthcare institutions work together to provide healthcare services.	0.867			
	A3 Medical institutions, public health institutions, volunteer groups and communities work together to provide health services	0.731			
Accessibility	B1 I have access to the healthcare devices and medical equipment I need.	0.69	0.783	0.789	0.485
	B2 I can get the medicine I need	0.709			
	B3 I have access to the services that are friendly to my culture and values	0.622			
	B4 I have access to the health services I need.	0.752			
Comprehensiveness	C1 My mental health and emotional feelings are concerned by healthcare. Medical staff monitor your mental state when providing you with medical and health services.	0.907	0.843	0.856	0.673
	C2 My life needs and social function are concerned by healthcare. Medical staff pay attention to your life confusion when providing you with medical and health services.	0.921			
	C3 My diverse physiological needs are concerned by healthcare.	0.589			
Continuity	D1 Medical staff have a comprehensive understanding of me (health status history, life history, etc.).	0.747	0.719	0.735	0.481
	D2 Different providers provided consistent care at different stages (follow-up, long-term treatment, etc.)	0.697			
	D3 My health information is coherent and can be transmitted and shared among different institutions, departments, and medical staff.	0.632			
Respect	E1 My life and personal dignity is respected.	0.769	0.83	0.834	0.503
	E2 My rights to choose medical institutions, medical staff and treatment options is respected.	0.756			
	E3 My rights of health privacy is respected and protected.	0.716			
	E4 The medical staff listened patiently to my medical and health service needs and feelings.	0.608			
	E5 The medical staff explained to me clearly.	0.686			

[a]All load values are significant at the 0.001 level; CR, composite reliability; AVE, average variance extraction.

3.2.5. Continuity

The continuity scale aimed to evaluate the degree of service coherence received and experienced by migrants, including the continuity of interpersonal interaction, services and resources. The initial indicators were extracted from literature, including the findings of Reeves S (63), and the importance of "building a unified information platform" mentioned by several documents of the National Health Commission of China (64, 65). To optimize the indicators, we also extracted indicators through thematic analysis, with a total word frequency of 129. The indicators were vested through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators had three components: interpersonal continuity, service continuity and resource continuity (3 items), a seven-point Likert scale was used to measure each item, with higher scores indicating better continuity. The scale ranged from 7 (total agreement) to 1 (total disagreement). The continuity scale's Cronbach's α coefficient was 0.719, its CR value was 0.735, and its AVE value was 0.481. When compared to other scales, the heteroplasm-elemental ratio was <0.90, demonstrating the scale's high reliability and validity (Tables 1, 2).

3.2.6. Respect

The respect scale aimed to evaluate migrants' perception of respect and privacy protection, etc. in the process of the treatment. The initial indicators were extracted from literature, including three components proposed for measuring human respect in the reactivity scale: autonomy, dignity and confidentiality in *The World Health Report, 2000* (66, 67) and communication as an additional aspect of respect from: *Multi-country Survey Study on Health and Health System's Responsiveness in 60 different countries in 2000-2001* (MCSS)

TABLE 2 Heterotrait—Monotrait (HTMT) of the questionnaire ($N = 765$).

Latent variable	Coordination	Accessibility	Comprehensiveness	Continuity	Respect
Coordination	–				
Accessibility	0.624	–			
Comprehensiveness	0.699	0.619	–		
Continuity	0.769	0.676	0.701	–	
Respect	0.368	0.610	0.437	0.482	–

(68, 69) developed by WHO. To optimize the indicators, we also extracted indicators through thematic analysis, with a total word frequency of 82. The indicators were vested through the two rounds of Delphi consultation, with an average score for importance over 4 and an average score for availability above 3.5. The indicators had four components: autonomy, dignity, confidentiality and communication (5 items), a seven-point Likert scale was used to measure each item, with higher scores indicating more respect. The scale ranged from 7 (total agreement) to 1 (total disagreement). The respect scale's Cronbach's α coefficient was 0.830, its CR value was 0.834, and its AVE value was 0.503. When compared to other scales, the heteroplasm-elemental ratio was <0.90, demonstrating the scale's high reliability and validity (Tables 1, 2).

3.3. Quality control

We conducted a pilot study before collecting the data used in the final analysis. After gathering and analyzing the issues found in the pilot study, we made revisions to the questionnaire and defined a clear study strategy. Investigators were selected from post-graduates with appropriate personal survey experience. Additionally, investigator training was provided before the survey was conducted to make sure that the investigators understood the project, the questionnaire, and the important details of the inquiry as well as adhered to consistent norms and practices, such as: (1) the principle of consistency required that the consistency of investigators' survey techniques should reach more than 95%; (2) the principle of conformity required that no <5% of the respondents be randomly selected for repeated investigation, and the coincidence rate of repeated investigation should reach 97%; (3) after the survey, the accuracy of the data was checked in time, and the incorrect and missing items in the questionnaire should be supplemented by a telephone return visit.

3.4. Ethical considerations

Before data collection, participants were informed of the study's objectives and its methods. Participants were made aware that taking part was completely voluntary and that their information would be coded to protect their privacy and only be utilized for research purposes. The study was approved by the Ethics Committee of Hangzhou Normal University (approval number: 20190022). The study was carried out in conformity with the ethical guidelines outlined in the 1964 Declaration of Helsinki and its later amendments, and each participant gave their informed consent.

3.5. Statistical analysis

3.5.1. Preliminary analyses

Data in this study was analyzed using Amos version 20.0, SPSS version 23.0 and the macro PROCESS procedure for SPSS version 4.1. We used the following criteria to assess normalcy, outliers, and multicollinearity: Kurtosis (ku) and coefficients of skewness (sk) were used to measure normalcy; the existence of outliers was identified by Mahalanobis Distance; the variance inflation factor (VIF) and tolerance rate were used to test for multicollinearity. We also used Spearman's correlation for bivariate associations (reported as values of r) and descriptive statistics for the primary study variables (given as means standard deviations).

3.5.2. Mediation and moderation analyses

The mediating impact between the perceived coordination and perceived continuity of healthcare services was examined using structural equation modeling (SEM) through accessibility or comprehensiveness. The reliability of the questionnaire was assessed using composite reliability (CR) and internal consistency (Cronbach's coefficient). Convergent validity (Average Variance Extracted, AVE) and discriminant validity (Heterotrait—Monotrait, HTMT) were used to assess the measurement's validity. To estimate and verify the acting path from coordination, accessibility, comprehensiveness, to continuity, we conducted the maximum-likelihood method in the SEM. To test the mediating effect, we used 5,000 repeats of the percentile bootstrap approach at a 95% confidence level (CI). The difference in effect was regarded as statistically significant if it did not include 0. To test the moderating effect of respect on

TABLE 3 Comparison of migrants' mean scores on the continuity questionnaire based on different demographic variables ($N = 765$).

Characteristic	Categorization	Total score
Gender	Male (338)	5.41±1.04
	Female (427)	5.14 ± 1.11
	t (*p*)	3.38 (<0.01)
Age (years)	<45 (587)	5.23 ± 1.12
	45–60 (121)	5.32 ± 0.95
	≥60 (57)	5.48 ± 1.04
	F (*p*)	1.53 (0.21)
Marital status	Unmarried (329)	5.28 ± 1.14
	Married (424)	5.24 ± 1.04
	Divorced (8)	5.88 ± 0.95
	Other (4)	5.26 ± 1.49
	F (*p*)	0.93 (0.42)
Educational background	Uneducated (21)	5.51 ± 0.93
	Primary school (53)	5.29 ± 1.05
	Middle school (123)	5.30 ± 1.05
	High school (172)	5.30 ± 1.09
	Junior college (165)	5.32 ± 1.10
	College and above (231)	5.15 ± 1.12
	F (*p*)	0.94 (0.46)
Occupation	Leader (79)	5.07 ± 0.98
	Professionals (133)	5.45 ± 1.01
	Office clerk (34)	5.34 ± 0.95
	Business Service staff (113)	5.03 ± 1.06
	Agriculture, forestry, animal husbandry, and fishery personnel (10)	4.94 ± 1.00
	Others (396)	5.31 ± 1.14
	F (*p*)	2.76 (0.02)
Income	Low (316)	5.38 ± 1.12
	Middle (97)	5.28 ± 1.13
	High (352)	5.16 ± 1.04
	F (*p*)	3.38 (0.04)
Region	Developed area (301)	5.14 ± 1.13
	Developing (464)	5.35 ± 1.05
	t (*p*)	−2.61 (<0.01)

the relationship between coordination and comprehensiveness, we used the hierarchical linear regression analysis with SPSS. Finally, in order to further investigate the influence respect has on the link between coordination and continuity through comprehensiveness, a straightforward slope test was conducted. The conditional indirect influence of coordination on continuity through comprehensive was examined when the respect score was at the sample mean, plus 1 SD and minus 1 SD.

4. Results

4.1. Demographic characteristics

The descriptive analysis is shown in Table 3. Of the 765 samples, 338 (44.2%) were male and 427 (55.8%) were female. The participants were mainly in the age group of <45 years old (76.7%), followed by those in the 45–60 age group (15.8%),

TABLE 4 Mean, standard deviation, and correlation coefficient of each variable ($N = 765$).

Variable	1	2	3	4	5
1. Coordination					
2. Accessibility	0.503**				
3. Comprehensiveness	0.577**	0.497**			
4. Continuity	0.599**	0.512**	0.547**		
5. Respect	0.311**	0.498**	0.377**	0.380**	
Mean value	5.278	5.554	4.983	5.265	6.084
Standard deviation	1.0710	0.9025	1.2587	1.0882	0.7945

**$p < 0.01$, two-tailed test.

and those above 60 years old (7.5%). In terms of marital status, 424 participants (55.4%) were married. As far as education is concerned, 231 (30.2%) had a university degree, i.e., a bachelor's degree or above, and from income perspective, 316 (41.3%) were low-income. In terms of occupation, 133 participants (17.4%) were professionals, 113 participants (14.8%) were business service staff, and 396 (51.8%) were others. Lastly, 301 (39.3%) lived in the developed region while 464 (60.7%) lived in the developing region.

Migrants' perceptions of continuity of healthcare were assessed by scale scores. Participants' continuity scores varied significantly across gender ($t = 3.38$, $p < 0.01$), occupation ($F = 2.76$, $p = 0.02$), income ($F = 3.38$, $p = 0.04$) and region ($t = -2.61$, $p < 0.01$). Male migrants (M = 5.41, SD = 1.04) scored higher than female migrants (M = 5.14, SD = 1.11). Low-income migrants (M = 5.38, SD = 1.12) scored higher than high-income migrants (M = 5.16, SD = 1.04). The professional personnel in the migrants had the highest score (M = 5.45, SD = 1.01), and the agricultural, forestry, animal husbandry, and fishery workers had the lowest score (M = 4.94, SD = 1.00). Migrants in less developed regions (M = 5.35, SD = 1.05) scored higher than those in developed regions (M = 5.14, SD = 1.13). Health service continuity scores based on participant demographics is presented in Table 3.

Table 4 shows the average and standard deviation of coordination, accessibility, comprehensiveness, continuity, and respect, and the Pearson correlation coefficients between variables. All the correlations between variables were significant, among which there were significant positive correlations among coordination, accessibility, comprehensiveness, continuity, and respect ($P < 0.01$).

4.2. Construction and fit of the SEM model

In this study, coordination, comprehensiveness and accessibility were taken as independent variables, and continuity was the dependent variable used to build an SEM. The maximum-likelihood method was used to estimate the initial model. The C.R. value in essence represents the normalized estimation of multivariate kurtosis (70). Values >5.00, according to Bentler (71), are typically a sign that the data are non-normally distributed, in practice. The sample in this application had a z-statistic of 61.097, which was suggestive of non-normality. Therefore, in order to accommodate the lack of multivariate normality, the model and parameters were adjusted using the Bollen-Stine bootstrap approach (72). The model was accepted as the results of fitting parameters showed that the p-value of each path was <0.05, then the model was modified with correction index. Figure 2 is the exhibition of the ultimate model, with each fitting index showing a good fit as presented in Table 5. Figure 2 presents the standardized path coefficients for the complete causal model. Six of the seven causal relationships hypothesized in the model were found to be statistically significant to different degrees with positive path coefficients: (i) coordination and comprehensiveness; (ii) comprehensiveness and continuity; (iii) coordination and continuity; (iv) coordination and accessibility; (v) accessibility and continuity; (vi) accessibility and comprehensiveness.

By standardizing the effects, we found that coordination, comprehensiveness and accessibility had positive effects on continuity, with standardized path coefficients being 0.43, 0.17, and 0.35 ($p < 0.001$), respectively, supporting the hypotheses H1, H3, and H5. Coordination and accessibility contributed positive effects on comprehensiveness, with the standardized path coefficients being 0.46 and 0.29 ($p < 0.001$), respectively, supporting the hypotheses H2 and H6. Additionally, coordination had positive effects on accessibility, with the coefficient being 0.59 ($p < 0.001$), supporting hypothesis H4.

4.3. Analysis of simple mediating effect

The simple mediating effect between coordination and continuity was tested by bootstrap, as shown in Table 6. Above all, the indirect effects of coordination on continuity *via* comprehensiveness were significant (the 95% CI was 0.033–0.131), and the direct effects of coordination on continuity was also significant (the 95% CI was 0.283–0.544). Since the 95% CI in the percentile columns did not include 0, it indicated that comprehensiveness partially mediated the effect of coordination on continuity. Besides, both the indirect effect (the 95% CI was 0.065–0.216) and direct effects (the 95% CI was 0.283–0.544) of coordination on continuity *via* accessibility were significant, reflecting that access also partially mediated the effect of coordination on continuity. Ultimately, the distal indirect effects of coordination on continuity *via* accessibility and comprehensiveness were significant (the 95% CI was 0.011–0.051), and the direct effects of this path were

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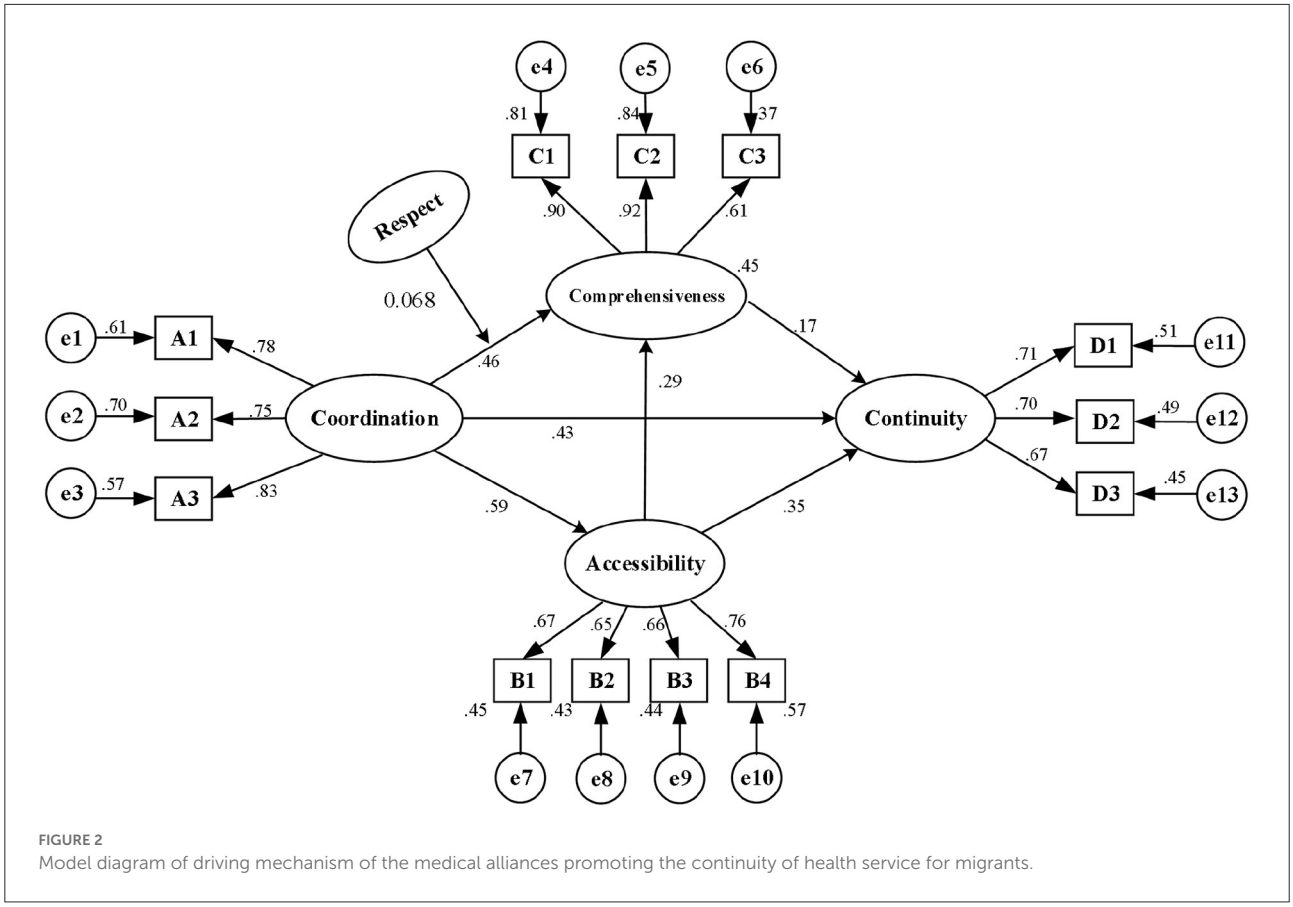

FIGURE 2
Model diagram of driving mechanism of the medical alliances promoting the continuity of health service for migrants.

TABLE 5 Fitting results of the structural equation model.

Fitting index	Fitting standard	Model	
		Initial model	Modified model
Chi-square freedom ratio χ^2/df	$1 < \chi^2/df < 3$ Good	4.063	1.464
Root mean square error of approximation RMSEA (90%CI)	<0.05 Good	0.063	0.025
Goodness of fit index, GFI	>0.90 Good	0.954	0.981
Adjusted goodness of fit index, AGFI	>0.90 Good	0.930	0.961
Normed fit index, NFI	>0.90 Good	0.947	0.981
Confirmatory fit index, CFI	>0.90 Good	0.960	0.994
Bentler and Bonett's non-normed fit index, TLI	>0.90 Good	0.948	0.992

also prominent (the 95% CI was 0.283–0.544), validating that accessibility and comprehensiveness incompletely mediates the effect of coordination on continuity.

4.4. Analysis of moderating effect

The hierarchical linear regression analysis was conducted to examine the moderating effect of respect between coordination and comprehensiveness. Model 1 added statistically significant control variables (Table 7) to the univariate analysis. Model 2 added independent variables (coordination) and moderating variables (respect) on the basis of Model 1, and Model 3 added the interactive items of independent variables and moderating variables (coordination*respect) on the basis of model 1 and model 2. To avoid multicollinearity between the variables, the independent variable (coordination), the dependent variable (comprehensiveness), and the moderating variable (respect) were centered before testing. The maximum variance expansion factor of the three models is 1.739, which is significantly

TABLE 6 Bootstrap confidence interval estimation results of simple mediating effect.

Variable relationship	Effect type	Effect value	LLCI	ULCI	Supported hypothesis
Coordination → comprehensiveness → continuity	Overall effect	0.491	0.366	0.627	H_2, H_3
	Direct effect	0.412	0.283	0.544	
	Indirect effect	0.079	0.033	0.131	
Coordination → accessibility → continuity	Overall effect	0.522	0.443	0.661	H_4, H_5
	Direct effect	0.412	0.283	0.544	
	Indirect effect	0.140	0.065	0.216	
Coordination → accessibility → comprehensiveness → continuity	Overall effect	0.441	0.314	0.573	H_4, H_6, H_3
	Direct effect	0.412	0.283	0.544	
	Indirect effect	0.029	0.011	0.051	

LLCI represents Lower limit 95% confidence intervals; ULCI represents upper limit: 95% confidence intervals.

lower than 10, indicating that no issue of multicollinearity was detected, and the results are reliable.

The results of Model 1 showed the influence of the control variable on the dependent variable. Gender, marital status, occupation and region had significant effects on the perceived comprehensiveness of healthcare. Female demonstrated a lower comprehensiveness score than their male counterparts ($\beta = -0.082$, $P = 0.024$). Married people perceived a significantly lower comprehensiveness score than unmarried people ($\beta = -0.082$, $p = 0.02$). In terms of occupation, technical professionals ($\beta = 0.084$, $P = 0.03$) and other personnel ($\beta = 0.141$, $P < 0.001$) had better perceived comprehensiveness of healthcare than organizational leaders. In addition, the group in the developing region perceived a higher comprehensiveness score than those in the developed region ($\beta = 0.132$, $p < 0.001$). The results of model 2 showed that the main effects of independent variable coordination ($\beta = 0.473$, $p < 0.001$) and moderating variable respect ($\beta = 0.217$, $p < 0.001$) on comprehensiveness were positive. Model 3 showed that the interactive items of coordination and respect had a positive effect on comprehensiveness ($\beta = 0.132$, $p = 0.01$), indicating respect have a positive moderating effect on the relationship between coordination and comprehensiveness.

The moderating role of respect between coordination and comprehensiveness was further explored by a simple slope test. The results demonstrated that respect had a considerable impact on the correlation between these two variables. The interaction diagram (Figure 3) visually reflects the moderating effect of respect on the relationship between coordination and comprehensiveness. It illustrated the interaction at high (plus 1 SD) and low (minus 1 SD) levels of coordination and respect, and the slope represents the influence of coordination on comprehensiveness. The results suggested that, for migrants who perceived higher level of respect in healthcare, there was a more powerful and positive link between coordination and comprehensiveness compared with those who perceived lower level of respect. Specifically, coordination had a significant effect on comprehensiveness for both high-respect perception group ($\beta = 0.678$, $t = 14.675$, $p < 0.001$) and low-respect perception group ($\beta = 0.508$, $t = 10.499$, $p < 0.001$).

4.5. Analysis of moderated mediation effects

The indirectly conditional effect of coordination on continuity through comprehensiveness at various values of respect was analyzed when the respect score was the sample mean and plus or minus 1 SD. The results showed that the indirectly conditional effects were significant in the mean, high level (+1 SD) or low level (−1 SD) of the migrants in both developed and developing regions, as supported by the bootstrap 95% CI. The moderated mediation index was statistically significant in the developed region ($\beta = 0.091$), while it was not significant in the developing region, since the bootstrap 95% CI included 0 (see Tables 8, 9), indicating that respect had a moderated mediating effect on the relationship between coordination and continuity *via* the comprehensiveness in the developed region.

5. Discussion

5.1. Practice implications and future prospects

This study proves the mechanism of the important dimensions of PCIC in medical alliances–continuity, accessibility and comprehensiveness, in promoting the continuity for migrants, and also explored the moderated mediating role of respect. Data collected from 765 migrants in representative counties from Zhejiang Province was analyzed using SPSS, SEM, and PROCESS procedure for SPSS. The result of SEM indicated that coordination had direct effect

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TABLE 7 Moderating effect of respect on the relationship between coordination and comprehensiveness.

Variable	Model 1	Model 2	Model 3
Gender			
Male (reference group)			
Female	−0.082*	−0.034	−0.03
Age (years)			
Youth (<45) (reference group)			
Middle-aged (<60)	−0.007	−0.014	−0.009
Elderly (≥60)	0.064	0.068	0.078
Marital status			
Unmarried (reference group)			
Married	−0.141**	−0.082*	−0.088*
Divorced	0.02	−0.007	−0.006
Others	0.007	0.007	0.006
Educational background			
Uneducated (reference group)			
Primary school	−0.006	0.01	0.008
Middle school	−0.013	0.025	0.029
High school	−0.023	−0.005	−0.007
Junior college	−0.059	−0.012	−0.012
College and above			
Occupation			
Leader (reference group)			
Professionals	0.084*	0.078*	0.071*
Office clerk	0.044	−0.001	−0.009
Business service staff	0.027	0.009	0.008
Agriculture, forestry, animal husbandry and fishery personnel	0.027	0.033	0.029
Others	0.141***	0.084**	0.081**
Income			
Low (reference group)			
Middle	0.003	0.038	0.041
High	−0.03	0.008	0.014
Region			
Developed area (reference group)			
Developing	0.132***	0.052	0.055
Respect		0.473***	0.474***
Coordination		0.217***	0.233***
Respect×Coordination			0.068***
R^2	0.091	0.409	0.414
Adjusted R^2	0.069	0.393	0.397
ΔR^2	0.091	0.318	0.005
Variance ratio	4.145	25.719	25.001
ΔF	4.145	199.983	6.693
VIF_{max}	1.719	1.732	1.739

*p < 0.05, **p < 0.01, ***p < 0.001; VIF_{max}, maximum variance expansion factor.

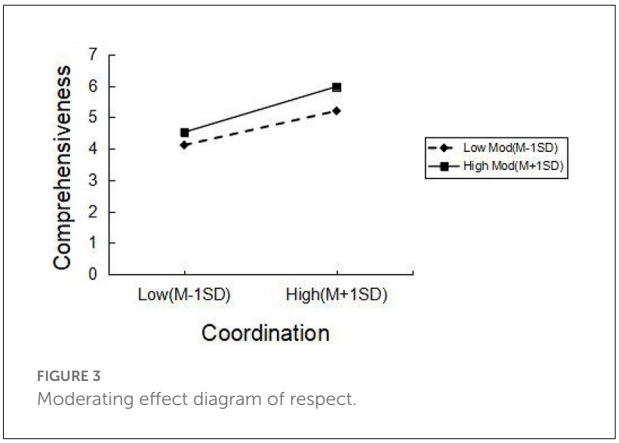

FIGURE 3
Moderating effect diagram of respect.

TABLE 8 Bootstrap confidence interval estimation results of moderated mediating effect: specific conditional values of respect.

	Developed area				Developing area			
	β	SE	LLCI	ULCI	β	SE	LLCI	ULCI
−1 SD	0.144	0.043	0.067	0.233	0.189	0.04	0.109	0.264
Mean	0.218	0.046	0.133	0.313	0.179	0.03	0.121	0.24
+1 SD	0.292	0.06	0.176	0.413	0.169	0.035	0.107	0.246

LLCI represents Lower limit 95% confidence intervals; ULCI represents upper limit: 95% confidence intervals.

on continuity, and also had mediating effect on continuity *via* comprehensiveness and accessibility. The hierarchical linear regression analysis indicated that respect have positive moderating effect on the relationship between coordination and comprehensiveness. The simple slope test indicated that in the developed region, respect had moderated mediating effect on the relationship between coordination and continuity *via* comprehensiveness of healthcare.

When analyzing migrants' perceived continuity, we found that the group living in the developing region of Zhejiang Province experienced better service continuity when seeking

TABLE 9 Index of moderated mediation.

	Developed area				Developing area			
	Index	SE	LLCI	ULCI	Index	SE	LLCI	ULCI
Respect	0.091	0.031	0.037	0.157	−0.11	0.026	−0.055	0.048

LLCI represents Lower limit 95% confidence intervals; ULCI represents upper limit: 95% confidence intervals.

healthcare. This difference may be a result of primary healthcare institutions in developing areas being more closely connected to migrants. This finding is consistent with previous studies showing that small primary care institutions in rural areas can improve the continuity of provider-patient relationships by increasing healthcare providers' understanding of migrants' needs (12, 73). This research also showed that female migrants had a perception of poorer continuity as compared to their male counterparts. This may be a result that women have higher needs and requirements for service continuity, such as long-term reproductive health guidance, thus are more sensitive to the continuity gaps (74, 75). In addition, participants who were professionals expressed better experience of continuity, the reason may be that they are generally more capable of communicating their needs and understanding care providers' advices, thus received more respect from the care providers. It is consistent with some previous studies that positive communication with providers can lead to better continuity of healthcare (76, 77). The findings may provide an alternative way to improve continuity through PCIC when resource is limited. Among the medical alliances, although those in the developing region may have more limited healthcare resources and less advanced information technology, continuity in this region is still higher than those in the developed region. It demonstrated that, to some extent, soft power such as doctor-patient relationship, attention to patient demand and respect are equally important to the resource investments into facilities and equipment. Gender and occupational differences in perceived continuity further underscore the importance of providing people-centered services to vulnerable groups. Although the socioeconomic status of women has improved significantly worldwide, women remain a vulnerable group. Due to women's educational and economic disadvantages, they need more respect, understanding and support in healthcare services, and more targeted healthcare programs are needed to prioritize long-term maternal and child care. Moreover, as migrants often engage in low SES occupations other than professionals, it requires healthcare providers to take into consideration their less advanced communication skills and special healthcare needs, to design more appropriate services, improve communication skills, and give necessary respect. Nowadays, it seems that there is still a huge gap to bridge.

Coordination, accessibility, comprehensiveness as attributes of healthcare, are widely used to measure the extent of PCIC practice. However, previous studies have not addressed the interrelatedness and the relative importance of these PCIC attribute (78). This study provided some evidence of the mechanisms for the impact of these attributes on continuity. The results of the SEM showed that coordination, comprehensiveness, and accessibility can predict the perceived continuity by migrants, to some extent, and the migrants may experience better care continuity by seeking healthcare with PCIC. The possible mechanisms may be that: firstly, the continuity of service management was improved by comprehensive healthcare services designed to meet diverse needs by inter-professional and across-organizations coordination and coherent service procedures such as two-way referral; secondly, the continuity of information was improved by sharing examination, imaging and other equipment and resources in the medical alliances, providing migrants access to homogeneous health resources and consistent information across suppliers, and; thirdly, the continuity of interpersonal relationships was also improved, as migrants have access to providers' information and doctor-patient contact through e-health platforms to get more familiar with providers and establish long-term relationship with medical staff. It is evident that accessibility and comprehensiveness are important factors mediating the coordination-continuity relationship, which is consistent with existing research on continuity of healthcare. For instance, Yao demonstrated that information sharing and inter-professional collaboration can encourage the flow of medical staff to the grass-roots, further provide comprehensive and coherent service for residents (43, 48), Ke and Wang argued that, the integration of healthcare enables people to gain access to comprehensive service and obtain timely and long-term health (44, 49). The results shown the importance of healthcare integration on continuity, as the attributes of PCIC do not function individually but are linked in a mutually supportive manner. The findings may provide a perspective for the governments, health authorities, providers to further deepen PCIC for higher continuity. Collaboration among providers may provide a cornerstone of PCIC healthcare, thus, further effective measures of creating internal drivers for long-term, broad collaboration should be taken, such as deepen interests and responsibility sharing among different stakeholders. Since accessibility and comprehensiveness are important mediating factors for coordination, in medical alliances, a series of mutually supportive measures should be adopted, such as optimizating collaborative service procedure for convenience of access, designing more people-centered

healthcare program around the migrants needs, optimizing resource allocation and effective utilization for comprehensive services, ect., so as to improve the health outcome brought by continuity through PCIC.

Furthermore, the mediation models provided a more detailed explanation of the mechanisms of coordination and continuity. Respect as an important dimension of PCIC was demonstrated to be a factor in the moderating mechanisms on the relationship between coordination and continuity. Interestingly, we found that comprehensiveness has a significant positive mediation effect between coordination and continuity which is moderated by respect in the developed region, while, the result is insignificant in the developing region. The insignificant result in the developing region, was probably because that migrants there were less sensitive to respect, and additionally, respect for individual is relatively undifferentiated in this region. In other words, in the developed region, respect in healthcare is discriminatory to some extent. Respect is a crucial factor that deserves attention from policymakers and healthcare providers. Thus, it is necessary to boost indiscriminate respect for migrants by developing medical ethics and professionalism among medical staff, establishing people-centered cultural environment in medical alliances, promoting clinical practice and typical case discussions to understand patients' right of privacy, informed consensus and autonomy. Moreover, freedom of choice is also an important aspect of respect, and it is necessary for migrants to be educated and empowered to have the right and ability to choose the appropriate services or providers, and make decisions together (79, 80).

Our results also highlighted that we may pay attention to the influence of socio-economic and cultural context of healthcare. Under the traditional healthcare mode in China, a friendly and mutually-respectful doctor-patient relationship was promoted, and the interaction between grass-root doctors and patients formed in the early days of China's liberation is a typical example. However, with modernization, urbanization and marketization, such a close-knit sociocultural is eroding, which may explain why respect for migrants may be worse in the developed region. To some extent, this is a warning that social cultural environment is a key aspect in improving health welfare of migrants. However, it is gratifying that the development of PCIC may shape a new cultural of respect, which empoweres individual value expression and freedom of choice, thus providing the basis for migrants to express free will and satisfy their diverse health needs. In medical alliance, individuals have a growing selection of health services and providers, which may empower them to integrate more self-values into health practice, thus promoting the continuity of relationships and the long-term care utilization, especially in developed region. This finding may have reference for the developing countries with insufficient health resources and unsatisfied health equity. In many region like Asia, although internal migrants have contributed significantly to economic growth and gained from higher wages in higher productivity areas, they remain socially and economically excluded from the wider benefits of economic growth such as continuity of healthcare (81). Although this study had been carried out in China, the integration of healthcare and the respectful environments brought about by PCIC can provide reference by other countries facing similar challenges of internal migrants under similar environment.

5.2. Strengths and limitations

Firstly, the comprehensive search of multiple databases ensured that the scales published in academic journals in line with the research content are widely included. And the scale was designed locally through informed interviews and Delphi consultation to ensure that the scale could accurately measure the continuous medical and healthcare services perceived by migrants in China under the background of medical alliances. Secondly, we adopted the method of combining quota sampling with judgment sampling, and selected sample sites based on the level of social and economic development, which enabled us to conduct a comprehensive, detailed and representative analysis of the role of medical alliances in promoting the continuity of services for migrants in Zhejiang Province. Thirdly, through moderated mediation analysis, the mediating effect of coordination and comprehensiveness is proved, and the moderating effect of respect is verified. This study unveiled the impact paths and interaction mechanisms of variables including coordination, accessibility, comprehensiveness and continuity, and the impact mechanism of continuity, as well as the unique role of respect in it, which enriches the existing research on healthcare service continuity of migrants.

The following are possible defects in this study. Firstly, a bias in the selection of research object may exist as participants may have chosen to participate in this study because of their attention to healthcare through medical alliances. Secondly, since data collection used self-report measures, the response bias cannot be ruled out, and the measures were based on individual experience rather than objective data, although we set control variables to eliminate individual interference. Thirdly, since the questionnaire adopted in this research was self-designed, the quality of measurement needed particularly evaluation however, the indicators were drawn from a series of questionnaires verified by multiple studies in different regions, and also referred to the results of interviews and Delphi method, therefore, the questionnaire had good reliability and validity Fourthly, only the viewpoints of migrants were taken into account in this study; the perspectives of healthcare professionals were disregarded. Additionally, due to the point-in-time nature of the data, the study did not measure the impact of changes over time. Lastly, since all participants were sampled in Zhejiang Province, the results may not be representative in other regions. However, since Zhejiang Province is the pilot area of medical alliance, the form of medical alliance in Zhejiang Province is similar to other regions, so the results have certain reference value.

Above all, there is no doubt that establishing long-term relationships between migrants and healthcare professionals is key to further optimizing the coordination and continuity mechanisms. Consequently, it is worth further discussion that extensional research goals could focus on the targets and demands of healthcare services recipients rather than merely on those of the providers. Clearly, whether the main reason for poor continuity is the services provider or the patient and which is more dominant could both be probed in subsequent research. In addition, the influencing factor of the perceived continuity of migrants in our research such as the external environment, features of the population, health behavior, and health outcome, can be associated with the framework of the Andersen behavioral model. This approach will further ensure that the impact of comprehensive factors related to migrants (such as social integration, technical factors, environmental, and cultural factors)on perceived continuity can be validated. Ultimately, this study can expand the sample size in domestic regions, then conduct a multi-group analysis and comparison to determine whether there is an inequality in this continuity of healthcare influence mechanism of migrants across regions. Hence, future studies should include an objective evaluation index, analyze migrants and providers to learn more about the factors that affect continuity of healthcare, and consider data collection from other districts.

6. Conclusion

The perception of migrant continuity was significantly improved by the PCIC practice in medical alliances. Accessibility and comprehensiveness mediated the positive correlation between coordination and continuity. In the developed region, we discovered that respect had a moderate mediating influence on the relationship between coordination and continuity through comprehensiveness. In addition, among migrants in the developing region, males and professionals experienced better service continuity. Therefore, measures to promote the continuity of healthcare through PICI in medical alliances should be paid attention to, including the coordination, accessibility, comprehensiveness, and respect.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Hangzhou Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

HZ: conceptualization, methodology, and software. YW and WS: formal analysis, writing—original draft preparation, and validation. WL and ZH: investigation. XH and TS: review. MW: data collection. ZH: writing. ZH, XH, and TS: supervision. SC: writing—review and editing. All authors approved the final manuscript.

Funding

This work was supported by the National Natural Science Foundation of China Project (Grant number: 72004051), the Ministry of Education of Humanities and Social Science Project (Grant number: 18YJCZH232), and the Hangzhou Normal University Undergraduate Innovation Ability Promotion Project (Grant number: CX2022051).

Acknowledgments

We would like to extend our sincere gratitude to the Zhejiang Province Health Commission for their assistance in carrying out the study. We also want to express our gratitude to all of the study participants for taking the time to fill out the questionnaire. We are also grateful to AJE and Du Yao, who assisted polish the paper.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.1030323/full#supplementary-material

References

1. Sun X, Chen M, Chan KL. A meta-analysis of the impacts of internal migration on child health outcomes in China. *BMC Public Health.* (2016) 16:66. doi: 10.1186/s12889-016-2738-1

2. Deshingkar P. Internal migration, poverty and development in Asia. In: *ODI Briefing Paper*. Institute of Development Studies and Overseas Development Institute. (2006). p. 11.

3. Ping H, Shaohua Z. Internal migration in China: linking it to development. in: International Organization for Migration, editor. *Migration, Development and Poverty Reduction in Asia*. Geneva: International Organization for Migratioz (2005).

4. Fan JX, Wen M, Jin L, Wang G. Disparities in healthcare utilization in China: do gender and migration status matter? *J Family Econ Issues.* (2012) 34:52–63. doi: 10.1007/s10834-012-9296-1

5. Zhang KH, Song S. Rural–urban migration and urbanization in China: evidence from time-series and cross-section analyses. *China Econ Rev.* (2003) 14:386–400. doi: 10.1016/j.chieco.2003.09.018

6. National Bureau of Statistics. *Bulletin of the Seventh National Census (No. 7)*. (2021). Available online at: http://www.stats.gov.cn/tjsj/zxfb/202105/t20210510_1817183.html (accessed May 11, 2021).

7. Chen J. Internal migration and health: re-examining the healthy migrant phenomenon in China. *Soc Sci Med.* (2011) 72:1294–301. doi: 10.1016/j.socscimed.2011.02.016

8. Zhang L, Liu S, Zhang G, Wu S. Internal migration and the health of the returned population: a nationally representative study of China. *BMC Public Health.* (2015) 15:719. doi: 10.1186/s12889-015-2074-x

9. Haggerty JL, Reid GK RJ, Freeman, Starfield BH, Adair CE, McKendry R. Continuity of care: a multidisciplinary review. *BMJ.* (2003) 327:1219–21. doi: 10.1136/bmj.327.7425.1219

10. World Health Organization. *Continuity and coordination of care: a practice brief to support implementation of the WHO Framework on integrated people-centred health services* (2018).

11. Lin Y, Lei R, Luo Y. Analysis of immunization coverage rate and its affecting factor of floating children in Zhujiang Delta River Area of Guangdong province. *Chin J Vacc Immuniz.* (2007) 13:586–9. doi: 10.3969/j.issn.1006-916X.2007.06.020

12. Zeng J, Shi L, Zou X, Chen W, Ling L. Rural-to-urban migrants' experiences with primary care under different types of medical institutions in Guangzhou, China. *PLoS ONE.* (2015) 10:e0140922. doi: 10.1371/journal.pone.0140922

13. Zheng L, Hu R, Dong Z, Hao Y. Comparing the needs and utilization of health services between urban residents and rural-to-urban migrants in China from 2012 to 2016. *BMC Health Serv Res.* (2018) 18:717. doi: 10.1186/s12913-018-3522-y

14. Chen G. *A Study ON Strategies to Improve the Utilization of Maternal and Child Health Care Services in the Floating Population* (Ph.D. thesis). Fudan University, ShangHai (2006).

15. Gong P, Liang S, Carlton EJ, Jiang Q, Wu J, Wang L, et al. Urbanisation and health in China. *Lancet.* (2012) 379:843–52. doi: 10.1016/S0140-6736(11)61878-3

16. Liu LC. The origin, policy analysis and system solution of the dilemma of migrant population seeking medical treatment in different places across provinces. *J Sichuan Univ Sci Eng.* (2020) 35:31–47. doi: 10.11965/xbew20200503

17. Schrag D, Xu F, Hanger M, Elkin E, Bickell NA, Bach PB. Fragmentation of care for frequently hospitalized urban residents. *Med Care.* (2006) 44:560–7. doi: 10.1097/01.mlr.0000215811.68308.ae

18. Shih A, Davis K, Schoenbaum S, Gauthier A, Nuzum R, McCarthy D. *Organizing the US Health Care Delivery System for High Performance*. New York, NY: The Commonwealth Fund (2008).

19. The World Bank, World Health Organization, Ministry of Finance of the People's Republic of China et al. *Deepening health reform in China : building high-quality and value-based service delivery-policy summary*. (2016). Available online at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2016/07/21/090224b08447d665/1_0/Rendered/PDF/Healthy0China00sed0service0delivery (accessed July 22, 2016).

20. World Health Organization. *Framework on Integrated,* People-Centred Health Services (2016).

21. Yuan S, Fan F, Zhu D. Effects of vertical integration reform on primary healthcare institutions in China: evidence from a longitudinal study. *Int J Health Policy Manag.* (2021) 11:1835–43. doi: 10.34172/ijhpm.2021.93

22. Sanz MF, Acha BV, Garcia MF. Co-design for people-centred care digital solutions: a literature review. *Int J Integr Care.* (2021) 21:16. doi: 10.5334/ijic.5573

23. Jiang LW, Song SM, Guo WL. Study on the models and development status of regional longitudinal medical alliance in China. *Med Soc.* (2014) 27:35–38. doi: 10.13723/j.yxysh.2014.05.011

24. National Health Commission of the People's Republic of China. *Reply to proposal No. 9500 of the fourth session of the 13th National People's Congress*. (2022). Available online at: http://www.nhc.gov.cn/wjw/jiany/202202/6243bc7dd0844d378305db5ad40eeee0.shtml (accessed February 09, 2022).

25. Yang F, Yang Y, Liao Z. Evaluation and analysis for chinese medical alliance's governance structure modes based on Preker-harding model. *Int J Integr Care.* (2020) 20:14. doi: 10.5334/ijic.5417

26. Yan F. *Integrated Health Services Reform between Community Health Service Centers and Hospitals in Hangzhou, Zhejiang Province*. Washington, DC: School of Public Health, Fudan University (2015).

27. National Health Commission of the People's Republic of China, National Administration of Traditional Chinese Medicine. *Notice on printing and distributing the administrative measures for medical association (for Trial Implementation)*. (2020). Available online at: http://www.gov.cn/zhengce/zhengceku/2020--07/18/content_5528009.htm (accessed July 09, 2020).

28. Sun HJ, Liu Z, Shen D, Zhao K, Dou Y, Feng SQ, et al. Reform development and policy recommendations of county medical community: based on survey of 200 county hospitals in 2019. *Chin J Health Policy.* (2020) 13:34–39. doi: 10.3969/j.issn.1674-2982.2020.09.006

29. People's network-The People's Health Network. *Ganzhou Fifth People's Hospital: a new mode of medical operation*. (2018). Available online at: http://health.people.com.cn/n1/2018/1010/c421589--30333020.html (accessed October 10, 2018).

30. Zhang CY. Effect observation of community intervention in preventive vaccination of migrant children. *Chin Community Doct.* (2019) 35:174–5. doi: 10.3969/j.issn.1007-614x.2019.06.118

31. Zhou J. Study of the effect of diabetes nursing home on community nursing intervention for patients with type 2 diabetes among migrant population. *Nurs J Chin Peoples Liber Army.* (2017) 34:9–12. doi: 10.3969/j.issn.1008-9993.2017.05.003

32. Shi L, Starfield B, Xu J, Politzer R, Regan J. Primary care quality: community health center and health maintenance organization. *South Med J.* (2003) 96:787–95. doi: 10.1097/01.SMJ.0000066811.53167.2E

33. Blanchard J, Lurie N. RESPECT: patient reports of disrespect in the healthcare setting and its impact on care. *J Fam Pract.* (2004) 53:721–31.

34. Van Speybroeck A, Beierwaltes P, Hopson B, McKee S, Raman L, Rao R, et al. Care coordination guidelines for the care of people with spina bifida. *J Pediatr Rehabil Med.* (2020) 13:499–511. doi: 10.3233/PRM-200738

35. Kuang L, Li L, Mei J. Core attributes, high-performance functional mechanism and policy implications of general practice. *Chin J Health Policy.* (2016) 9:2–10. doi: 10.3969/j.issn.1674-2982.2016.01.001

36. Bahr SJ, Weiss ME. Clarifying model for continuity of care: a concept analysis. *Int J Nurs Pract.* (2019) 25:e12704. doi: 10.1111/ijn.12704

37. O'Malley AS, Rich EC, Shang L, Rose T, Ghosh A, Poznyak D, et al. New approaches to measuring the comprehensiveness of primary care physicians. *Health Serv Res.* (2019) 54:356–66. doi: 10.1111/1475-6773.13101

38. Tricco AC, Antony J, Ivers NM, Ashoor HM, Khan PA, Blondal E, et al. Effectiveness of quality improvement strategies for coordination of care to reduce use of health care services: a systematic review and meta-analysis. *CMAJ.* (2014) 186:E568–78. doi: 10.1503/cmaj.140289

39. Maeng DD, Martsolf GR, Scanlon DP, Christianson JB. Care coordination for the chronically ill: understanding the patient's perspective. *Health Serv Res.* (2012) 47:1960–79. doi: 10.1111/j.1475-6773.2012.01405.x

40. Haggerty JL, Burge F, Pineault R, Beaulieu MD, Bouharaoui F, Beaulieu C, et al. Management continuity from the patient perspective: comparison of primary healthcare evaluation instruments. *Healthc Policy.* (2011) 7:139–53. doi: 10.12927/hcpol.2011.22709

41. Wei L, Zhang Y, Zhang L. Research on the status of continuity and coordination of rural vertical health service network in view of doctors. *Chin Health Serv Manag.* (2015) 32:217–221.

42. de Bruin SR, Versnel N, Lemmens LC, Molema CC, Schellevis FG, Nijpels G, et al. Comprehensive care programs for patients with multiple chronic conditions: a systematic literature review. *Health Policy.* (2012) 107:108–45. doi: 10.1016/j.healthpol.2012.06.006

43. Patterson CJ, Feightner JW. Comprehensive care for the elderly. *Can Fam Physician*. (1993) 39:1380–91.

44. Ke NQ, Kuang L. Defining and conceptualizing general practice: the comprehensiveness of primary care. *Chin J Health Policy*. (2018) 11:5. doi: 10.3969/j.issn.1674-2982.2018.04.008

45. Levesque J-F, Harris MF, Russell G. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *Int J Equity Health*. (2013) 12:1–9. doi: 10.1186/1475-9276-12-18

46. Ribeiro SP, Cavalcanti MLT. Primary health care and coordination of care: device to increase access and improve quality. *Cien Saude Colet*. (2020) 25:1799–808. doi: 10.1590/1413-81232020255.34122019

47. Joshi C, Russell G, Cheng IH, Kay M, Pottie K, Alston M, et al. A narrative synthesis of the impact of primary health care delivery models for refugees in resettlement countries on access, quality and coordination. *Int J Equity Health*. (2013) 12:88. doi: 10.1186/1475-9276-12-88

48. Yao P, Xie J, Liu XY, Guo QY. Medical alliance's effect on promoting the accessibility of high-quality medical resources. *Modern Hosp Manag*. (2015) 13:5. doi: 10.3969/j.issn.1672-4232.2015.05.006

49. Wang YT, Kuang L, Zhao JG. Study on defining and conceptualizing of general practice: the accessibility of primary care. *Chin J Health Policy*. (2017) 10:7. doi: 10.3969/j.issn.1674-2982.2017.05.002

50. Li R. *Study of Influences of Continuity Medical Care Under Different Collaborative Models Among Hospitals and Community Health Service Center*. Huazhong University of Science and Technology (2011).

51. Mohamoud G, Mash R. The quality of primary care performance in private sector facilities in Nairobi, Kenya: a cross-sectional descriptive survey. *BMC Prim Care*. (2022) 23:120. doi: 10.1186/s12875-022-01700-3

52. Reiter-Brennan C, Dzaye O, Davis D, Blaha M, Eckel RH. Comprehensive care models for cardiometabolic disease. *Curr Cardiol Rep*. (2021) 23:22. doi: 10.1007/s11886-021-01450-1

53. Beach MC, Branyon E, Saha S. Diverse patient perspectives on respect in healthcare: a qualitative study. *Patient Educ Couns*. (2017) 100:2076–80. doi: 10.1016/j.pec.2017.05.010

54. Tickle N, Gamble J, Creedy DK. Women's reports of satisfaction and respect with continuity of care experiences by students: findings from a routine, online survey. *Women Birth*. (2021) 34:e592–8. doi: 10.1016/j.wombi.2020.11.004

55. Zhejiang Provincial Bureau of Statistics. *Main data bulletin of the seventh census of Zhejiang Province*. (2021). Available online at: http://tjj.zj.gov.cn/art/2021/5/13/art_1229129205_4632764.html (accessed May 13, 2021).

56. Orchard CA, King GA, Khalili H, Bezzina MB. Assessment of interprofessional team collaboration scale (AITCS): development and testing of the instrument. J *Contin Educ Health Prof*. (2012) 32:58–67. doi: 10.1002/chp.21123

57. Giannoula T, Olaf T, Nadine C, Veronique V, Maja L-H, Steven T, et al. Outcome indicators on interprofessional collaboration interventions for elderly. *Int J Integr Care*. (2016) 16:5. doi: 10.5334/ijic.2017

58. Shi L, Starfield B, Xu J. Validating the adult primary care assessment tool. *J Fam Pract*. (2001) 50:161–71. doi: 10.1037/t77102-000

59. Yang H, Shi L, Lebrun LA, Zhou X, Liu J, Wang H. Development of the Chinese primary care assessment tool: data quality and measurement properties. *Int J Qual Health Care*. (2013) 25:92–105. doi: 10.1093/intqhc/mzs072

60. Sakai I, Yamamoto T, Takahashi Y, Maeda T, Kunii Y, Kurokochi K. Development of a new measurement scale for interprofessional collaborative competency: The Chiba Interprofessional Competency Scale (CICS29). *J Interprof Care*. (2017) 31:59–65. doi: 10.1080/13561820.2016.1233943

61. Dow AW, DiazGranados D, Mazmanian PE, Retchin SM. An exploratory study of an assessment tool derived from the competencies of the interprofessional education collaborative. *J Interprof Care*. (2014) 28:299–304. doi: 10.3109/13561820.2014.891573

62. Cassady CE, Starfield B, Hurtado MP, Berk RA, Nanda JP, Friedenberg LA. Measuring consumer experiences with primary care. *Pediatrics*. (2000) 105:998–1003. doi: 10.1542/peds.105.S3.998

63. Reeves S, Pelone F, Harrison R, Goldman J, Zwarenstein M. Interprofessional collaboration to improve professional practice and healthcare outcomes. *Cochrane Database Syst Rev*. (2017) 6:CD000072. doi: 10.1002/14651858.CD000072.pub3

64. National Health Commission of China. *Notice on printing and distributing the work plan for comprehensive performance appraisal of medical Consortium (for Trial Implementation)*. (2018). Available online at: http://www.nhc.gov.cn/yzygj/s3594q/201808/570358dbf0af41238f46bb89e4af538b.shtml (accessed August 09, 2018).

65. National Health Commission of China. *Notice on printing and distributing the guidance plan for performance appraisal of national basic public health service projects*. (2015). Available online at: http://www.nhc.gov.cn/wjw/ghjh/201506/bbd6c2c666ec4641aa7fa6733aedc767.shtml (accessed June 25, 2015).

66. World Health Organization. *Report of the scientific peer review group on health systems performance assessment*. World Health Organization (2002).

67. World Health Organization. *Technical Consultation on Concepts and Methods for Measuring the Responsiveness of Health Systems. Health Systems Performance Assessment: Debates, Methods and Empiricism*. Geneva: World Health Organization (2003). p. 115–23.

68. Üstün TB, Chatterji S, Villanueva M, Bendib L, Çelik C, Sadana R, et al. *WHO Multi-Country Survey Study on Health and Responsiveness*. Geneva: World Health Organization (2001).

69. Letkovicova H, Prasad A, Vallée RL, Valentine N, Adhikari P, van der Heide G. The *Health Systems Responsiveness Analytical Guidelines for Surveys in the Multi-country Survey Study*. Geneva: World Health Organization (2005).

70. Mardia KV. Applications of some measures of multivariate skewness and kurtosis in testing normality and robustness studies. *Sankhyā* (1974) 36:115–28.

71. Bentler PM. *EQS 6 Structural Equations Program Manual*. Encino, CA: Multivariate Software Inc (2005).

72. Bollen KA, Stine RA. Bootstrapping goodness-of-fit measures in structural equation models. *Sociol Methods Res*. (2016) 21:205–29. doi: 10.1177/0049124192021002004

73. Zhou H, Zhang W, Zhang S, Wang F, Zhong Y, Gu L, et al. Health providers' perspectives on delivering public health services under the contract service policy in rural China: evidence from Xinjian County. *BMC Health Serv Res*. (2015) 15:75. doi: 10.1186/s12913-015-0739-x

74. Frieden TR. China can substantially reduce its high burden of stroke and heart attack. *China CDC Wkly*. (2020) 2:780–2. doi: 10.46234/ccdcw2020.211

75. Chen W, Feng Y, Fang J, Wu J, Huang X, Wang X, et al. Effect of trust in primary care physicians on patient satisfaction: a cross-sectional study among patients with hypertension in rural China. *BMC Fam Pract*. (2020) 21:196. doi: 10.1186/s12875-020-01268-w

76. Jansky M, Owusu-Boakye S, Nauck F. "An odyssey without receiving proper care" - experts' views on palliative care provision for patients with migration background in Germany. *BMC Palliat Care*. (2019) 18:8. doi: 10.1186/s12904-019-0392-y

77. Chae D, Lee J, Asami K, Kim H. Experience of migrant care and needs for cultural competence training among public health workers in Korea. *Public Health Nurs*. (2018) 35:211–9. doi: 10.1111/phn.12390

78. Flocke SA. Measuring attributes of primary care: development. *J. Fam Pract*. (1997) 45:64–74.

79. Liao ZD, Teng XM, Chen S, Cheng PR. Study on patient centered behavior of seeking medical treatment in different places–taking shanghai as an example. *China Health Insur*. (2020):3. doi: 10.19546/j.issn.1674-3830.2020.10.014

80. Wen XT, Chen FY, Yuan ZK, Liu XJ, Xie F, Jiang XQ. Based on factor analysis method comprehensive evaluation on satisfaction of patients with hospitalization in other places. *Chongqing Med*. (2019) 48:654–9. doi: 10.3969/j.issn.1671-8348.2019.04.025

81. Deshingkar P. Internal migration, poverty and development in Asia. *IDS Bull*. (2006) 37:88–100. doi: 10.1111/j.1759-5436.2006.tb00272.x

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 10 January 2023
DOI 10.3389/fpubh.2022.1003129

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 25 July 2022
ACCEPTED 15 December 2022
PUBLISHED 10 January 2023

CITATION
Kurshed AAM, Vincze F, Pikó P, Kósa Z, Sándor J, Ádány R and Diószegi J (2023) Alcohol consumption patterns of the Hungarian general and Roma populations.
Front. Public Health 10:1003129.
doi: 10.3389/fpubh.2022.1003129

Alcohol consumption patterns of the Hungarian general and Roma populations

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Introduction: Harmful alcohol use is a significant public health problem worldwide, though the alcohol-related burden affects disproportionately certain populations and ethnic minorities, with the WHO European Region being the most heavily affected and putting an increased risk on Roma populations. This ethnic minority group is the largest and most vulnerable ethnic minority in Europe and Hungary as well.

Methods: The present study aims to describe and compare the alcohol consumption behaviors of the Hungarian general and Roma populations using the Alcohol Use Disorders Identification Test (AUDIT), which provides a comprehensive view of alcohol consumption behavior. In addition, a decomposition analysis was performed when the multivariate logistic or Poisson regression model showed significant differences between the two samples.

Results: Our findings suggest that Roma people in our study sample experience more alcohol-related harm, even when considering past problems. The decomposition analysis revealed that gender and relationship status differences act more intensely among Roma than non-Roma when considering alcohol-related harm.

Discussion: Equalizing these differences would be expected to reduce the Hungarian general and Roma populations' alcohol-related harm frequency gap. Investigating alcohol-attributed harms at the ethnicity level provides important information to identify high-risk groups and, thus, to design and implement more targeted and accessible interventions for alcohol problems.

KEYWORDS

alcohol consumption, AUDIT, Roma population, Hungarian population, decomposition

1. Introduction

Globally, alcohol consumption has been considered one of the leading risk factors for illness and mortality (1), ultimately contributing to increased premature death and the loss of healthy life years (2). According to estimates, harmful alcohol consumption accounted for 1.78 million deaths worldwide in 2020 (3); moreover, research suggests that during the COVID-19 pandemic, alcohol consumption and related harm and deaths increased further (4, 5). Both the proportion of alcohol-attributable deaths and DALYs (10.1% of all deaths and 10.8% of all DALYs) and consumption levels (9.8 l per capita in 2016) were found to be the highest in the WHO European Region (6). Although pure alcohol consumption decreased in most EU countries and also in Hungary (from 12.1 l in 2010 to 11.4 l in 2016; 19.1 liters for men and 4.5 l for women) (6), heavy alcohol use and related problems remained an issue (7), with Hungary having a significantly higher prevalence of alcohol use disorders (21.2% in Hungary vs. 8.8% in Europe) and alcohol dependence (9.4% in Hungary vs. 3.7% in Europe) compared to the average of the WHO European Region (6). According to sales data in 2019, Hungary was still characterized by consumption levels above the average of OECD countries (8.7 liters) and being among those countries (Latvia, followed by the Czech Republic, Austria, France, Hungary, Lithuania, and Slovenia) that reported consumption over 11 l per person (8).

Health behavior, including alcohol consumption patterns, may vary not only across populations but also among ethnicities (9). Previous research on racial and ethnic disparities in health behaviors consistently indicated unfavorable differences for obesity and leisure-time physical inactivity when comparing black and Mexican-American women with white women, and for smoking and physical inactivity in the case of black men (10). Meanwhile, results of studies on alcohol consumption in the United States are contradictory in terms of ethnic and racial comparisons (11–18). In Europe, the alcohol-related burden affects certain groups unevenly. Inequities have been identified regarding gender, education level, socioeconomic status, place of residence, and ethnicity. The extent of the effect and the complex interplay of these factors may vary across countries, potentially leading to differences in risk factors and consequences (9). Numerous studies have been conducted in European countries to compare the patterns of alcohol consumption behavior of Roma, the largest ethnic minority population, to that of the majority populations. Due to the lack of official documentation, fear of stigmatization, and reluctance to self-identify, the actual number of the Roma population remained unspecified, but it has been estimated that around 10–12 million Roma individuals inhabit the European Region (19), and the majority of them live in Central and Eastern Europe, representing more than 5% of the total population (20). In Hungary, the Roma represent 8.9% of the total population, with an estimated 876.000 individuals—a number that is steadily increasing (21). All over Europe, this minority population has faced decades of discrimination, which has manifested as marginalization in the formal labor market, poor education, inadequate access to healthcare services, and a less favorable health status compared to majority populations (22–29). Despite linguistic assimilation, the cultural identity and traditions maintained by Roma populations may still have a significant impact on their health behaviors.

In Central and Eastern Europe (CEE), Roma can be considered "perennial" outsiders, as described by Powell and Lever (30), Toma and Fosztó (31), and van Baar et al. (32). Roma disidentification and stigmatization have persisted over time, facilitating their social and spatial marginalization and giving rise to segregation (31). Negative stereotypes have been attached to Roma people, which do not seem to change with time (31, 32). In Romania, the Roma can be characterized by a history of political, social, and economic marginalization (33) and were even afflicted by slavery during history (34). Not much improvement could be observed over time, with Roma still being at the bottom of Romanian society (35), and unfavorable perceptions of Roma by the public also persisting (34, 36). Even in regions without severe spatial segregation, Roma communities experienced anti-Roma prejudice (31, 34). Roma still have been negatively stereotyped, as demonstrated in a study conducted in 2010 on the stereotyped ideas of Czechs about the Roma culture and lifestyle (37). Long-term discrimination and stigmatization may affect emotions and manifest in feelings of inferiority, potentially further enforcing separation, according to the authors Cretan et al. (36).

The situation in Hungary is not different from other CEE countries. According to results obtained in a study, spatial segregation and stigmatization (mainly associated with physical appearance and illegal activities) of Roma still persist (38, 39). In certain regions of the country (i.e., northeastern and south-western Hungary), even entire villages are segregated (40). Research in two segregated, urban Roma communities in Szeged (the third largest city in Hungary by population) pointed out that segregated Roma communities suffer injustice in three essential areas as a result of a combination of environmental and social injustice: access to work and goods, access to decent-quality housing, and access to essential public services due to financial and infrastructural difficulties. The majority of Roma have no other choice but to accept irregular, seasonal, low-waged, and often semi-illegal labor. All these challenges have a complex impact on the situation of the Roma people in Hungary (33, 39).

One study on alcohol intake conducted in Slovakia did not find any differences in overall consumption among men of Roma and non-Roma populations but identified lower rates in Roma women compared to non-Roma (41). On the other hand, Roma mothers had a higher risk of drinking alcohol during pregnancy than non-Roma mothers in this country (42). A study in Moldova presented the finding that Roma families spent more (116% of the non-Roma) on alcohol and tobacco compared to non-Roma (43). Roma people in Turkey could be characterized

by a higher alcohol intake, and the frequency of alcoholism was 3.2 times higher among them than in others (44). In comparison with non-Roma, a higher proportion of Roma children were found to be daily alcohol users in Lithuania and Latvia, though the differences were not statistically significant (45). Results of a study conducted by Roma social workers in the Czech Republic showed that substance use, including regular excessive alcohol intake, was 2–6 times higher among Roma than the general population (46). Similarly, findings obtained from a study in Spain demonstrated that Roma women had significantly higher consumption of alcohol compared to non-Roma women (47). However, gender-specific results were obtained from a preceding study, where young Spanish Roma men were more likely to drink alcohol compared to other young men, whereas among women, alcohol consumption was less frequent among Roma than in the general population (48). Comparing the alcohol consumption habits of the Roma and non-Roma populations in Slovenia using the Alcohol Use Disorders Identification Test (AUDIT) revealed that although the Roma scored lower overall on the AUDIT and were characterized by a higher proportion of teetotalers, they also had a lower proportion of non-hazardous drinkers (49).

Although one study in Hungary found the prevalence of abstainers among Roma to be higher compared to the general adult population (29), alcohol consumption patterns among children and adolescents were less favorable compared to non-Roma (prevalence of daily alcohol consumption and drunkenness, lifetime prevalence of alcohol intoxication, earlier initiation of alcohol consumption) according to research results (50–52). Furthermore, the study on the decade of Roma inclusion identified negative changes among Hungarian Roma regarding heavy drinking, and the gap widened in comparison with the general population (53).

As demonstrated above, several studies have investigated the alcohol consumption behavior of Roma populations in Europe and Hungary from various aspects, and therefore using different alcohol consumption descriptions and assessment methods. Not only quantity but drinking frequency and intensity should also be considered when measuring the extent of harmful consumption (7). The AUDIT (Alcohol Use Disorder Identification Test) tool allows for the collection of information on various aspects of alcohol consumption and thus provides a comprehensive view of different dimensions of alcohol drinking behaviors, including alcohol-related harm, even when past problems are taken into account, which is also important when considering alcohol-related burden (54). Still, only one study in Slovenia (49) and none in Hungary collected information on alcohol consumption using the AUDIT, which provides a comprehensive view of different dimensions of alcohol consumption, drinking behaviors, and alcohol-related problems. By considering these, the present study aims to describe alcohol consumption behaviors of the Hungarian general (HG) population from an international point of view and also to compare them to those of the Hungarian Roma (HR) population using the AUDIT screening tool, which could be an important step when examining and addressing inequalities in alcohol-related harm from a national perspective (9). Data collection at the ethnicity level is an essential step in increasing knowledge about potential differences in alcohol consumption between Roma and non-Roma populations and also in understanding how ethnic inequities and inequalities act in addition to gender and other socioeconomic differences. Decomposing these differences may aid in the planning and implementation of targeted interventions aiming to reduce alcohol-related harm.

2. Materials and methods

2.1. Study design and sampling

Data used in this study were derived from a complex comparative health survey (55). This cross-sectional study was conducted in two counties (Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg) of northeastern Hungary, where the majority of the Roma in the country live. The planned sample size of the study was 1,000 respondents, and probability sampling techniques were used to pick 500 subject representatives of HG and 500 subject representatives of HR living in segregated colonies. The assessment of the health behavior and health status of the study populations was based on three pillars: (i) physical examination (weight, height, waist circumference, blood pressure measurements, visual acuity, cardiovascular fitness tests, and measurements of the lateral spinal flexion and extensibility of the ischiocrural muscles) carried out in general practitioners' (GPs') offices; (ii) blood sample collection (for genetic analysis, routine laboratory investigations, and a lipid hormone profile); (iii) questionnaire surveys. Questionnaires were administered by trained practice nurses and Roma university students under the supervision of public health coordinators in the HG and HR populations, respectively. Data collection was carried out between 17 May and 29 August 2018. The study was approved by the Ethical Committee of the Hungarian Scientific Council on Health (61327-2017/EKU). Written informed consent was obtained from all participants in each study population in accordance with the Declaration of Helsinki.

2.1.1. A sample representative of the Hungarian general population living in northeast Hungary

Study subjects from the Hungarian general population were recruited through a population-based disease registry called the General Practitioners' Morbidity Sentinel Stations Programme (GPMSSP), which program was founded in 1998 to monitor the incidence and prevalence of chronic non-communicable diseases of great public health importance. The source population of the GPMSSP includes all Hungarian

citizens registered by the 59 participating general practitioners (56, 57). Our study population was randomly selected from the GPMSSP registry. Individuals 20–64 years of age registered by the participating general practitioners (GPs) of the two counties of northeast Hungary and living in private households were randomly enrolled. The desired sample size was 25 subjects from each of the 20 randomly selected GP practices in these two counties. As two GPs declined to participate, the final sample consisted of 450 participants from the practices of eighteen GPs. Data collection on health behavior was carried out in GP's practices during a health visit when questionnaires were delivered in a face-to-face manner by practice nurses.

2.1.2. A sample representative of the Hungarian Roma population living in segregated colonies in northeast Hungary

A stratified multistep random sampling technique was applied to recruit Roma participants from the same counties in northeast Hungary (Hajdú-Bihar and Szabolcs-Szamár-Bereg counties). During a previous environmental survey, segregated colonies having more than 100 inhabitants were identified by Roma field workers whose ethnicity was confirmed by self-declaration (58). Following the necessary verification of this previously created database, 20 colonies were randomly selected, and 25 households were randomly chosen from each colony. From each household, one individual between the ages of 20 and 64 was enrolled by using a random table, which resulted in 500 sampled individuals. To overcome the potential difficulties and distrust of Roma individuals toward interviewers, questionnaires on health behavior were taken by trained Roma university students who were familiar with local and ethnic circumstances.

2.2. Studied variables

2.2.1. Sociodemographic patterns

Questions about assessing sociodemographic characteristics were taken from the Hungarian version of the 2014 European Health Interview Survey (59). Respondents were classified according to covariate variables such as age, gender, marital status, highest level of education, economic activity, self-perceived financial status, and ethnicity. The following age groups were used: 20–34, 35–49, and 50+ years. The highest level of education was categorized as primary or less, secondary, high school, and tertiary school. We classified the respondents according to marital status as married, single, widowed, or divorced. Economic activity was described with the categories worker, unemployed, and pensioner/other allowance/student. Self-perceived financial status was measured by a standard question, with respondents assessing their prosperity on a five-point Likert scale from very bad to very good. Responses were categorized as good, satisfactory, and bad.

2.2.2. Assessment of alcohol consumption patterns

Unhealthy alcohol consumption-related behaviors were assessed using the 10-item AUDIT (total score range of 0–40 points), which tool covers all the necessary domains of alcohol consumption to be examined (54) and has also been translated and validated in Hungarian (60). In line with the aims, (1) unhealthy alcohol behavior, (2) problematic drinking, (3) hazardous levels of alcohol use, (4) alcohol dependence, (5) alcohol-related harm, and (6) past alcohol problems were the primary outcome indicators. Based on the previously conducted international studies, problematic drinking was evaluated according to the 10-item AUDIT total score achievement according to the following thresholds: $\geq$8 points for men and $\geq$5 points for women (54, 61, 62). In our analyses, the criteria for possible hazardous alcohol consumption levels were met if a score of 1 or more on question 2 or question 3 was reached, while points scored above 0 on questions 4–6 were considered alcohol dependence symptoms. If at least one point was scored on questions 7–10, this indicated that alcohol-related harm was already being experienced by the respondents. The answers "Yes, but not in the last year" and "Yes, during the last year" to the final two AUDIT questions can also be examined individually from the overall score as evidence of past alcohol-related problems (54). Interviewers were trained prior to the study, and the questionnaire was delivered face-to-face.

2.3. Statistical analysis

First, the crude and age-adjusted frequencies of alcohol-related behaviors were calculated for the HR and HG samples. The association with the Roma ethnicity was evaluated by chi-square and Fisher's exact tests. Then, we used multiple Poisson and logistic regression models to investigate the influence of Roma ethnicity, independent of sociodemographic factors (age, gender, education, economic activity, marital status, and financial status), on the six studied primary outcome indicators. Associations were quantified by odds ratios (OR) and corresponding 95% confidence intervals (CIs).

We employed the Oaxaca–Blinder decomposition technique to explain the proportion of ethnic inequalities in alcohol consumption behaviors that could be explained by different socioeconomic variables. This regression-based counterfactual method was originally developed by Oaxaca (63) and Blinder (64) for linear models, but it is also possible to generalize the method for non-linear response models. This technique

divides the gap between the mean values of an outcome into two components. The endowment component arises because of differences in the groups' characteristics; the coefficient component is attributed to different influences of these characteristics in each group. We performed the decomposition only when the multivariate logistic or Poisson regression model showed significant differences between the Hungarian general and Roma samples. Using the method described by Powers (65), the "mvdcmp" command was run in version 13 of the Stata software (Stata Corporation, College Station, Texas).

3. Results

3.1. Sociodemographic characteristics of the studied samples

The questionnaires were completed by 797 individuals (men: 35.26%, women: 64.74%). The proportion of people aged 50 and up was 35.13%. The majority of the respondents had primary education or less (51.82%) and lived with someone else (married: 63.86%). More than half of the population studied (66.62%) was an economically active worker, and the percentage of adults with satisfactory self-perceived economic status was 54.45%. The education attainment, economic activity, financial status, and gender variables indicated the less favorable status of the Roma respondents in comparison to the Hungarian general sample (Table 1).

3.2. Crude and gender-adjusted alcohol consumption behaviors

Table 2 summarizes the crude gender and ethnic differences in alcohol consumption frequency according to AUDIT question 1. The crude frequency of 2–3 times a week or more was significantly lower among the HR sample (5.47%) than in the non-Roma sample (12.75%). After the gender stratification, the differences remained significant and also indicated a lower frequency of alcohol consumption among the HR sample. The differences in the frequency of consuming six or more drinks per occasion by gender between the HG and HR samples were insignificant (Table 3). The number of drinks consumed each week (based on the second question of AUDIT) differed significantly only between HG and HR women ($p = 0.008$). Drinking more than two drinks per week was found to be higher in HG men compared to women (28.5 and 6.99%, respectively, not presented in a table format).

In the Roma sample, the crude frequency of alcohol-related harm was significantly higher (13.33%) compared to the Hungarian general sample (6.20%) (Table 4). After the gender stratification, the alcohol-related harm frequency was three times higher among Roma men (HG: 12.92%, HR: 30.69%) and approximately seven times higher among Roma women (HG: 0.89, HR: 6.93%). Past alcohol problems were observed to be relatively low (1.71%) in Hungarian general respondents, while four times (4.95%) higher frequencies were assessed among the Roma population. 12.87% of the Roma men and 2.12% of the Roma women had past alcohol problems, according to the final two AUDIT questions; meanwhile, these frequencies were significantly lower among the Hungarian general respondents (men: 3.89%, women: 0.00%). The differences in problematic drinking, hazardous consumption, and alcohol dependence between the two studied samples were not significant.

3.3. Multivariate analyses of alcohol consumption behaviors

Factors affecting alcohol use with regard to the studied indicators are shown in Table 5. Using multivariate logistic models that controlled for age, gender, education, marital status, financial status, and economic activity, Roma ethnicity was found to be a risk factor in two indicators related to alcohol consumption behavior. Compared to the Hungarian general sample, alcohol-related harm was three times higher (OR: 3.47; 95%CI = 1.61–7.49) in the Roma sample, and the Roma ethnicity was a significant risk factor (OR = 4.09; 95% CI = 1.02–16.46) for having past alcohol problems (Table 5).

Furthermore, respondents' data showed a decrease in the risk of all analyzed outcomes (AUDIT total scores, problematic drinking, consumption at hazardous levels, alcohol dependence, alcohol-related harms, and past problems) for women, the oldest age category (50 years and older) decreased, and single marital status increased the risk of consuming alcohol at hazardous levels (Table 5).

The predicted ethnic differences in the prevalence of alcohol-related harm have been decomposed using B-O decomposition for non-linear models. As shown in Table 6, single marital status accounted for −7.90% of the alcohol-related harm frequency gap while gender explained −59.86%, which means equalizing gender and marital status explained differences would be expected to reduce the HG and HR alcohol-related harm frequency gap by about 8 and 60%, respectively. All of the coefficient effects were insignificant, which indicates the protective or risk effects of the studied variables are as strong for HG as they are for HR. Roma ethnicity has a significant positive effect (13.32 percentage points) on alcohol-related harm frequency. In other words, had ethnicity had no effect, the outcome gap would have been 89.24% lower. In the case of past alcohol problems, the decomposition could not be performed due to low stratum-specific numbers (only seven respondents were identified as having had past alcohol problems in the HG sample).

TABLE 1 Characteristics of the Hungarian general and Roma populations.

Characteristics	Variable	Total *n* (%)	HG *n* (%)	HR *n* (%)	*P*-value**
Education*	Primary or less	413 (51.82%)	86 (20.98%)	327 (84.50%)	**<0.001**
	Secondary	151 (18.95%)	109 (26.59%)	42 (10.85%)	
	High school	150 (18.82%)	138 (33.66%)	12 (3.10%)	
	Tertiary education	76 (9.54%)	75 (18.29%)	1 (0.26%)	
Economic activity*	Worker	531 (66.62%)	303 (73.90%)	228 (58.91%)	**<0.001**
	Pensioner, other allowance, student	138 (17.31%)	69 (16.83%)	69 (17.83%)	
	Unemployed	115 (14.43%)	32 (7.80%)	83 (21.45%)	
Marital status*	Married	509 (63.86%)	253 (61.71%)	256 (66.15%)	0.240
	Single	166 (20.83%)	95 (23.17%)	71 (18.35%)	
	Widow, divorced	115 (14.43%)	60 (14.63%)	55 (14.21%)	
Financial status*	Good	185 (23.21%)	127 (30.98%)	58 (14.99%)	**<0.001**
	Satisfactory	434 (54.45%)	227 (55.37%)	207 (53.49%)	
	Bad	165 (20.70%)	48 (11.71%)	117 (30.23%)	
Age category (years)	20–34	209 (26.22%)	99 (24.15%)	110 (28.42%)	0.348
	35–49	308 (38.64%)	160 (39.02%)	148 (38.24%)	
	50+	280 (35.13%)	151 (36.83%)	129 (33.33%)	
Gender	Men	281 (35.26%)	180 (43.90%)	101 (26.10%)	**<0.001**
	Women	516 (64.74%)	230 (56.10%)	286 (73.90%)	
Total		797 (100%)	410 (100.00%)	387 (100.00%)	

HG, Hungarian general population; HR, Hungarian Roma population. *Unequal to 100% due to missing cases (range of the missing answers proportion: 0.49–1.95%). **Pearson's chi-squared and Fisher's exact test. Bold indicates statistical significance.

TABLE 2 Drinking frequency and prevalence (AUDIT question 1) among the Hungarian general and Roma populations, by gender.

	Never *n* (%)	Monthly or less *n* (%)	2–4 times a month *n* (%)	2–3 times a week or more *n* (%)	*P*-value*
HG men	52 (29.05%)	55 (30.73%)	28 (15.64%)	44 (24.58%)	**0.007**
HR men	22 (21.78%)	52 (51.49%)	12 (11.88%)	15 (14.85%)	
HG women	139 (60.70%)	61 (26.64%)	21 (9.17%)	8 (3.49%)	**<0.001**
HR women	180 (63.60%)	93 (32.86%)	4 (1.41%)	6 (2.12%)	
HG total	191 (46.81%)	116 (28.43%)	49 (12.01%)	52 (12.75%)	**<0.001**
HR total	202 (52.60%)	145 (37.76%)	16 (4.17%)	21 (5.47%)	

HG, Hungarian general population; HR, Hungarian Roma population. *Pearson's chi-squared and Fisher's exact test. Bold indicates statistical significance.

4. Discussion

Globally, the highest levels of alcohol consumption are recorded in the WHO European Region, along with the greatest proportions of total ill health and premature death due to alcohol as well (6). Still, this burden is unevenly distributed among countries in Europe and for certain groups and ethnicities within countries, though not all countries have alcohol consumption and related data stratified by factors beyond age and gender (9). Even though, according to the WHO's Global Status Report on Alcohol and Health, alcohol consumption has declined in Hungary since and is expected to do so in the future, considering the prevalence of alcohol use disorders and dependence, the country still has one of the highest values in the world and among OECD countries (6, 8).

Since not only consumption levels but patterns are also responsible for alcohol-related harm, we aimed to collect data on alcohol consumption behavior with the comprehensive 10-question alcohol harm screening tool AUDIT in both the Hungarian general and Roma populations, the latter being the largest and most disadvantaged ethnic minority in Europe and Hungary, too. To the best of our knowledge, this is the first

TABLE 3 The prevalence of consuming six or more drinks of alcohol per occasion (AUDIT question 3) among the Hungarian general and Roma populations, by gender.

	Never *n* (%)	Less than monthly *n* (%)	Monthly or more often *n* (%)	*p*-value*
HG men	118 (65.56%)	43 (23.89%)	19 (10.56%)	0.872
HR men	62 (62.63%)	25 (25.25%)	12 (12.12%)	
HG women	214 (93.04%)	14 (6.09%)	2 (0.87%)	0.342
HR women	259 (91.52%)	16 (5.65%)	8 (2.83%)	
HG total	332 (80.98%)	57 (13.90%)	21 (5.12%)	0.400
HR total	321 (84.03%)	41 (10.73%)	20 (5.24%)	

HG, Hungarian general population; HR, Hungarian Roma population. *Pearson's chi-squared and Fisher's exact test.

TABLE 4 Alcohol consumption behaviors of the Hungarian general and Roma populations.

	HG *n* (%)	HR *n* (%)	*P*-value*
Problematic drinking			
Men	13 (7.39%)	14 (14.74%)	0.054
Women	4 (1.79%)	13 (4.78%)	0.084
Total	17 (4.25%)	27 (7.36%)	0.065
Consumption at a hazardous level			
Men	77 (43.02%)	46 (47.42%)	0.482
Women	25 (10.92%)	43 (15.30%)	0.147
Total	102 (25.00%)	89 (23.54%)	0.635
Alcohol dependence			
Men	14 (7.82%)	14 (14.14%)	0.094
Women	1 (0.44%)	6 (2.19%)	0.134
Total	15 (3.70%)	20 (5.36%)	0.265
Alcohol-related harm			
Men	23 (12.92%)	31 (30.69%)	**<0.001**
Women	2 (0.89%)	19 (6.93%)	**0.001**
Total	25 (6.20%)	50 (13.33%)	**0.001**
Past problems			
Men	7 (3.89%)	13 (12.87%)	**0.007**
Women	0 (0.00%)	6 (2.12%)	**0.035**
Total	7 (1.71%)	19 (4.95%)	**0.010**

HG, Hungarian general population; HR, Hungarian Roma population. Problematic drinking: cutoff: men ≥8; women ≥5. Alcohol consumption at a hazardous level: scores of 1 or more on question 2 or question 3. Alcohol dependence: points scored above 0 on questions 4–6. Alcohol-related harm: points scored on questions 7–10. Past problems: based on the final two questions of AUDIT. *Pearson's chi-squared and Fisher's exact test. Bold indicates statistical significance.

study in Hungary to collect alcohol consumption data from the Roma population with the AUDIT questionnaire and apply a decomposition analysis for the predicted ethnic differences in the prevalence of alcohol-related harm.

From an international point of view, studies using the same methodology are not common, may not be from the same period, and may not necessarily include individuals within the same age range. International studies available in the literature applying the AUDIT tool did not always use the same outcome and independent variables, and only a few of them analyzed alcohol-related harm. The AUDIT 10-item questionnaire was applied in four waves of the National Drug Strategy Household Survey (NDSHS) in Australia with respondents aged 14 years or older, analyzing total AUDIT scores, hazardous drinking (cut-off total score of 8 or more for both men and women), and AUDIT risk levels with independent variables of age and gender. In 2016, the percentage of men engaging in hazardous drinking was 14.99% (66) (HG: 7.39%; cut-off score 8 or more). According to the latest data available, recorded alcohol consumption among the population aged 15 and over was lower in Australia compared to Hungary (8). The lower proportion of HG men with problematic drinking may be explained by the methodology of the research itself. Higher levels or unhealthy patterns of alcohol consumption are sensitive issues, and since questionnaires were administered by practice nurses instead of GPs, underreporting could potentially affect our results. Other findings were in line with our research, i.e., men consumed more alcohol than women, and older age categories could be characterized as having lower risks for hazardous drinking (reference 18–24 years) (66).

Within the European context, Swedish data are available from the years 1997, 2001, 2005, 2009, 2014, and 2018 with equal proportions of men and women (aged between 17 and 80 years) included in the study. Subjects were contacted by letter; participation was anonymous and voluntary. Total AUDIT scores were described with respect to age and gender. Consistent with the literature and with our findings, men scored higher than women (67).

Studies assessing the alcohol consumption habits of the general population in Hungary with the same methodology are scarce and even conducted in different time domains. Our results about the Hungarian general population's alcohol consumption patterns may be compared with the findings of

TABLE 5 Results of multivariate negative binomial and logistic regression analyses on alcohol use as measured by AUDIT questions, with socioeconomic factors and ethnicity as the primary independent variables under investigation.

Characteristics	Variable	AUDIT OR* (95% CI)	Problematic drinking OR** (95% CI)	Hazardous level OR** (95% CI)	Alcohol dependence OR** (95% CI)	Alcohol-related harm OR** (95% CI)	Past problems OR** (95% CI)
Ethnicity	HG	1.00	1.00	1.00	1.00	1.00	1.00
	HR	1.29 (0.97–1.73)	1.69 (0.71–4.04)	1.14 (0.68–1.90)	1.29 (0.46–3.59)	**3.47 (1.61–7.49)**	**4.09 (1.02–16.46)**
Education	Primary or less	1.00	1.00	1.00	1.00	1.00	1.00
	Secondary	1.09 (0.80–1.48)	1.22 (0.51–2.91)	1.10 (0.65–1.88)	0.74 (0.25–2.21)	0.96 (0.44–2.11)	1.00 (0.26–3.82)
	High school	0.98 (0.70–1.39)	0.70 (0.21–2.32)	0.83 (0.45–1.54)	0.57 (0.15–2.21)	1.17 (0.46–2.99)	1.31 (0.24–7.24)
	Tertiary education	1.13 (0.75–1.72)	NC	1.01 (0.48–2.13)	0.24 (0.03–2.24)	0.61 (0.15–2.48)	NC
Economic activity	Worker	1.00	1.00	1.00	1.00	1.00	1.00
	Pensioner, other allowance, student	1.02 (0.77–1.36)	0.83 (0.31–2.22)	0.63 (0.35–1.14)	1.03 (0.33–3.21)	0.65 (0.26–1.62)	0.72 (0.17–2.98)
	Unemployed	1.10 (0.82–1.48)	0.97 (0.40–2.40)	1.28 (0.75–2.18)	2.46 (0.95–6.42)	1.28 (0.63–2.60)	1.54 (0.52–4.53)
Marital status	Married	1.00	1.00	1.00	1.00	1.00	1.00
	Single	1.18 (0.91–1.52)	1.69 (0.76–3.76)	**1.57 (1.00–2.48)**	1.26 (0.47–3.34)	1.61 (0.86–3.03)	0.95 (0.29–3.16)
	Widow, divorced	1.03 (0.77–1.39)	1.03 (0.40–2.68)	1.16 (0.67–2.03)	1.13 (0.39–3.33)	0.86 (0.36–2.10)	0.78 (0.20–2.95)
Financial status	Good	1.00	1.00	1.00	1.00	1.00	1.00
	Satisfactory	1.11 (0.87–1.42)	0.89 (0.37–2.16)	1.33 (0.84–2.12)	0.51 (0.20–1.30)	0.95 (0.49–1.85)	0.41 (0.13–1.32)
	Bad	1.34 (0.98–1.83)	1.68 (0.64–4.43)	1.38 (0.77–2.48)	0.87 (0.30–2.48)	1.24 (0.56–2.74)	1.32 (0.42–4.16)
Age category (years)	20–34	1.00	1.00	1.00	1.00	1.00	1.00
	35–49	1.08 (0.83–1.42)	1.73 (0.66–4.55)	0.73 (0.45–1.18)	1.88 (0.54–6.55)	0.85 (0.43–1.68)	3.94 (0.79–19.68)
	50+	0.98 (0.73–1.31)	1.70 (0.61–4.74)	**0.55 (0.32–0.93)**	3.13 (0.88–11.09)	0.86 (0.41–1.81)	4.06 (0.77–21.29)
Gender	Men	1.00	1.00	1.00	1.00	1.00	1.00
	Women	**0.27 (0.22–0.33)**	**0.30 (0.16–0.60)**	**0.18 (0.12–0.26)**	**0.11 (0.04–0.26)**	**0.14 (0.08–0.25)**	**0.12 (0.04–0.32)**

HG, Hungarian general population; HR, Hungarian Roma population; AUDIT, AUDIT total scores; OR, odds ratio; CI, confidence interval. *Negative binomial regression. Problematic drinking: based on AUDIT scores, where cutoff: men ≥ 8. Women ≥ 5. **Binary logistic regression. Alcohol consumption at a hazardous level: scores of 1 or more on question 2 or question 3. Alcohol dependence: points scored above 0 on questions 4–6. Alcohol-related harm: points scored on questions 7–10. Past problems: based on the final two AUDIT questions. NC, not countable due to low strata-specific numbers. Bold indicates statistical significance.

10.3389/fpubh.2022.1003129

TABLE 6 Multivariate decomposition of the group (HG, HR) difference in alcohol-related harm.

		Endowments		Coefficients	
		Coef. (95% CI)	Pct.	Coef. (95%CI)	Pct.
	Primary or less	1.00			1.00
Education	Secondary	0.58% (1.90%; 3.05%)	8.18%	−0.22% (−3.56%; 3.13%)	−3.07%
	High school	−3.82% (11.33%; 3.69%)	−54.26%	2.58% (−3.47%; 8.64%)	36.07%
	Tertiary education	NC	NC	1.06% (−1.23%; 3.34%)	14.99%
	Worker	1.00			1.00
Economic activity	Pensioner, student	−0.14% (−0.43%; 0.15%)	−2.00%	−0.96% (−3.45%; 1.54%)	−13.59%
	Unemployed	1.43% (−0.75%; 3.60%)	20.25%	0.00% (0.00%; 0.00%)	0.00%
	Married	1.00			1.00
Marital status	Single	**−0.56% (1.01%; 0.10%)**	**−7.90%***	2.57% (−0.19%; 5.33%)	36.48%
	Widow divorced	−0.02% (−0.08%; 0.05%)	−0.23%	1.76% (−0.88%; 4.40%)	24.98%
	Good	1.00			1.00
Financial status	Satisfactory	0.02% (−0.30%; 0.34%)	0.28%	−0.35% (−6.15%; 5.45%)	−4.92%
	Bad	0.43% (−2.30%; 3.17%)	6.17%	−0.45% (−1.90%; 1.00%)	−6.37%
	20–34	1.00			1.00
Age category	35–49	0.05% (−0.08%; 0.17%)	0.68%	−0.07% (−4.50%; 4.36%)	−0.99%
	50+	−0.04% (−0.44%; 0.36%)	−0.53%	2.78% (−2.05%; 7.60%)	39.43%
Gender	Men	1.00			1.00
	Women	**−4.21% (5.94%; 2.49%)**	**−59.86%****	3.98% (−1.75%; 9.70%)	56.48%
Subtotal		−6.28% (15.37%; 2.80%)	−89.24%	**13.32% (3.00%; 23.64%)**	**189.24%***
	Total	7.04% (3.00%; 11.08%)**			

HG, Hungarian general population; HR, Hungarian Roma population. Alcohol-related harm: points scored on questions 7–10. Endowments: due to differences in characteristics. Coefficients: due to differences in coefficients. $^{*}p < 0.05$, $^{**}p < 0.01$. Coef. (%), coefficients multiplied by 100; CI, confidence interval; Pct., expressed as a percentage; NC, not countable due to low strata-specific numbers. Bold indicates statistical significance.

the Adult Population National Survey on Addiction Problems in Hungary (NSAPH 2015). This research was carried out on a nationally representative sample (2,274 individuals) of the Hungarian adult population aged 18–64 years of age, providing information on drinking frequency, quantity, heavy drinking, drunkenness, family history of regular alcohol use, and outpatient and inpatient care due to alcohol using the AUDIT questionnaire, among others (68). This survey found a higher prevalence of past 12-month drinkers (total 74.2%; men 83.3%; women 66.6%) compared to our data (total 53.19%; men 70.95%; women 39.30%). Furthermore, 78.8% of respondents in the study (men 66.7%, women 88.4%) never experienced a heavy drinking pattern (≥6 drinks on one occasion), and 14.6% (men 22%, women 8.5%) consumed less than they did monthly (69), which is in line with our findings. The higher abstinence rates of our Hungarian study sample may be explained by the higher health consciousness of enrolled individuals. Since data collection required an additional visit to GPs, which may be indicative of higher compliance and a higher awareness and understanding of health issues. Furthermore, questionnaires were administered by practice nurses (in contrast with NSAPH), making alcohol consumption a potentially sensitive issue for patients belonging to the GP practices. It is also important to note that our survey covered two counties in northeast Hungary, which are part of the Northern Great Plain region, where abstinence rates were found to be one of the highest in the country (70); meanwhile, the NSAPH collected alcohol consumption at the national level and also 3 years earlier.

Other AUDIT studies on the Hungarian general population were only available well before our study, making comparability of alcohol consumption data difficult. An investigation between 1997 and 2002 as a part of the GENACIS project focused on nine European countries (Switzerland, Spain, the U.K., Sweden, Finland, the Netherlands, the Czech Republic, Iceland, and Hungary) using the AUDIT tool to assess alcohol consumption behaviors. Comparing these data with our research findings should be done with caution since age ranges and interviewing methods differed (telephone, postal, face-to-face, self-administered) in the countries, and data collection took place much earlier than our investigation. Furthermore, types

of alcohol-related harm were analyzed separately, rather than as a single outcome variable. In all countries, drinking frequency and quantity were higher for men. In 2001, as a part of this project, the alcohol behavior of the Hungarian sample (age range of 19–65 years) was analyzed with self-administered questions. In this European study, only Sweden and Iceland could be identified by a lower prevalence of drinking more than two drinks per week, and Hungarian women were characterized by the lowest frequency in this aspect. Although only Finland and Iceland preceded Hungary in terms of heavy drinking (at least once per month) among men, Sweden, Finland, and Iceland were characterized by a higher prevalence among women. When comparing the Hungarian data with our results, the frequency of drinking more than two drinks per week was similar, but the frequency of heavy drinking was found to be higher (71) when compared to our findings. Though these data would be hardly comparable with ours, as data collection occurred over one and a half decades apart, from 2000 to 2001 an increase was observed in alcohol consumption levels in Hungary (and stagnating at this level until 2006) and ever since, a general declining trend in consumption levels can be observed (72).

Comparing the alcohol behavior of the Hungarian general and Roma populations in our study suggests that although Roma people consume alcohol at lower frequencies, they experience more alcohol-related harm, even when considering past problems. This is congruent with the findings from Slovenia by Zelko et al. which is the only research available on Roma using the AUDIT questionnaire (49). Furthermore, studies in Europe also indicate that alcohol-related harm affects certain groups disproportionately, with the harm increasing with lower socioeconomic status, though mostly accompanied by lower consumption levels (9). Likewise, in the United States, alcohol use is also differentially associated with negative outcomes for different ethnic groups, which are not only related to the levels of alcohol consumption, since residents of socially disadvantaged areas and some ethnic minorities experience more harm per gram of alcohol consumed than those living in better conditions. The underlying causes may include differences in social and socioeconomic factors (73, 74), cultural differences in attitudes toward alcohol (74–76) and help-seeking behaviors, a shortage of health and social services, knowledge of negative consequences, shame and stigma associated with alcohol problems, and biological or genetic differences in alcohol metabolism (74).

Understanding the underlying social, cultural, and other factors contributing to the disparities in alcohol-related harm is essential from the point of view of public health (77). Although higher socioeconomic status (SES) is usually linked to more favorable health behaviors, in the case of alcohol consumption, the link is not always so clear-cut. The frequency of alcohol use tends to be higher among individuals with higher SES, but when considering drinkers, larger quantities are consumed by people with low socioeconomic status (78). Furthermore, more alcohol-related harm is experienced by some groups in socially disadvantaged areas and by some ethnic minorities than by those in better conditions (74). Discrimination and stigma clearly impact stress throughout life and risky health behaviors, including alcohol use. Excessive alcohol use can be a way to cope with the stress of everyday life and with ethnic discrimination, as research from the United States suggests. While the relationship with the African American community is unclear, higher alcohol consumption can be linked to self-reported unfair treatment and racial discrimination among the Asian American and Latino communities (16). In addition, research suggests that there may be a larger stigma associated with alcohol-consuming women in certain cultures (77). Furthermore, the built environment (poor conditions, including less favorable building conditions, housing, water safety, and sanitation) was also found to be associated with indicators of heavy drinking (79). These factors—which are all relevant for Roma living in Europe and Hungary—cannot be ignored when addressing racial and ethnic disparities in alcohol-related harm. When it comes to sensitive issues like alcohol problems, where there is a feeling that it may increase stigma against them, Roma's previous negative experiences with health services and mistrust of medical professionals may be a barrier to help-seeking. Delay in seeking help may also be caused by the problem that Roma often try to hide their mental health problems from family and from community members, which is due to the fear of damaging the family's reputation. Health treatment is often only sought at more advanced stages of the problem (80).

Cultural norms and beliefs toward alcohol consumption could be different and influence alcohol consumption patterns. Certain cultures may be permissive, which may apply to Roma as well because of a lack of knowledge of health consequences (74–76, 80). Besides a poor understanding of the nature of addiction itself (74–76, 80) and the availability of services and treatment options, Roma could be distrustful of the medical system (81). Physical barriers to healthcare services may delay or hamper receiving adequate medical care and counseling, especially in the case of Roma living in segregated colonies.

Our decomposition analysis revealed that, when considering alcohol-related harm, disparities in gender and relationship status affect Roma more than non-Roma, i.e., being single or a woman causes more intense differences. Equalizing the gender and marital status differences would be expected to reduce the HG and HR alcohol-related harm frequency gaps by about 8 and 60%, respectively. These findings might be explained by factors arising from Roma culture. This in fact means that, again, being single and a woman are considered inferior statuses in Roma communities (24, 73, 82–85), which may also contribute to differences in alcohol-related harm among them.

In addition to ethnic-specific differences, our study findings were consistent with common knowledge of the protective effect of being a woman on alcohol consumption behaviors, e.g., women are less likely to experience alcohol consumption

at hazardous levels, suffer from the presence or incipience of alcohol dependence, and experience present or past alcohol-related harm (69, 71), even when dependence and alcohol consumption are measured with different tools (70, 86).

Some limitations of our study are related to the Roma population. The Roma sample was not representative of the overall Hungarian Roma population; it was only representative of Roma living in segregated colonies in northeast Hungary, where they are concentrated. Roma individuals who were, to various degrees, assimilated with the country's general population were not included in the analysis. Many Roma can be reluctant to self-define themselves as Roma (87); therefore, the reference sample of the Hungarian general population may have included some Roma people as well. It also has to be indicated that in our present study, the representation of women among HR was higher when compared to HG, similar to our previous surveys conducted among segregated Roma colonies in Hungary (88) and to a cross-sectional study conducted in Slovakia as well (89). This is because data collection occurred during the day when women were at home and men were away working. Between 2010 and 2015, the budget for public works was quadrupled by the Hungarian government for all Hungarian municipalities. This is especially relevant for villages situated in northeast Hungary, where segregated Roma settlements are concentrated, since the majority of participating workers in the program are men from underprivileged Roma communities (55). In addition, subjects aged 65 or over are not represented in our study samples. Since the representation of people over 65 years was as low as 3–4% in our previous Roma surveys (29, 53, 88), the size of the strata 65-X would be too small to make reliable conclusions for this subgroup of the population. Another limitation can arise due to the decreased number of Roma respondents in some sociodemographic strata (e.g., tertiary education). The small number of Roma subjects likely resulted in a type II error, which is responsible for the lack of observable differences between the Roma and non-Roma samples.

Furthermore, alcohol consumption and related problems may be underreported (90) even when using the AUDIT questionnaire (91), and the performance of the AUDIT screening tool may be diminished in certain ethnic minorities and ethnic groups with low acculturation (61). This problem may also occur in Roma communities since previous research suggests that Roma may be more inclined to please the investigators than the rest of the population, which may have an impact on the questionnaire results (76, 92, 93). This is especially relevant when asking about sensitive issues such as alcohol consumption. Roma people are already facing discrimination, stigma, and negative stereotypes and may fear answering alcohol consumption questions truthfully, which may be even more pronounced when describing the negative effects of alcohol use. The accurate understanding of the AUDIT questions and recalling the necessary information can also be a problem in some cases. However, these two potential issues were addressed by including Roma students as interviewers.

Nevertheless, investigating alcohol-attributed damage at the ethnic level provides important information to identify high-risk groups, and thus to design and implement more targeted and accessible therapies for alcohol problems. Our study provides insight into the alcohol consumption habits of the Hungarian general and Roma populations, pointing out a specific need for intervention targeting Roma people.

5. Conclusion

Our findings suggest that there are disparities in certain aspects of alcohol–related damage in Hungary when the Roma population is considered. Fighting stigma and poverty in the case of marginalized people, i.e., Roma living in European countries and Hungary, is essential to reducing inequities in alcohol-related harm. Furthermore, understanding the impact of culture on alcohol consumption is important for policymakers; culture-specific approaches are needed so that interventions and treatment options can meet the needs of vulnerable groups and ethnic minorities. Health education on the adverse effects of alcohol should be delivered and specifically tailored to Roma and removing barriers to receiving adequate health services is also essential. An option may be the improvement of screening and counseling (and treatment referrals when needed) delivered at the primary care level since GP practices are the most easily accessible for marginalized and segregated populations.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethical Committee of the Hungarian Scientific Council on Health (61327-2017/EKU). The patients/participants provided their written informed consent to participate in this study.

Author contributions

AAMK was involved in data analysis and writing the manuscript. FV analyzed the data. PP took part in the creation of the database and the coding and sorting of the data. ZK and JS were involved in the design of the

complex comparative health survey and data collection. RÁ took part in all steps of the development of the complex comparative health survey, guided the writing of the manuscript, and was involved in finalizing it. JD took part in interpreting the results and writing and finalizing the manuscript. All authors contributed to the article and approved the submitted version.

Funding

This work was supported by the GINOP-2.3.2-15-2016-00005 project. The project was co-financed by the European Union under the European Social Fund and European Regional Development Fund, as well as by the Hungarian Academy of Sciences (TK2016-78) and the Eötvös Loránd Research Network (TKCS-2021/32). Project no. 135784 has also been implemented with the support provided by the National Research, Development, and Innovation Fund of Hungary, financed under the K_20 funding scheme.

Acknowledgments

AAMK receives the Stipendium Hungaricum Scholarship for the Ph.D. program.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Park SH, Kim DJ. Global and regional impacts of alcohol use on public health: emphasis on alcohol policies. *Clin Mol Hepatol.* (2020) 26:652–61. doi: 10.3350/cmh.2020.0160

2. Shield K, Manthey J, Rylett M, Probst C, Wettlaufer A, Parry CD, et al. National, regional, and global burdens of disease from 2000 to 2016 attributable to alcohol use: a comparative risk assessment study. *Lancet Public Health.* (2020) 5:e51–61. doi: 10.1016/S2468-2667(19)30231-2

3. GBD 2021 Alcohol Collaborators. Population-level risks of alcohol consumption by amount, geography, age, sex, and year: a systematic analysis for the global burden of disease study 2020. *Lancet.* (2022) 400:185–235. doi: 10.1016/S0140-6736(22)00847-9

4. White AM, Castle IP, Powell PA, Hingson RW, Koob GF. Alcohol-Related deaths during the COVID-19 pandemic. *JAMA.* (2022) 327:1704–6. doi: 10.1001/jama.2022.4308

5. OECD. *OECD Health Policy Studies, Preventing Harmful Alcohol Use*. Paris: OECD Publishing (2021).

6. World Health Organization. *Global Status Report on Alcohol and Health 2018*. Geneva: World Health Organization (2018).

7. OECD/European Union. *Health at a Glance: Europe 2020: State of Health in the EU Cycle*. Paris: OECD Publishing (2020)

8. OECD. *Health at a Glance 2021:OECD Indicators*. Paris: OECD Publishing (2021).

9. World Health Organization. *Regional Office for Europe. Alcohol and Inequities. Guidance for Addressing Inequities in Alcohol-Related Harm*. World health Organization (2014). Available online at: https://www.euro.who.int/__data/assets/pdf_file/0003/247629/Alcohol-and-Inequities.pdf (accessed April 25, 2022).

10. National Research Council (US) Panel on Race, Ethnicity, and Health in Later Life, Bulatao RA, Anderson NB, editors. *Understanding Racial and Ethnic Differences in Health in Late Life: A Research Agenda*. Washington, DC: National Academies Press (US) (2004).

11. Substance Abuse and Mental Health Services Administration. *Results From the 2012 National Survey on Drug Use and Health: Summary of National Findings*. Rockville, MD: Substance Abuse and Mental Health Services Administration (NSDUH Series H-46, HHS Publication No. (SMA) (2013).

12. Dawson DA. Beyond black, white and hispanic: race, ethnic origin and drinking patterns in the United States. *J Subst Abuse.* (1998) 10:321–39. doi: 10.1016/S0899-3289(99)00009-7

13. Cook WK, Mulia N, Karriker-Jaffe K. Ethnic drinking cultures and alcohol use among Asian American adults: findings from a national survey. *Alcohol Alcohol.* (2012) 47:340–8. doi: 10.1093/alcalc/ags017

14. Borrell LN, Roux AVD, Jacobs DR Jr, Shea S, Jackson SA, Shrager S, et al. Perceived racial/ethnic discrimination, smoking and alcohol consumption in the multi-ethnic study of atherosclerosis (MESA). *Prev Med.* (2010) 51:307–12. doi: 10.1016/j.ypmed.2010.05.017

15. Chae DH, Takeuchi DT, Barbeau EM, Bennett GG, Lindsey JC, Stoddard AM, et al. Alcohol disorders among Asian Americans: associations with unfair treatment, racial/ethnic discrimination, and ethnic identification (the national Latino and Asian Americans study, 2002–2003). *J Epidemiol Community Health.* (2008) 62:973–9. doi: 10.1136/jech.2007.066811

16. Gee GC, Delva J, Takeuchi DT. Relationships between self-reported unfair treatment and prescription medication use, illicit drug use, and alcohol dependence among Filipino Americans. *Am J Public Health.* (2007) 97:933–40. doi: 10.2105/AJPH.2005.075739

17. Terrell FM, Miller AR, Foster K, Watkins CE Jr. Racial discrimination-induced anger and alcohol use among black adolescents. *Adolescence.* (2006) 41:485–92.

18. Gilbert PA, Zemore SE. Discrimination and drinking: a systematic review of the evidence. *Soc Sci Med.* (2016) 161:178–94. doi: 10.1016/j.socscimed.2016.06.009

19. European Commission. *Communication from the Commission to the European Parliament, the Council the European Economic and Social Committee and the Committee of the Regions Framework for National Roma Integration Strategies up to 2020*. Brussels: European Commission (2011). Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0173&from=en (accessed May 26, 2022).

20. Bernáth A. *Roma in Eastern Europe. Roma in Central and Eastern Europe*. Berlin: GESIS Leibniz Institute for the Social Sciences, Service Agency Eastern Europe (2009).

21. Pásztor IZ, Pénzes J, Tátrai P, Pálóczi Á. The number and spatial distribution of the Roma population in Hungary–in the light of different approaches. *Folia Geogr.* (2016) 58:5.

22. European Union Agency for Fundamental Rights. *The Situation of Roma in 11 EU Member States: Survey Results at a Glance.* Available online at: https://fra.europa.eu/sites/default/files/fra_uploads/2099-FRA-2012-Roma-at-a-glance_EN.pdf (accessed May 26, 2022).

23. Bartoš VB, Bauer M, Chytilová J, Matějka F. Attention discrimination: theory and field experiments with monitoring information acquisition. *Am Econ Rev.* (2016) 106:1437–75. doi: 10.1257/aer.20140571

24. Ciaian PK, Kancs DA. Causes of the social and economic marginalisation: the role of social mobility barriers for Roma. In: *EERI Research Paper Series: 2016 EERI RP 2016/03.* Brussels: Economics and Econometrics Research Institute (EERI) (2016).

25. European Commission. *Directorate-General for Health and Consumers, Roma health Report, Health Status of the Roma Population: Data Collection in the Member States of the European Union, Publications Office.* (2015). Available online at: https://data.europa.eu/doi/10.2772/3140 (accessed May 26, 2022).

26. Colombini M, Rechel B, Mayhew SH. Access of Roma to sexual and reproductive health services: qualitative findings from Albania, Bulgaria and Macedonia. *Glob Public Health.* (2012) 7:522–34. doi: 10.1080/17441692.2011.641990

27. Kühlbrandt C, Footman K, Rechel B, McKee M. An examination of Roma health insurance status in Central and Eastern Europe. *Eur J Public Health.* (2014) 24:707–12. doi: 10.1093/eurpub/cku004

28. McFadden A, Siebelt L, Gavine A, Atkin K, Bell K, Innes N, et al. Gypsy, Roma and traveller access to and engagement with health services: a systematic review. *Eur J Public Health.* (2018) 28:74–81. doi: 10.1093/eurpub/ckx226

29. Kósa Z, Széles Gy, Kardos L, Kósa K, Németh R, Országh S, et al. A comparative health survey of the inhabitants of Roma settlements in Hungary. *Am J Public Health.* (2007) 97:853–9. doi: 10.2105/AJPH.2005.072173

30. Powell R, Lever J. Europe's perennial 'outsiders': a processual approach to Roma stigmatization and ghettoization. *Curr Sociol.* (2017) 65:680–99 doi: 10.1177/0011392115594213

31. Toma S, Fosztó L. Roma within obstructing and transformative spaces: migration processes and social distance in ethnically mixed localities in Romania. *Intersect EEJSP.* (2018) 4:57–80. doi: 10.17356/ieejsp.v4i3.396

32. van Baar H, Ivasiuc A, Kreide R, Editors. *The Securitization of the Roma in Europe. Human Rights Interventions.* Cham: Palgrave Macmillan (2019). doi: 10.1007/978-3-319-77035-2

33. Vincze E. Faces and causes of roma marginalization. In: Szalai J, Zentai V, editors. *Faces and Causes of Roma Marginalization in Local Contexts Serbia Romania Hungary*. Budapest: Center For Policy Studies Central European University (2014). p. 67–96.

34. Cretan R, Covaci RN, Jucu SI. Articulating 'otherness' within multiethnic rural neighbourhoods: encounters between Roma and non-Roma in an East-Central European borderland. *Identities.* (2021) 1–19. doi: 10.1080/1070289X.2021.1920774

35. Fosztó L. "Was there a 'gypsy problem' in socialist Romania? From suppressing 'nationalism' to recognition of a national minority." *Stud Babes Bolyai Sociol.* (2018) 63:117–40. doi: 10.2478/subbs-2018-0014

36. Cretan R, Kupka P, Powell R, Walach V. Everyday Roma stigmatization: racialized urban encounters, collective histories and fragmented habitus. *IJURR.* (2022) 46:82–100. doi: 10.1111/1468-2427.13053

37. Weinerová R. Anti-gypsyism in the Czech Republic: Czechs' perception of Roma in cultural stereotypes. *Acta Ethnograph Hung.* (2014) 59:211–21. doi: 10.1556/AEthn.59.2014.1.10

38. Cretan R, Málovics Gy, Méreine Berki B. On the perpetuation and contestation of racial stigma: Urban Roma in a disadvantaged neighbourhood of Szeged. *Geogr Pannonica.* (2020) 24:294–310. doi: 10.5937/gp24-28226

39. Málovics Gy, Cretan R, Méreine Berki B, Tóth J. Socio-environmental justice, participatory development, and empowerment of segregated urban Roma: Lessons from Szeged, Hungary. *Cities.* (2019) 91. doi: 10.1016/j.cities.2018.11.013

40. Méreine Berki B, Málovics GY, Cretan R. "You become one with the place": social mixing, social capital, and the lived experience of urban desegregation in the Roma community. *Cities.* (2021) 117:103302. doi: 10.1016/j.cities.2021.103302

41. Babinská I, Gecková AM, Jarcuska P, Pella D, Mareková M, Stefkova G, et al. Does the population living in Roma settlements differ in physical activity, smoking and alcohol consumption from the majority population in Slovakia. *Cent Eur J Public Health.* (2014) 22:P22–7. doi: 10.21101/cejph.a3897

42. Diabelková JR, Rimárová K, Urdzík P, Dorko E, Bušová A. Risk factors of preterm birth and low birth weight neonates among Roma and non-Roma mothers. *Cent Eur J Public Health.* (2018) 26:S25–31. doi: 10.21101/cejph.a5273

43. Cace S, Cantarji V, Sali N, Alla M. *Roma in the Republic of Moldova*. Chisnau: United Nations Development Programme (2007). Available online at: https://www.researchgate.net/profile/Sorin-Cace/publication/293487948_Roma_in_the_Republic_of_Moldova/links/56b8ea2b08ae39ea9905b3ec/Roma-in-the-Republic-of-Moldova.pdf (accessed May 26, 2022).

44. Ekuklu G, Deveci S, Eskiocak M, Berberoglu U, Saltik A. Alcoholism prevalence and some related factors in Edirne, Turkey. *Yonsei Med J.* (2004) 45:207–14. doi: 10.3349/ymj.2004.45.2.207

45. Kanapeckiene V, Valinteliene R, BerŽanskyte A, Kevalas R, Supranowicz P. Health of Roma children in Vilnius and Ventspils. *Medicina.* (2009) 45:153. doi: 10.3390/medicina45020020

46. Chomynová P, Kozák J, Mravčík V. Substance use in Roma population in contact with social workers in the Czech Republic: a cross-sectional questionnaire survey. *J Ethn Subst Abuse.* (2021) 20:275–94. doi: 10.1080/15332640.2020.1717399

47. Carrasco-Garrido P, López de Andrés A, Hernández Barrera V, Jiménez-Trujillo I, Jiménez-García R. Health status of Roma women in Spain. *Eur J Public Health.* (2011) 21:793–8. doi: 10.1093/eurpub/ckq153

48. La Parra D. *Towards Equity in Health: Comparative Study of National Health SURVEYS in the Roma Population and the General Population in Spain, 2006*. Madrid: Ministerio de Sanidad y Consumo (2009).

49. Zelko E. Differences in alcohol consumption habits between Roma and non-Roma in Northeastern Slovenia. *Sloven Nurs Rev.* (2017) 42–51. doi: 10.14528/snr.2017.51.2.156

50. Sárváry A, Kósa Z, Jávorné Erdei R. Telepszerü körülmények között élo gyermekek egészségmagatartás Északkelet-Magyarországon (Article in Hungarian: health behaviour of children living in colonies in North-Eastern Hungary). *Népeü.* (2012) 90:230–44.

51. Gerevich J, Bácskai E, Czobor P, Szabó, J. Substance use in Roma and non-Roma adolescents. *J Nerv Ment Dis.* (2010) 198:432–6. doi: 10.1097/NMD.0b013e3181e07d51

52. Sárváry A, Kósa Z, Jávorné Erdei R, Gyulai A, Takács P, Sándor J, et al. Socioeconomic status, health related behaviour, and self-rated health of children living in Roma settlements in Hungary. *Cent Eur J Public Health.* (2019) 27:24–31. doi: 10.21101/cejph.a4726

53. Sándor J, Kósa Z, Boruzs K, Boros J, Tokaji I, McKee M, et al. The decade of Roma Inclusion: did it make a difference to health and use of health care services? *Int J Public Health.* (2017) 63:803–15. doi: 10.1007/s00038-017-0954-9

54. World Health Organization. *The Alcohol Use Disorders Identification Test Guidelines for Use in Primary Care.* Second edition. Geneva: World Health Organization (2001).

55. Ádány R, Pikó P, Fiatal S, Kósa Z, Sándor J, Bíró É, et al. Prevalence of Insulin resistance in the Hungarian general and Roma populations as defined by using data generated in a complex health (interview and examination) survey. *Int J Environ Res Public Health.* (2020) 17:4833. doi: 10.3390/ijerph17134833

56. Széles G, Vokó Z, Jenei T, Kardos L, Pocsai Z, Bajtay A, et al. A preliminary evaluation of a health monitoring programme in Hungary. *Eur J Public Health.* (2005) 15:26–32. doi: 10.1093/eurpub/cki107

57. Szigethy E, Széles G, Horvath A, Hidvegi T, Jermendy G, Paragh G, et al. Epidemiology of the metabolic syndrome in Hungary. *Public Health.* (2012) 126:143–9. doi: 10.1016/j.puhe.2011.11.003

58. Kósa K, Daragó L, Ádány R. Environmental survey of segregated habitats of Roma in Hungary: a way to be empowering and reliable in minority research. *Eur J Public Health.* (2011) 21:463–8. doi: 10.1093/eurpub/ckp097

59. *Hungarian Central Statistical Office Health Interview Survey (EHIS), 2014. Questionnaire.* (2014). Available online at: https://www.ksh.hu/elef/archiv/2014/pdfs/elef2014_kerdoiv.pdf (accessed June 28, 2022).

60. Gerevich J, Bácskai E, Rózsa S. A kockázatos alkoholfogyasztás prevalenciája. *Psychiatr Hung.* (2006) 21:45–56.

61. Reinert DF, Allen JP. The alcohol use disorders identification test: an update of research findings. *Alcohol Clin Exp Res.* (2007) 31:185–99. doi: 10.1111/j.1530-0277.2006.00295.x

62. Aalto M, Alho H, Halme JT, Seppä K. AUDIT and its abbreviated versions in detecting heavy and binge drinking in a general population survey. *Drug Alcohol Depend.* (2009) 103:25–9. doi: 10.1016/j.drugalcdep.2009.02.013

63. Oaxaka R. Male-female wage differentials in urban labor markets. *Int Econ Rev.* (1973) 14:693–709. doi: 10.2307/2525981

64. Blinder AS. Wage discrimination: reduced form and structural estimates. *J Hum Resour.* (1973) 8:436–55. doi: 10.2307/144855

65. Powers DA, Yoshioka H, Yun M-S. Mvdcmp: multivariate decomposition for nonlinear response models. *Stata J.* (2012) 11:556–76. doi: 10.1177/1536867X1101100404

66. O'Brien H, Callinan S, Livingston M, Doyle JS, Dietze PM. Population patterns in alcohol use disorders identification test (AUDIT) scores in the Australian population; 2007-2016. *Aust N Z J Public Health*. (2020) 44:462–7. doi: 10.1111/1753-6405.13043

67. Källmén H, Berman AH, Elgán TH, Wennberg P. Alcohol habits in Sweden during 1997-2018: a repeated cross-sectional study. *Nord J Psychiatry*. (2019) 73:522–6. doi: 10.1080/08039488.2019.1660912

68. Paksi B, Demetrovics Z, Magi A, Felvinczi K. Methodology of the national (representative) survey on addiction problems in hungary (NSAPH 2015) [Article in Hungarian: Az országos lakossági adatfelvétel az addiktológiai problémákról 2015 (OLAAP 2015) reprezentatív lakossági felmérés módszertana és a minta leíró jellemzoi]. *Neuropsychopharmacol Hung*. (2017) 19:55–85.

69. Alkoholfogyasztás a Felnott Népesség Körében—a 2015. *Évi Országos Lakossági Adatfelvétel Addiktológiai Problémákról (OLAAP 2015) Alapján a Magyar Addiktológiai Társaság Tematikus Konferenciája. Reálisan az alkohol ügyrol" 2016. Május 19*. Budapest. [In Hungarian: Alcohol consumption of the adult Hungarian population based on the National (Representative) Survey on Addiction Problems in Hungary (NSAPH 2015)] (2015).

70. Hungarian Central Statistical Office. *STADAT Table 4.1.1.38. Distribution of Population by Alcohol Consumption Patterns*. Available online at: https://www.ksh.hu/stadat_files/ege/en/ege0038.html (accessed May 5, 2022).

71. Knibbe R, Derickx M, Kuntsche S, Grittner U, Bloomfield K. A comparison of the alcohol use disorder identification test (AUDIT) in general population surveys in nine European countries. *Alcohol Alcohol*. (2006) 41:i19–25. doi: 10.1093/alcalc/agl072

72. World Health Organiztion. *Health for All Database, Pure Alcohol Consumption, Age 15+ (Litres Per Capita)*. Available online at: https://gateway.euro.who.int/en/hfa-explorer/ (accessed May 5, 2022).

73. Szabóné Kármán J. *A Magyarországi Cigány/Roma Népesség Kultúrantropológiai és Orvosantropológiai Megközelítésben*. In: Kármán JS, editor. *Romológiai Füzetek 2 Étrend, Táplálkozás.*. Debrecen: Debreceni Református Hittudományi Egyetem (2018). p. 31–4.

74. Chartier K, Caetano R. Ethnicity and health disparities in alcohol research. *Alcohol Res Health*. (2010) 33:152–60.

75. European Monitoring Centre on Racism and Xenophobia. *Breaking the Barriers—Romani Women and Access to Public Health Care*. European Centre on Racism and Xenophoboa (2003). Available online at: https://fra.europa.eu/sites/default/files/fra_uploads/180-ROMA-HC-EN.pdf (accessed May 30, 2022).

76. Petek D, Pavlic DR, Svab I, Lolic D. Attitudes of Roma toward smoking: qualitative study in Slovenia. *Croat Med*. (2006) 47:344–7.

77. Sudhinaraset M, Wigglesworth C, Takeuchi DT. Social and cultural contexts of alcohol use: influences in a social-ecological framework. *Alcohol Res*. (2016) 38:35–45.

78. Huckle T, You RQ, Casswell S. Socio-economic status predicts drinking patterns but not alcohol-related consequences independently. *Addiction*. (2010) 105:192–202. doi: 10.1111/j.1360-0443.2010.02931.x

79. Bernstein KT, Galea S, Ahern J, Tracy M, Vlahov D. The built environment and alcohol consumption in urban neighborhoods. *Drug Alcohol Depend*. (2007) 91:244–52. doi: 10.1016/j.drugalcdep.2007.06.006

80. NHS England. *The Roma Support Group the Roma Community. Information Leaflet for Health Care Professionals and NHS Personnel*. NHS England (2016). Available online at: https://www.england.nhs.uk/wp-content/uploads/2016/07/roma-info-leaflet.pdf (accessed November 15, 2022).

81. Vivian C, Dundes L. The crossroads of culture and health among the Roma (gypsies). *J Nurs Scholarsh*. (2004) 36:86–91. doi: 10.1111/j.1547-5069.2004.04018.x

82. European Union Agency for Fundamental Rights. *Discrimination Against and Living Conditions of Roma Women in 11 EU Member States Roma Survey—Data in Focus*. Belgium: European Union Agency for Fundamental Rights (2016).

83. Matras Y. *Roma Culture: An Introduction*. Roma Culture, Project Education of Roma Children in Europe Project, Council of Europe (2015). Available online at: http://languagecontact.humanities.manchester.ac.uk/YM/downloads/Matras,%20Y.%20(2011)%20Roma%20culture%20an%20introduction.pdf (accessed June 24, 2022).

84. Afanasieva L, Bukrieieva I, Glyns'ka L, Hlebova N, & Semikin, M. Family roles of Roma and ways to overcome its socio-cultural isolation. *J Hist Cult Art Res*. (2020) 9:288–96. doi: 10.7596/taksad.v9i3.2716

85. Szuhay P. *A Magyarországi Cigányság Kultúrája: Etnikus Kultúra Vagy a Szegénység Kultúrája*. Panoráma: Budapest (1999).

86. Hungarian Central Statistical Office. *STADAT Table 4.1.1.30. Care for Alcoholics*. Hungarian Central Statistical Office. Available online at: https://www.ksh.hu/stadat_files/ege/en/ege0030.html (accessed May 30, 2022).

87. Islam S, Small N, Bryant M, Yang T, Cronin de Chavez A, Saville, et al. Addressing obesity in Roma communities: a community readiness approach. *Int J Hum Rights Healthc*. (2019) 12:79–90. doi: 10.1108/IJHRH-06-2018-0038

88. Kósa Z, Moravcsik-Kornyicki Á, Diószegi J, Roberts B, Sándor J, Ádány R. Prevalence of metabolic syndrome among Roma living in segregated colonies: a comparative health examination survey in Hungary. *Eur J Public Health*. (2015) 25:299–304. doi: 10.1093/eurpub/cku157

89. Macejova Z, Kristian P, Janicko M, Halanova M, Drazilova S, Antolova D, et al. The Roma population living in segregated settlements in Eastern Slovakia has a higher prevalence of metabolic syndrome, kidney disease, viral hepatitis B and E, and some parasitic diseases compared to the majority population. *Int J Environ Res Public Health*. (2020) 17:3112. doi: 10.3390/ijerph17093112

90. Gilligan C, Anderson K, Ladd BO, Yong YM, David M. Inaccuracies in survey reporting of alcohol consumption. *BMC Public Health*. (2019) 19:1639. doi: 10.1186/s12889-019-7987-3

91. Hoonpongsimanont W, Ghanem G, Chen Y, Sahota PK, Carroll C, Barrios C, et al. Underreporting of alcohol use in trauma patients: a retrospective analysis. *Subst Abus*. (2021) 42:192–6. doi: 10.1080/08897077.2019.1671936

92. Niksic D, Kurspahic-Mujcic A. The presene of health-risk behaviour in Roma family. *Bosn J Basic Med Sci*. (2007) 7:146–51. doi: 10.17305/bjbms.2007.3070

93. Zelko E, Švab, I, Rotar-Pavlič, D. Quality of life and patient satisfaction with family practice care in a Roma population with chronic conditions in northeast Slovenia. *Zdr Varst*. (2015) 54:336–44. doi: 10.1515/sjph-2015-0003

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 01 March 2023
DOI 10.3389/fpubh.2023.1009214

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Public Health Policy, a section of the journal Frontiers in Public Health

RECEIVED 01 August 2022
ACCEPTED 07 February 2023
PUBLISHED 01 March 2023

CITATION
Asim S, Nichini E, Goggins WB, Dong D and Yeoh E-K (2023) Maternity care experience of Pakistani ethnic minority women in Hong Kong. *Front. Public Health* 11:1009214. doi: 10.3389/fpubh.2023.1009214

Maternity care experience of Pakistani ethnic minority women in Hong Kong

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Background: Persistent inequalities in maternity care experience and outcomes exist globally for ethnic minority (EM) and migrant women. Despite the fact that this is an important research area, no prior study has been done in Hong Kong (HK) to examine maternity care experience of EM women.

Objectives: To investigate maternity care experience of Pakistani EM women (both local born and immigrants) during pregnancy, birth and after birth in hospital in HK. An evaluation of their satisfaction and factors predicting satisfaction with care during the three phases of maternity care was included in the study.

Methods: A cross sectional survey was conducted among Pakistani EM women who had given birth in HK in last 3 years, using a structured questionnaire by a bilingual interviewer, from April to May 2020. Counts and percentages were used to describe all categorical variables. Association between predictor variables and overall satisfaction was assessed by bivariate analysis and multiple logistic regression.

Results: One hundred and twenty questionnaires were completed. Almost 60 percent of the women were very satisfied with the overall care. More than half of the women described the care they received as kind, respectful and well communicated. After adjusting for age and parity, HK born Pakistani women expressed relatively less satisfaction with care, especially during pregnancy and labor and birth, as compared with Pakistan born women. Women with conversational or fluent English-speaking ability also felt comparatively less satisfied particularly from intrapartum and postnatal care in hospital. Education level had a negative association with satisfaction with care during pregnancy.

Conclusions: Maternity care providers should take into account the diversity of EM women population in HK. Our findings suggest that effective communication and care that can meet individual needs, expectations, and values is imperative to improve experience and quality of maternity care for EM women in HK.

KEYWORDS

Pakistani women, maternity care, ethnic minority, immigrant, Hong Kong

1. Introduction

Maternity care, which is the healthcare received throughout pregnancy, during labor and childbirth and up to 6 weeks after childbirth, is of vital significance for maternal and child health. As such, policies have been implemented worldwide to ensure provision of equitable good quality maternity care to every pregnant woman and child. Such efforts

incorporated the agenda of the United Nations Millennium Development Goals 4 and 5 (MDG, 2000–2015) and later the Sustainable Development Goal 3 (SDG, 2016–2030) (1, 2). In articulation with this, the World Health Organization (WHO) also formulated the new Global Strategy for Women's, Children's and Adolescents' Health (2016–2030) for the SDG era in conjunction with the global community (3).

Despite these efforts, persistent inequalities in maternity care experience and outcomes exist globally, particularly for ethnic minority and migrant women (4–6). These women tend to have higher susceptibility to anxiety and depression as compared to majority and native women (7, 8). Moreover, there is potentially increased risk of prematurity, low birth weight, increased maternal and infant morbidity and mortality (9, 10). Previous research identified several factors shaping these inequalities, including communication gap and lack of information due to language and cultural differences, structural barriers, stereotyping, discrimination and social exclusion (11, 12). Other factors included socio-economic status, poverty, gender inequalities and living in highly deprived areas (10, 12).

While branding itself as an international and inclusive city, Hong Kong holds a hegemonic Chinese culture where discrimination and marginalization of ethnic and migrant communities are widespread (13). Despite their deep-rooted presence in the city since its British colonial times, South Asians in general, and the Pakistani community in particular, is one of the most marginalized EM population in HK in terms of economic, social and educational levels (14). Such marginalization is also reflected in the health sector where they are exposed to higher health risks yet poorer access to healthcare services (15, 16); women in particular felt disengaged with the HK healthcare system (17).

Such marginality is likely to have detrimental effects on maternity care experience of Pakistani EM women in HK. Research conducted in Western countries has in fact documented adverse perinatal outcomes and poor maternity care experience of Pakistani EM women. A study from the United Kingdom (UK) for instance investigated increased perinatal mortality in Pakistani EM women and found that they had more risk factors, including low birth weight, diabetes, gestational diabetes, less BMI (<18 kg/m2), high parity and delayed bookings (>12 weeks) (18). Another UK study indicated that very few Pakistani mothers took pre-conception folic acid as they were less aware of the role of folic acid in congenital anomalies prevention (19). Low utilization of pain relief during birth was more common among Pakistani women, due to low education, less native language speaking ability and discrepancies in information availability. As a result, these women felt unsupported and dissatisfied with the maternity care they received (20–22). Conversely, Pakistani women with higher education were highly confident, well supported and informed appropriately (20).

Although HK has one of the lowest maternal mortality and infant mortality rate in the world (23), yet these indicators alone are insufficient in measuring quality care. WHO maternal and newborn quality care framework emphasized on experience of care as a key domain along with clinical care provision and availability of human and physical resources (24). Women satisfaction with care is a quality indicator to measure experience of care that should be evaluated for identifying areas for action to provide good quality maternity care (25). The objective of this study is to investigate maternity care experience of Pakistani EM women (both local born and immigrants) during pregnancy, birth and after birth in hospital in HK. An evaluation of their satisfaction and factors predicting satisfaction with care during the three phases of maternity care was also included in the study.

2. Materials and methods

2.1. Study design, setting, and period

A cross-sectional study was conducted in HK from April to May 2020. Due to the social distancing measures during COVID-19, the survey was done on phone through WhatsApp video call. Ethics approval was obtained from the Survey and Behavioral Research Ethics Committee of the University (SBRE-19-521).

2.2. Populations and eligibility

All women living in HK, aged 18 and above, self-identified themselves as Pakistani and had given birth to at least one child in HK in the past 3 years, were included as the target population of the study. Women whose baby had died were excluded.

2.3. Sample size determination and sampling procedures

Purposive and snowball sampling was employed to recruit the eligible participants. The participants were reached through local Pakistani WhatsApp groups, social networks, non-governmental organizations working for ethnic minorities and community workers. The purpose and procedure of the study was explained to them and those who agreed to join were contacted to set the schedule for the interview.

Sample size was estimated by assuming 50% women satisfaction with maternity care services and 95% confidence interval with 7% error of margin. It was calculated by the equation (26):

$$N = \frac{\left[z^2_{\frac{\alpha}{2}} \times p \times (1-p) \times DEFF\right]}{d^2}$$

Where α (Probability of type 1 error) = 0.05, p (Prevalence proportion) = 0.5, DEFF (Effect Size) = 1, d (Absolute precision) = 0.07, N (Sample size) = 196. We planned to interview 200 Pakistani women.

2.4. Data collection tools and procedures

Data was collected through a structured, interviewer administered paper-based questionnaire, adopted from the Survey of Bangladeshi women's experience of maternity services (SBWEMS) (27). After obtaining the informed consent, the participants were interviewed to fill the questionnaire on phone

TABLE 1 Characteristics of study participants.

Characteristics	$N = 120$ *n* (%)
Age group (yrs.)	
15–24	17 (14.2)
25–34	79 (65.8)
36 and above	24 (20.0)
Parity	
Prim parous	37 (30.8)
Multiparous	83 (69.2)
Gestation at birth	
≥37 weeks	99 (82.5)
<37 weeks	21 (17.5)
Infant birth weight	
≥2.51 kg	100 (83.3)
<2.5 kg	20 (16.7)
Type of delivery	
Vaginal delivery	83 (69.2)
Vaginal assisted by equipment	03 (2.5)
A planned cesarean delivery	16 (13.3)
An emergency cesarean delivery	18 (15)
Country of birth	
Pakistan	98 (81.7)
Hong Kong	21 (17.5)
Others	01 (0.8)
Education level	
Secondary and less	78 (65)
Some university and above	42 (35)
Primary language	
Urdu	60 (50)
English	2 (1.7)
Cantonese	1 (0.8)
Others	57 (47.5)

through WhatsApp video call at the prescheduled date and time by a bilingual interviewer. The interview was conducted in English or Urdu depending upon participant's preference. On an average the interview lasted for 45–60 min.

2.5. Outcome variables and measurements

The primary outcome variable was women's overall satisfaction with care in each of the three phases of pregnancy. For overall satisfaction participants were asked "Thinking back now, how satisfied are you, overall, with the care you received during your pregnancy, labor and delivery and after birth (in separate questions)?" Responses were recorded on a 4 point Likert scale: very satisfied, somewhat satisfied, somewhat dissatisfied and very dissatisfied. For statistical analysis, the answers were dichotomized into "high satisfaction (Very satisfied)" and "less satisfaction (somewhat satisfied, somewhat dissatisfied, and very dissatisfied)". This was done firstly because not many women opted for the somewhat dissatisfied or very dissatisfied categories. Secondly from previous research we found that a rating of "very satisfied" is used as indicator for optimal care with lower ratings pointing out that there was room for improvement (28, 29). Further maternity care experience was assessed in terms of access to care, information exchange and perceptions of care. These were evaluated by questions regarding choice of gender of health care professionals, continuity of care, interactions with staff, availability of interpreters, information leaflets, and satisfaction with analgesia, length of stay in the hospital and preferences for care.

2.6. Data quality control

We employed the SBWEMS questionnaire which had good validity and reliability in examining ethnic minority women's satisfaction with antenatal, intrapartum and postnatal care (27). The questionnaire was pilot tested with 10 Pakistani EM women to check any inconsistencies and objections and revised accordingly.

2.7. Data processing and analysis

All the data was checked for completeness and entered in SPSS version 24.0, which was also used for all analysis. Counts and percentages were used to describe all categorical variables including the variables related to outcome variables. Bivariate analyses, including the chi-square test, Fisher's exact test was performed to test the associations between individual predictors and the outcome variables (not shown in results). Multiple logistic regression analysis was then done with the significant independent variables forthree outcome (dependent) variables: less satisfaction with care during pregnancy, labor and birth and after birth. *P*-value < 0.05 was considered statistically significant. Age and parity were adjusted as confounders. The fit of the model was tested using the Hosmer-Lemeshow test.

3. Results

One hundred and twenty questionnaires were completed. Table 1 shows the profile of the participants. The majority of the women were Pakistan born (81.7%), aged at 34 years and below (80.0%), had delivered vaginally (71.7%), at term (82.5%) and had normal birth weight babies (83.3%). About two-thirds of them were multiparous (69.2%) and had education level of Secondary or below (65%). Half of the respondents spoke Urdu as their primary language followed by other regional languages of Pakistan, whereas English and Cantonese were less often spoken as primary languages. Table 2 shows the self-described language ability of the respondents. More than half (60%) were able to speak and two-thirds could read, write and understand English either

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TABLE 2 Language ability of the participants.

Languages		Not at all *n* (%)	With difficulty *n* (%)	Well *n* (%)	Fluent *n* (%)
Urdu	Speak	0	6 (5)	53 (44.2)	61 (50.8)
	Read	19 (15.8)	11 (9.2)	41 (34.2)	49 (40.8)
	Write	24 (20)	13 (10.8)	36 (30)	47 (39.2)
	Understand	0	5 (4.2)	56 (46.7)	59 (49.2)
English	Speak	14 (11.7)	34 (28.3)	39 (32.5)	33 (27.5)
	Read	19 (15.8)	18 (15)	40 (33.3)	43 (35.8)
	Write	20 (16.7)	19 (15.8)	38 (31.7)	43 (35.8)
	Understand	12 (10)	27 (22.5)	38 (31.7)	43 (35.8)
Cantonese	Speak	66 (55)	28 (23.3)	19 (15.8)	7 (5.8)
	Read	100 (83.3)	11 (9.2)	7 (5.8)	2 (1.7)
	Write	101 (84.2)	8 (6.7)	9 (7.5)	2 (1.7)
	Understand	60 (50)	32 (26.7)	21 (17.5)	7 (5.8)

well or fluently. Only 23.3 and 21.6% women could understand and speak Cantonese well or fluent and very few could read or write.

3.1. Antenatal care

During the antenatal care (Table 3), more than half (57.6%) of the women had choice of time of antenatal checkups but only 22% of the women were given choice of whether to have a man or woman perform their antenatal checkups. Two-thirds (67%) of the women strongly agreed that they were always encouraged to ask questions and always understood the advice given during their checkups. Almost two-thirds (63.3%) had enough time talking to doctors or midwives. Twenty-two percent of the women were provided with information leaflets in their primary language and 59% of those who received them reported that they were understandable and comprehensive. Majority of the women were provided interpreters by HCPs (73.8%). Only ten women attended antenatal classes and 61.7% did not attend the classes due to their lack of knowledge of the existence of these classes.

3.2. Intrapartum care

Regarding care during labor and birth (Table 3), most women (73%) were allowed to have choice of supporting people during labor and birth. The majority (84%) had someone to provide interpreting services during labor and birth and of these 42% of the women were offered choice of interpreter by the HCPs. Less than two thirds (61.7%) were very satisfied with the communication with HCP and only half (50.8%) reported a very kind attitude of staff during labor and birth. Less than half (47.5%) of the women were very satisfied with the pain relief received during labor and only 31% were allowed to move during labor.

3.3. Postnatal care in hospital

With respect to care during postnatal period in hospital (Table 3), most of the women (70%) were given skin to skin contact with baby in the first hour after birth. However, only 31% were offered the chance to start breast feeding in the first hour after birth, only 34% of the babies were exclusively breast fed and 40% of the babies received both breast and bottle milk while in the hospital. The majority, 83%, of the women felt that they received enough breast feeding advice and support.

Two-thirds (67%) of the women had a post-natal stay of 3 days or more, and most (80%) felt right about their length of stay. More than half of the respondents (56.7 %) stated that the staff looked after them in a very kind way following the birth of the baby. Less than 10% of women were asked by the HCPs if they had any preference or wanted to follow any particular custom after the baby's birth.

3.4. Satisfaction with care

Women's satisfaction with care during pregnancy, labor/birth and after birth in hospital are shown in the Table 4. More than half of the participants were very satisfied with antenatal care (57.5%), intrapartum care (59.2%) and postnatal care in the hospital (59.2%). Nearly one third were somewhat satisfied with the care received during antenatal (35.8%), intrapartum (32.5%) and postnatal periods (35.8%). Less than 10% were somewhat dissatisfied or very dissatisfied with the maternity care received during the three phases of pregnancy. After adjusting for age and parity, country of birth and education level were statistically significant independent predictors of satisfaction with care during pregnancy; country of birth and English speaking (collapsed into with difficulty or not at all, well, fluent) were statistically significant independent predictors of satisfaction with care during labor and birth; while English speaking had only borderline significant association with satisfaction with care after birth in the multivariable analysis. The

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TABLE 3 Access to care, information exchange and perceptions of care during the three phases of maternity.

During pregnancy	
Have choice of time of antenatal check-ups	68 (57.6)[†]
Have choice with whom to have antenatal checkups (man or woman)	26 (22.0)[†]
Received continuous antenatal care from one or two people or different of the same team	30 (25)
Attended antenatal classes	10 (8.3)
Did not know about antenatal classes	74 (61.7)
Received nutritional supplements (folate, iron, calcium)	82 (68.3)
Provided information leaflets in primary language	27 (22.5)
Professional interpreter provided by the Healthcare professionals	31 (73.8)[‡]
Explained enough information about tests and procedures needed	94 (78.3)
Had enough time talking to doctors or midwives during check-ups	76 (63.3)
Always encouraged to ask questions and understood advice given	80 (66.7)
Never felt treated differently to other people by HCP	96 (80)
During labor and birth	
Choice about type of healthcare professional (man or woman)	31 (25.8)
During labor and birth allowed to have choice of support people	87 (72.5)
Allowed to move around during labor	37 (30.8)
Right number of hospital staff around during labor and birth	92 (76.7)
Needed interpreter	31 (25.8)
Was aware of the availability of professional interpreter	29 (93.5)[§]
Had someone to provide interpreting services	26 (83.9)[§]
Offered choice of interpreter by the HCP	13 (41.9)[§]
Very satisfied with the communication with HCP	74 (61.7)
Had met staff before	26 (21.7)
HCP treated with respect for most of the time	73 (60.8)
Doctors spent enough time during labor and birth	73 (60.8)
Midwives spent enough time during labor and birth	88 (73.3)
Very satisfied with the pain relief received	57 (47.5)
Left alone and worried in labor	25 (20.8)
Left alone and worried after birth	22 (18.3)
Staff looked after in a very kind way during labor and delivery	61 (50.8)
Never felt treated differently to other people by HCP	89 (74.2)
After birth in hospital	
Postnatal stay 3 days or more	80 (66.7)
Felt length of stay about right	97 (80.8)
Baby had skin to skin contact in the first hour after birth	84 (70)
Offered to help start breastfeeding in first hour after birth by the HCP	37 (30.8)
Baby was exclusively breast milk fed vs. both breast and formula milk or only formula milk in the first few days	41 (34.2)
Received enough breast feeding advice and support	100 (83.3)
Always understood the information provided	70 (58.3)
Felt got enough help with own needs from hospital staff	100 (83.3)
Felt got enough help with baby from hospital staff	99 (82.5)
Happy with visiting times	79 (65.8)

(Continued)

TABLE 3 (Continued)

Staff looked after in a very kind way following the birth of baby	68 (56.7)
Strongly agree doctors spent enough time	43 (35.8)
Strongly agree midwives spent enough time	59 (49.2)
HCP asked if had any preference or wanted to follow any particular custom after birth of baby	11 (9.2)
HCP asked about any food preference	105 (87.5)

Counts with percentages, N = 120.
† Total number of participants = 118, 02 women did not receive initial antenatal care in Hong Kong.
‡ Total number of participants = 42, rest did not require interpreting services.
§ Total number of participants = 31, rest did not require interpreting services.

TABLE 4 Satisfaction with maternity care services (counts with percentages, *N* = 120).

Level of satisfaction	During pregnancy	During labor and birth	After birth
Very satisfied	69 (57.5)	71 (59.2)	71 (59.2)
Somewhat satisfied	43 (35.8)	39 (32.5)	43 (35.8)
Somewhat dissatisfied	7 (5.8)	5 (4.2)	5 (4.2)
Very dissatisfied	1 (0.8)	5 (4.2)	1 (0.8)

p-values of Hosmer Lemeshow statistics for the three models with these variables were 0.305 > 0.05, 0.852 > 0.05, and 0.843 > 0.05 respectively indicating models fit well. The results of the multivariable analysis (Table 5) reflects that HK born Pakistani women were about four times more likely to be less than very satisfied with the antenatal care when compared to Pakistan born women [adjusted odds ratio (AOR) = 4.1, 95% confidence interval (CI) = 1.3–13.0] and those with education of some university or above were almost 3 times less satisfied with the care received (AOR = 2.9, 95% CI = 1.1–7.4) than those with lower education levels. Also HK born women (AOR = 3.7, 95% CI = 1.2–11.1) and women with English speaking ability of well (AOR = 4.0 95% CI = 1.3–12.0) and fluent (AOR = 3.8, 95% CI = 1.1–14.0) were significantly more likely to be less than very satisfied with the intrapartum care in comparison with Pakistan-born women and women with who could not speak English at all or with difficulty. For postnatal care only those who rated their English speaking as "well" had borderline significantly higher odds of being less than very satisfied (AOR = 2.4 95% CI = 1.0–7.7).

4. Discussion

This study found that the majority of the surveyed Pakistani EM women in HK were either very satisfied or somewhat satisfied with their overall maternity care. More than half of the women described the care they received as kind, respectful and well communicated. Women's country of birth, English-speaking ability and level of education were significant factors associated with level of satisfaction during different phases of pregnancy. HK born Pakistani women expressed relatively less satisfaction with care, especially during pregnancy and labor and birth, as compared with Pakistan born women. Women with conversational or fluent English-speaking ability also felt comparatively less satisfied particularly from intrapartum and postnatal care in hospital. Besides, education level had a negative association with satisfaction with care during pregnancy.

Women's relatively increase satisfaction with care in the present study might be related to developments of maternal health services catering for ethnic minority women over the years. The differences in women's satisfaction in association with country of birth can be explained by women's different expectations of maternity health services and their prior experience of healthcare system (30). Pakistan born women may have previous experience with healthcare in Pakistan, which is a low-income country having less resources as compared to HK. Based on this comparison, these women's expectations of care were fulfilled and they conveyed increased satisfaction with the resources and facilities provided by maternity care services in HK. Similar findings were reported in an Australian study of maternity care experience of immigrant Afghan women in Melbourne, Australia (31). On the contrary, HK born Pakistani women were acquainted with the health services in HK or had past experience of maternity care in HK; as a result, they may have developed greater expectations of care and thus were likely to be critical of the care they received. Similar views were expressed by the UK healthcare professionals providing care to the UK-born EM women. They found UK-born EM mothers to be more self-confident and expressive, and involved in care-related decision making. They had an enhanced understanding of the healthcare system, available resources and expectations of care (32).

Similar to previous research (33, 34), women's expectations and satisfaction with healthcare services also varied with the education level achieved. Women with higher education level tended to be more vocal, information seeking and might anticipate higher level of responsiveness from the healthcare providers. This may explain why Pakistani women with higher education in Hong Kong had less satisfaction with the antenatal services provided.

Effective communication between healthcare professionals and patients is vital for quality care (35); previous research showed language barriers clearly impede good communication between the ethnic minority women and their care givers (12, 36). Yet the settings and findings of the current study are different compared to previous research, which was mainly conducted in English speaking countries (20, 21). In Hong Kong Cantonese is in fact the native language, while English is the second official language (37); in this context, Pakistani women with self-rated conversational or fluent English-speaking ability perceived more language barriers compared to those who had low or no proficiency at all, particularly

10.3389/fpubh.2023.1009214

TABLE 5 Multivariable analysis showing AOR for less satisfaction with the overall maternity care services.

Characteristics	During pregnancy		During labor and birth		After birth	
	AOR (CI)	*P*-value	AOR (CI)	*P*-value	AOR (CI)	*P*-value
Country of birth						
Pakistan	1		1		1	
Hong Kong	**4.1 (1.3–13.0)**	**0.01**	**3.7 (1.2–11.1)**	**0.02**	1.7 (0.6–4.7)	0.32
English speaking						
Not at all or with difficulty	1		1		1	
Well	1.6 (0.6–4.5)	0.37	**4 (1.3–12)**	**0.01**	2.8 (1.0–7.7)	0.05
Fluent	1.5 (0.4–5.2)	0.48	**3.8 (1.1–14)**	**0.04**	2.4 (0.7–8.1)	0.15
Education level						
Secondary and less	1		1		1	
Some university or above	**2.9 (1.1–7.4)**	**0.02**	1.2 (0.5–3.0)	0.75	1.4 (0.6–3.5)	0.44

AOR, Adjusted odds ratio; CI, Confidence interval; $P < 0.05$, Significant. The bold values represent statistically significant results.

during labor and birth. The results of this study indicate that most of the women who had no or low English proficiency were provided with interpreting services; as a result, they felt communication was effective and the care received satisfactory. On the other hand, women with increased English-speaking fluency faced difficulties in communication due to the non-availability of English-speaking healthcare professionals, especially midwives and lower-level staff. Therefore, these women felt less responded to and engaged by the maternity care staff and were eventually less satisfied with the care received. A systematic review of immigrant women maternity care experience also highlights the importance of shared language between the women and the service provider. One of the main barriers between immigrant women and their caregivers is the language difficulty which creates hindrance in good communication and understanding. This problem mainly arises when the women are not fluent in the language of the receiving country (29).

The relationship between women and healthcare professionals plays a key role in shaping their perceptions of care, accessing services, utilization and outcomes (12). Although women in this study had increased overall satisfaction with their care, yet their desire for support, kind behavior of staff, understanding and respectful attitude were not fulfilled to a larger extent particularly during labor and birth. Conversely, positive experiences were reported when the staff showed empathy, attended to their individual needs with patience, sensitivity and in a timely manner. These findings are consistent with other studies of ethnic minority women's experience of maternity care (12, 21, 38, 39).

4.1. Strengths and limitations

This study has some limitations. Firstly, it did not include the local population for comparison and also the results cannot be implied to other ethnic minority groups. Secondly women who had given birth within the previous 3 years were included in the study, they might have had difficulties in recalling their experiences and introduce potential recall bias. Thirdly our sample size was relatively small as we were not able to achieve our calculated sample size.

Despite of the abovementioned limitations, this study has some strengths too. It is the first to explore the maternity care experience of ethnic minority Pakistani women in HK. Estimating satisfaction is not easy. Respondents may be hesitant to acknowledge dissatisfaction. In this study the interviews conducted by an interviewer of same gender and ethnic group as the respondent, and in the language of women's choice, is probably a protection against the likelihood that dissatisfaction would not be expressed. Involvement of the bilingual researcher sharing the similar ethnicity and cultural upbringing as that of respondents ensured the participation of this hard to reach group. This improves the integrity of the study (40), and indeed the sample was heterogeneous ranging from only Urdu speaking mothers to mothers having English fluency and women who bridged educational spectrum from illiteracy to higher degrees.

4.2. Implications

The study demonstrated that effective communication and care that can meet individual expectations, needs and values are essential for providing good quality care to the Pakistani EM women. Maternity care providers should take into account the diversity of EM population in HK. In addition to the provision of interpreters and social assistance to the women with decrease language proficiency and education level, it is also necessary to provide opportunities for the educated and well-spoken women. There is a need to increase the number of Midwives and lower staff with enhanced English language fluency in HK so that language barrier can be overcome and better communication can facilitate better maternity care experience and improve maternal and health outcomes. Thus, it reiterates the importance of provision of person-centered maternity care in improving quality and reducing inequalities among ethnic minority and migrant women.

5. Conclusion

This study gives an insight into the evaluation of maternal healthcare system of HK from a sub-group of EM women perspective. Providing person-centered care and addressing barriers in communication can lead to relatively higher level of satisfaction and improvements in the quality of care provided to EM population. Further research is required in this under researched area with the involvement of broader and diverse ethnic minority groups.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Survey and Behavioral Research Ethics Committee, The Chinese University of Hong Kong, (SBRE-19-521). The patients/participants provided their verbal informed consent to participate in this study.

Author contributions

Conceptualization and methodology: SA, EN, WG, and DD. Data collection and writing—original draft preparation: SA. Data analysis: SA and WG. Data curation: SA, EN, and WG. Visualization: DD. Writing—review and editing: EN, DD, WG, and E-KY. All authors have read and agreed to the published version of the manuscript.

Acknowledgments

We would like to extend our thanks to the Chinese University of Hong Kong, Jockey Club School of Public Health and Primary care, who granted permission for the work, and to the Pakistani women who gave up their time and shared their perspectives so generously.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

References

1. Millennium Development Goals (MDGs). Available online at: https://www.who.int/news-room/fact-sheets/detail/millennium-development-goals-(mdgs) (accessed January 27, 2023).

2. Health - United Nations Sustainable Development. Available online at: https://www.un.org/sustainabledevelopment/health/ (accessed August 1, 2022).

3. Survive Thrive Transform the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) at a Glance. Available online at: www.everywomaneverychild.org (accessed August 1, 2022).

4. Fair F, Raben L, Watson H, Vivilaki V, van den Muijsenbergh M, Soltani H. Migrant women's experiences of pregnancy, childbirth and maternity care in European countries: a systematic review. *PLoS ONE.* (2020) 15:e0228378. doi: 10.1371/journal.pone.0228378

5. Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Varner MW, et al. Racial and ethnic disparities in maternal morbidity and obstetric care. *Obst Gynecol.* (2015) 125:1460. doi: 10.1097/AOG.0000000000000735

6. Henderson J, Gao H, Redshaw M. Experiencing maternity care: the care received and perceptions of women from different ethnic groups. *BMC Preg Childbirth.* (2013) 13:1–14. doi: 10.1186/1471-2393-13-196

7. Gennaro S, O'Connor C, McKay EA, Gibeau A, Aviles M, Hoying J, et al. Perinatal anxiety and depression in minority women. *MCN Am J Mater Child Nurs.* (2020) 45:138. doi: 10.1097/NMC.0000000000000611

8. Shakeel N, Eberhard-Gran M, Sletner L, Slinning K, Martinsen EW, Holme I, et al. A prospective cohort study of depression in pregnancy, prevalence and risk factors in a multi-ethnic population. *BMC Preg Childbirth.* (2015) 15:1–11. doi: 10.1186/s12884-014-0420-0

9. Wang E, Glazer KB, Sofaer S, Balbierz A, Howell EA. Racial and ethnic disparities in severe maternal morbidity: a qualitative study of women's experiences of peripartum care. *Women's Health Issues.* (2021) 31:75–81. doi: 10.1016/j.whi.2020.09.002

10. Puthussery S. Perinatal outcomes among migrant mothers in the United Kingdom: is it a matter of biology, behaviour, policy, social determinants or access to health care? *Best Pract Res Clin Obstet Gynaecol.* (2016) 32:39–49. doi: 10.1016/j.bpobgyn.2015.09.003

11. Crowe R. Factors contributing to maternal health inequalities for women who are not white British in the UK. *Br J Midwifery.* (2022) 30:160–71. doi: 10.12968/bjom.2022.30.3.160

12. Higginbottom GMA, Evans C, Morgan M, Bharj KK, Eldridge J, Hussain B. Experience of and access to maternity care in the UK by immigrant women: a narrative synthesis systematic review. *BMJ Open.* (2019) 9:e029478. doi: 10.1136/bmjopen-2019-029478

13. Crabtree S, Wong H. 'Ah Cha'! The racial discrimination of Pakistani minority communities in Hong Kong: an analysis of multiple, intersecting oppressions. *Soc Work.* 43:945–63. doi: 10.1093/bjsw/bcs026

14. O'Connor P. *Islam in Hong Kong: Muslims and Everyday Life in China's World City. Islam in Hong Kong: Muslims and Everyday Life in China's World City.* Oxford: Oxford academic (2012). p. 1–217.

15. Chen C, Chan KH. *Type 2 Diabetes Management in Hong Kong Ethnic Minorities: What Primary Care Physicians Need to Know.* (2014) 20:222–8. Available online at: https://pdfs.semanticscholar.org/ff2b/9e7316bd519d4611c7f74409d15d998b5da4.pdf (accessed August 1, 2022).

16. Vandan N, Wong JYH, Gong WJ, Yip PSF, Fong DYT. Health system responsiveness in Hong Kong: a comparison between South Asian and Chinese patients' experiences. *Public Health.* (2020) 182:81–7. doi: 10.1016/j.puhe.2020.01.019

17. Vandan N, Wong JYH, Fong DYT. Accessing health care: experiences of South Asian ethnic minority women in Hong Kong. *Nurs Health Sci.* (2019) 21:93–101. doi: 10.1111/nhs.12564

18. Garcia R, Ali N, Guppy A, Griffiths M, Randhawa G. Ethnic differences in risk factors for adverse birth outcomes between Pakistani, Bangladeshi, and White British mothers. *J Adv Nurs.* (2020) 76:174–82. doi: 10.1111/jan.14209

19. Garcia R, Ali N, Griffiths M, Randhawa G. Understanding the consumption of folic acid during preconception, among Pakistani, Bangladeshi and white British mothers in Luton, UK: a qualitative study. *BMC Preg Childbirth.* (2018) 18:1–9. doi: 10.1186/s12884-018-1884-0

20. Cross-Sudworth F, Williams A, Herron-Marx S. Maternity services in multi-cultural Britain: using Q methodology to explore the views of first- and second-generation women of Pakistani origin. *Midwifery.* (2011) 27:458–68. doi: 10.1016/j.midw.2010.03.001

21. *Pakistani Muslim Women Birthing in Northern England: Exploration of Experiences and Context - ProQuest*. Available online at: https://www.proquest.com/openview/dbabab0c72b92c9e2607ac14a0f615ae/1?pq-origsite=gscholar&cbl=2026366 (accessed August 1, 2022).

22. Vangen S, Stoltenberg C, Schei B. *Ethnicity & Health Ethnicity and use of obstetrical analgesia: Do Pakistani women receive inadequate pain relief in labour?* (2010). Available online at: https://doi.org/10.1080/13557858.1996.9961783 (accessed August 1, 2022).

23. *Centre for Health Protection - Major Health Indicators in 2020 and 2021*. Available online at: https://www.chp.gov.hk/en/statistics/data/10/27/110.html (accessed August 1, 2022).

24. Tunçalp, Were WM, Maclennan C, Oladapo OT, Gülmezoglu AM, Bahl R, et al. Quality of care for pregnant women and newborns - The WHO vision. *BJOG.* (2015) 122:1045–9. doi: 10.1111/1471-0528.13451

25. World Health. Standards for improving quality of maternal and newborn care in health facilities. *WHO.* (2016) 2021:84. Available online at: https://cdn.who.int/media/docs/default-source/mca-documents/qoc/quality-of-care/standards-for-improving-quality-of-maternal-and-newborn-care-in-health-facilities.pdf

26. Lwanga SK, Lemeshow S. *Sample Size determination in Health Studies*. Geneva: WHO (1991). p. 1–88.

27. Duff LA, Lamping DL, Ahmed LB. Evaluating satisfaction with maternity care in women from minority ethnic communities: development and validation of a Sylheti questionnaire. *Int J Qual Health Care.* (2001) 13:215–30. doi: 10.1093/intqhc/13.3.215

28. Hennegan J, Redshaw M, Miller Y. Born in another country: women's experience of labour and birth in Queensland, Australia. *Women Birth.* (2014) 27:91–7. doi: 10.1016/j.wombi.2014.02.002

29. Small R, Roth C, Raval M, Shafiei T, Korfker D, Heaman M, et al. Immigrant and non-immigrant women's experiences of maternity care: a systematic and comparative review of studies in five countries. *BMC Preg Childbirth.* (2014) 14:1–17. doi: 10.1186/1471-2393-14-152

30. Lakin K, Kane S. Peoples' expectations of healthcare: a conceptual review and proposed analytical framework. *Soc Sci Med.* (2022) 292:114636. doi: 10.1016/j.socscimed.2021.114636

31. Shafiei T, Small R, McLachlan H. Women's views and experiences of maternity care: A study of immigrant Afghan women in Melbourne, Australia. *Midwifery.* (2012) 28:198–203. doi: 10.1016/j.midw.2011.02.008

32. Puthussery S, Twamley K, Harding S, Mirsky J, Baron M, Macfarlane A. "They're more like ordinary stroppy British women": attitudes and expectations of maternity care professionals to UK-born ethnic minority women. *Sage J.* (2008) 13:195–201. doi: 10.1258/jhsrp.2008.007153

33. Chemir F, Alemseged F, Workneh D. Satisfaction with focused antenatal care service and associated factors among pregnant women attending focused antenatal care at health centers in Jimma town, Jimma zone, South West Ethiopia; A facility based cross-sectional study triangulated with qualit. *BMC Res Notes.* (2014) 7:164. doi: 10.1186/1756-0500-7-164

34. Quintana JM, González N, Bilbao A, Aizpuru F, Escobar A, Esteban C, et al. Predictors of patient satisfaction with hospital health care. *BMC Health Ser Res.* (2006) 6:102. doi: 10.1186/1472-6963-6-102

35. Binder P, Borné Y, Johnsdotter S, Essén B. Shared language is essential: Communication in a multiethnic obstetric care setting. *J Health Commun.* (2012) 17:1171–86. doi: 10.1080/10810730.2012.665421

36. Attanasio L, Kozhimannil KB. Patient-reported communication quality and perceived discrimination in maternity care. *Med Care.* (2015) 53:863–71. doi: 10.1097/MLR.0000000000000411

37. *Language Log ≫ Cantonese: Still the Main Spoken Language of Hong Kong*. Available online at: https://languagelog.ldc.upenn.edu/nll/?p=33511 (accessed December 21, 2022).

38. Jomeen J, Redshaw M. Ethnic minority women's experience of maternity services in England. *Ethn Health.* (2013) 18:280–96. doi: 10.1080/13557858.2012.730608

39. Redshaw M, Heikkilä K. Ethnic differences in women's worries about labour and birth. *Ethn Health.* (2011) 16:213–23. doi: 10.1080/13557858.2011.561302

40. Eboh WO, Pitchforth E, Teijlingen E van. *Lost words: research via translation. Midwives Magazine*. (2007). 10:374–8. Available online at: https://go.gale.com/ps/i.do?p=AONE&sw=w&issn=14792915&v=2.1&it=r&id=GALE%7CA169595679&sid=googleScholar&linkaccess=fulltext (accessed December 21, 2022).

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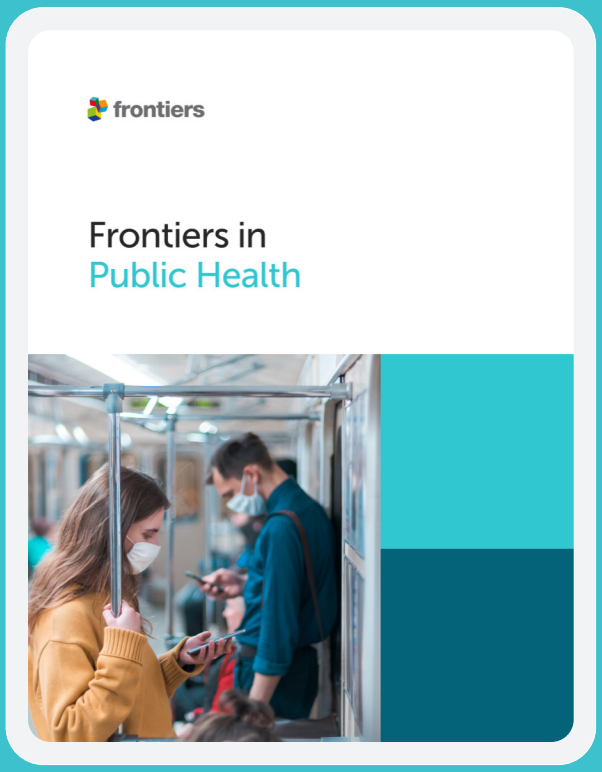

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