



Social integration as a mediator of the association between housing tenure and health inequalities among China's migrants: A housing discrimination perspective

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ABSTRACT

Due to the housing affordability crisis and institutional discrimination embedded in China's housing system, which refers to the unequal rights between homeowners and renters, migrant renters face greater social exclusion and health inequalities compared to migrant homeowners. Although housing tenure is considered an important determinant of health, along with other socioeconomic factors, the pathways underlying the association between housing tenure and health remain overlooked. Using data from the 2017 China Migrants Dynamic Survey of 62,268 participants, this study examined the mediating effects of social integration between housing tenure and self-rated health, and whether housing affordability moderated the mediating effects. Simple mediation models showed that social integration partly mediated the association between housing tenure and self-rated health. Moderated mediation models revealed that housing affordability moderated the association between housing tenure and social integration, and did not moderate the association between social integration and self-rated health. Compared with migrants living in affordable housing, the mediating effect of social integration was significantly smaller among migrants living in unaffordable housing. The results add knowledge to previous literature by uncovering the underlying mechanisms between housing tenure and health and linking housing studies to social inequalities in health. Our study suggested that diminishing housing discrimination and improving housing affordability could not only be beneficial for migrants' health but also be helpful to narrowing the health inequalities among migrants.

1. Introduction

China has witnessed a large-scale population migration from rural to urban areas in the past few decades, resulting in a rapid rise in urban housing demand and price (Wang et al., 2017). The soaring housing price has exacerbated migrants' housing affordability, particularly for middle and low-income groups (Liu et al., 2020), leading to increased psychosocial stress and a reduction in other necessities (e.g., food, nutrition, and medical care) (Arundel et al., 2022; Chung et al., 2020; Mason et al., 2013), which may jeopardize their health. In addition, migrants move to urban areas in search of better economic and employment opportunities. Due to the institutional discrimination embedded in China's housing system (i.e., the unequal rights between homeowners and renters), migrant owners are more likely to receive access to basic public health services (e.g., health records, health

education, and free medical check-ups), while migrant renters are more likely to be denied access, resulting in social inequalities in health (Huang & Yi, 2015; Wang et al., 2020; Zhang & Chen, 2018). Hence, in the Chinese context, investigating how housing tenure and affordability are associated with health inequalities among migrants is warranted from a housing discrimination perspective.

Housing is a crucial social determinant of health (Andersen et al., 2017; Swope & Hernandez, 2019; Wang et al., 2019). Both the physical aspects of housing (e.g., condition, structure, and size) and the socio-economic aspects (e.g., neighbourhood environment, tenure, and affordability) are closely associated with health in China and elsewhere (Clair & Hughes, 2019; Vasquez-Vera et al., 2021; Zhou & Guo, 2023a; Ziersch & Due, 2018). Among the numerous influencing factors, housing tenure is frequently placed at the center of the housing and health relationship (Bentley et al., 2016). Although housing tenure is strongly

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related to health, this relationship between tenure types and health has been debated (Baker et al., 2013). Most previous studies established that homeowners were associated with better health than renters (Park & Jung, 2019; Pledger et al., 2019; Tomioka et al., 2019; Wang, 2023). Yet there is also literature suggesting that migrants who own a home in the host city show poorer health than those who rent (Jia et al., 2023; Zhou & Guo, 2023b). To further explore how housing tenure impacts health, it is necessary to investigate its underlying mechanisms. However, among the considerable research on housing tenure and health, only a small proportion examined the pathways linking housing tenure to health. Beyond physical and social features of housing and neighbourhood (e.g., physical features of housing, dwelling environment, and relationships with neighbours) (Pollack et al., 2004), social environment (e.g., social capital, sense of community, and social control) (Zhang et al., 2023), residential stability (Li et al., 2022), or satisfaction with economic conditions (Park & Seo, 2021), social integration stands as a potential mediating candidate.

The social integration of migrants is the process by which individuals develop their interpersonal networks and involvement in communities (Spencer-Oatey, 2018; Ware et al., 2008), including multiple dimensions such as sense of belonging, integration willingness, acculturation, and self-identity (Fuente & Herrero, 2012). The process of social integration means the improvement of social networks, less social strains, and more social support (Holt-Lunstad et al., 2010). On the one hand, social integration is associated with better health (Lin et al., 2017; Raitakari et al., 2016). Indeed, it can significantly impact health outcomes through social mentality and perceived stress (Xia & Ma, 2020; Zhou et al., 2022). Previous research further found that social integration can also improve migrants' physical health via increasing utilization of health services (Fei et al., 2023). On the other hand, due to the unequal rights between homeowners and renters resulting from discrimination in China's housing system, migrant renters cannot obtain equal access to public services (e.g., children education, healthcare, and social welfare) like migrant owners, which has become a barrier for them to integrate into society in host cities (Zhong et al., 2017). For migrants, owning a home in the host city is considered as a manifestation of self-identity and a strong sense of pride (Liu et al., 2018). Indeed, migrant owners were found to have higher levels of social integration than migrant renters (Lin et al., 2023), and the impact of housing tenure on migrants' social integration is partially mediated by their settlement intention and integration will (Zou & Deng, 2022). Nonetheless, whether social integration mediates the association between housing tenure and self-rated health has never been formally tested – a first knowledge gap that this study aims to fill.

Beyond the effect of housing tenure on health through social integration, an intersectional perspective suggests that housing tenure and affordability may combine and that such a combination may reinforce inequalities in health outcomes (i.e., health effects of housing tenure were observed differently by affordability) (Kavanagh et al., 2016; Park & Jung, 2019). Here, we postulated that housing affordability may moderate the association between housing tenure and health through social integration. First, housing affordability may moderate the association between housing tenure and social integration (i.e., first component of the mediating pathway). Previous research has shown that migrants' settlement intention is significantly related to their social integration (Zou & Deng, 2022) and that their settlement intention depends in part on the cost of housing in the host city (Jeanty et al., 2010; Zabel, 2012). Migrants living in affordable housing would face less housing cost burden and more easily integrate into society in host cities than those living in unaffordable housing. As a result, the strength of the association between housing tenure and social integration may decrease as housing affordability weakens.

Second, housing affordability may also moderate the association between social integration and self-rated health (i.e., second component of the mediating pathway). On the one hand, owing to more easily experiencing housing-related insecurity (e.g., poor housing conditions,

forced moves) (Routhier, 2019), migrants with unaffordable housing may be more likely to rely on social integration as a sense of security to protect their health than those with affordable housing. In contrast, migrants with affordable housing could utilize their financial resources to keep healthy, leading to a lower dependence on social integration. In this light, the health benefit of social integration could be larger among migrants with unaffordable housing than those with affordable housing. On the other hand, the moderating effect of housing affordability between social integration and self-rated health may be in the opposite direction. Housing affordability is found to be the key driver of the selective migration of households into less advantaged areas (Baker et al., 2016). Migrants with poor housing affordability may be more likely to live in poor neighbourhoods and more often exposed to poor social networks and social support (Sheng et al., 2019), relative to those with strong housing affordability. In this light, migrants with strong housing affordability could get more benefit from social integration in improving health than those with poor housing affordability. Generally, the benefit of social integration for health could differ across different housing affordability, although it is debatable whether social integration is more beneficial for migrants in unaffordable housing or migrants in affordable housing. Despite the described intersection of housing tenure, housing affordability, social integration, and health, at the time of writing, no study has investigated whether housing affordability moderates the mediating effect of social integration between housing tenure and self-rated health – a second knowledge gap that this study aims to fill.

The focus of this study is not on the housing discrimination that migrants are subject to, but on how housing discrimination (i.e., the unequal rights between homeowners and renters) contributes to health inequalities through social integration by reporting differential effects according to different housing affordability. Hence, we examine whether social integration mediates the association between housing tenure and health and whether the mediating effects vary across different housing affordability groups in China. The moderated mediation analytical framework is illustrated in Fig. 1. We hypothesize that social integration would mediate the association between housing tenure and health (H1). We further hypothesize that housing affordability would moderate this mediating pathway (H2). To test these hypotheses, we rely on a large-scale sample composed of migrant populations in China.

2. Method

2.1. Data source

This study used the 2017 China Migrants Dynamic Survey (CMDS) data, which was conducted by the National Health Commission of China. This survey employed a stratified three-stage probability proportional to size (PPS) sampling method. The sample covered 351 cities within 32 provincial-level units in China. The targets of the survey were migrants who were aged 15 and older, did not have household registrations (*hukou*) in the host city, and had resided locally for more than one month. Although the survey records information about the entire household, this study only investigated the economic migration of the household. Migrants whose reason for migration is not employment or business were excluded. The age of migrants was limited to between 18 and 65. Observations with invalid and missing values in the variables of interest were also dropped. After data cleaning, 62,268 observations were obtained. The flowchart of observations was shown in Fig. S1. The spatial distribution of the study samples was shown in Fig. S2.

2.2. Measurements

Outcomes: Self-rated health is a general evaluation of individuals' health status, not related to any specific disease, but covering mainly physical and functional aspects of health (Praeg et al., 2016). Migrants in CMDS were asked to evaluate their health on a four-point scale (1 =

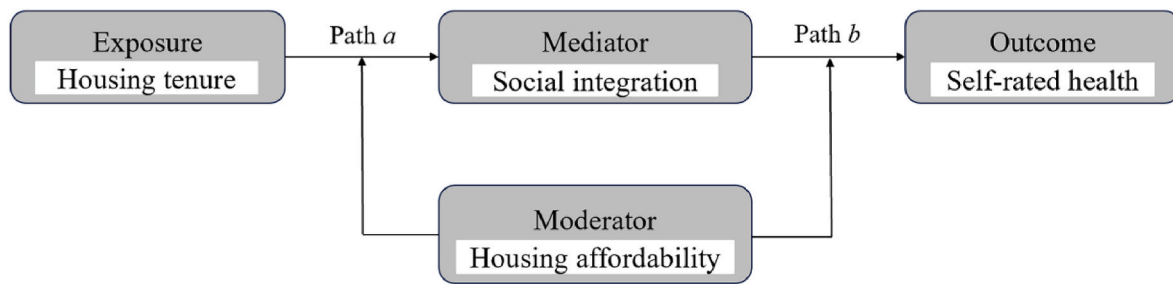


Fig. 1. Analytical framework: Moderated mediation analysis.

very poor, 4 = good). About 85.66 % of the migrants in the sample reported themselves as having good health. Due to the skewed distribution of responses, a binary variable with 1 indicating good health and 0 denoting fair/poor/very poor health was generated.

Predictor: Housing tenure usually consists of three types which are private rental housing, homeowners with a mortgage, and homeowners without a mortgage (Fafard St-Germain & Tarasuk, 2020). Consistent with prior literature (Wang, 2023), housing tenure was classified as renter (private rental housing) and owner (homeowner with or without a mortgage). A binary variable with 1 indicating owner and 0 denoting renter was created.

Mediating variable: Align with previous literature (Fuente & Herero, 2012), social integration was measured by migrants' perceptions of integration, including sense of belonging, integration willingness, acculturation, and self-identity. Eight questions were included, of which five items were positive and three items were negative, with the statement based on a four-point Likert scale (1 = strongly disagree, 4 = strongly agree). The Social Integration Assessment Scale was shown in Table S1. The Cronbach's alpha coefficient for the eight items was 0.75. In alignment with previous literature (Tong & Kawachi, 2020), an aggregated indicator of social integration was computed by positive items and negative items reversed over scores. The total score ranged from 8 to 32, with the higher value reflecting a higher level of social integration.

Moderating variable: Housing affordability is associated with housing insecurity or stress related to affording rent or a mortgage (Stahre et al., 2015). Housing affordability was computed by dividing a household's monthly housing costs (rent or mortgage payments) by its monthly income (Li & Liu, 2018). A household that spent thirty percent or more of its income on housing costs was considered to have housing stress (Leishman & Rowley, 2012). Housing affordability was classified as affordable when migrants' rent or mortgage payments were less than or equal to 30 percent of household income, and as unaffordable if otherwise. A binary variable with 1 indicating unaffordable and 0 denoting affordable was generated.

Confounding variables: This study considered sociodemographic and socioeconomic factors as confounders that may influence health. Sociodemographic factors included gender, marital status, and age. Socioeconomic factors included education, occupation, and household income. Specifically, the value of gender was set to 1 if the participant is male and 0 otherwise. Marital status was assigned a value of 1 if married and 0 otherwise. Age was used as a continuous variable. Education was measured by the educational attainment of the migrants and was divided into three levels from low to high: junior high school or lower, senior high school, and college or higher. According to the occupational division method widely used in China (Li et al., 2020; Wang et al., 2018; Xie et al., 2015), migrants' occupations were divided into four categories: manual workers, service personnel, self-employed workers, and professionals. Consistent with existing research (Mason et al., 2013), since housing affordability is related to income, it was necessary to adjust for income to separate the effects of housing affordability from the effects of economic hardship, and income was mean-centered and scaled by ¥1000.

2.3. Statistical analyses

This study explored the mediating effects of social integration between housing tenure and self-rated health through a two-step modeling strategy. First, to examine the association between housing tenure and social integration (*a* Path in Fig. 1), social integration (continuous variable) was specified as the dependent variable (Model 1). Second, to investigate the relationship between social integration and self-rated health (*b* Path in Fig. 1), self-rated health (dichotomous variables) was designated as dependent variables and adjusted for housing tenure (Model 2). To test the moderating effect of housing affordability, housing affordability and its interactive term with housing tenure were added (Model 3), and its interactive terms with housing tenure and social integration were included (Model 4). If any of the above interaction terms were significant, housing affordability would be considered as a potential moderator. To further understand the moderating effect of housing affordability, a simple slopes analysis was conducted.

To statistically examine the moderated mediating effects of social integration between housing tenure and self-rated health across different housing affordability, the generalized structural equation model (GSEM) was employed, which only included the significant interaction term(s) (Hayes, 2013). Considering the sampling distribution of the conditional indirect effects was known to be non-normal, the bootstrap approach was utilized to compute conditional indirect effects and obtain bias-corrected confidence intervals (Hayes & Preacher, 2014). 5000 bootstrapping samples were generated from the original dataset via random sampling. Bias-corrected confidence intervals that did not include zero indicated that indirect effects significantly varied across different housing affordability. Conditional indirect effects were computed by multiplying coefficients (*a* path \times *b* path) from the GSEM model along with different housing affordability.

In all the above models, social integration was mean-centered, and sociodemographic and socioeconomic factors were adjusted. For linear models, unstandardized coefficients (β) were reported, and for logistic models, odds ratios (OR) were reported. All analyses were conducted by Stata/MP 17.0 with a two-tailed *p*-value <0.05 as the level of significance.

3. Results

3.1. Descriptive analyses

In total, 62,268 participants were included in the study. In this sample, 85.66 % of the migrants reported themselves as having good self-rated health. Moreover, the homeownership rate for the migrants was 24.53 %. Applying the 30 % criterion, about 11.56 % of the migrants' housing affordability was unaffordable. The migrants' average social integration score was 24.83 ± 3.29 . Descriptive statistics and univariate associations with self-rated health were provided in Table 1.

3.2. Results of the moderated mediation analyses

Table 2 showed the adjusted association among housing tenure,

Table 1
Sample characteristics (N = 62,268).

Variables	M,%	SD	r/ χ^2 , p-value
Self-rated health			
Poor	14.34	–	–
Good	85.66	–	–
Housing tenure			
Renter	75.47	–	$\chi^2 = 6.05, p=0.014$
Owner	24.53	–	
Social integration	24.83	3.29	$r = 0.07, p < 0.001$
Housing affordability			
Affordable	88.44	–	$\chi^2 = 6.75, p = 0.009$
Unaffordable	11.56	–	
Age	35.20	9.24	$r = -0.18, p < 0.001$
Gender			
Female	41.03	–	$\chi^2 = 0.67, p = 0.413$
Male	58.97	–	
Marital status			
Single	20.60	–	$\chi^2 = 280.13, p < 0.001$
Married	79.40	–	
Education			
Junior high school or lower	54.76	–	$\chi^2 = 417.04, p < 0.001$
Senior high school	21.95	–	
College or higher	23.30	–	
Occupation			
Manual workers	29.75	–	$\chi^2 = 98.83, p < 0.001$
Service personnel	43.05	–	
Self-employed workers	11.10	–	
Professionals	16.11	–	
Household income	0.54	5.75	$r = 0.03, p < 0.001$

Note: Univariate associations with self-rated health were computed using correlations (r) and chi-square tests (χ^2) for continuous and categorical variables, respectively.

social integration, housing affordability, and self-rated health. Results of the simple mediation analyses demonstrated significant mediating effects of housing tenure on self-rated health through social integration. Specifically, housing tenure was positively associated with social integration (Model 1: $\beta = 1.50, p < 0.001$). Social integration was positively associated with self-rated health (Model 2: OR = 1.07, $p < 0.001$). The direct effect of housing tenure on self-rated health (Model 2: OR = 0.81, $p < 0.001$) remained significant after adjustment for social integration. Therefore, social integration partly mediated the association between housing tenure and self-rated health.

Results of the moderated mediation analyses showed that housing affordability significantly moderated the mediating effects of social integration between housing tenure and self-rated health. Specifically, housing affordability significantly moderated the association between housing tenure and social integration (Model 3: $\beta = -0.79, p < 0.001$) (a Path in Fig. 1). However, housing affordability did not significantly moderate the association between social integration and self-rated health (Model 4, $p = 0.586$) (b Path in Fig. 1). The simple slope analysis revealed that the association between housing tenure and social integration was significantly stronger among migrants who lived in affordable housing ($\beta = 1.62, p < 0.001$), relative to those living in unaffordable housing ($\beta = 0.83, p < 0.001$) (Fig. 2).

Bootstrapping results (Table 3) further indicated that owners have significantly lower good health odds than renters whenever they are housing affordable or unaffordable. The indirect effects of housing tenure on self-rated health through social integration were significant across different housing affordability. The indirect effect size showed a decreased trend as housing affordability became poor. Specifically, the indirect effect of social integration between housing tenure and self-rated health decreased from 0.105 (95 % BC CI = [0.093, 0.118], $p < 0.001$) to 0.054 (95 % BC CI = [0.043, 0.066], $p < 0.001$). Table 3 (the last column) also indicated that compared with migrants who had strong housing affordability, the indirect effect of housing tenure on self-rated health via social integration was significantly smaller among those having poor housing affordability ($\beta = -0.051, 95 \% BC CI = [-0.064,$

Table 2
Moderating effects of housing affordability on the association between housing tenure and self-rated health through social integration, with “poor” self-rated health as references (N = 62,268).

	Model 1: Social integration β (95 % CI)	Model 3: Social integration β (95 % CI)	Model 2: Self-rated health OR (95 % CI)	Model 4: Self-rated health OR (95 % CI)
Housing tenure (ref: renter)	1.50*** (1.44, 1.56)	1.62*** (1.55, 1.69)	0.81*** (0.76, 0.85)	0.82*** (0.77, 0.87)
Social integration	–	–	1.07*** (1.06, 1.07)	1.07*** (1.06, 1.07)
Housing affordability (ref: affordable)	–	0.39*** (0.29, 0.49)	–	0.85** (0.77, 0.93)
Housing tenure × Housing affordability	–	–0.79*** (-0.95, -0.63)	–	1.02 (0.88, 1.18)
Social integration × Housing affordability	–	–	–	1.01 (0.98, 1.03)
Gender (ref: female)	0.07** (0.02, 0.12)	0.07** (0.02, 0.12)	1.16*** (1.10, 1.22)	1.16*** (1.10, 1.21)
Married (ref: single)	–0.05 (-0.12, 0.01)	–0.03 (-0.10, 0.03)	0.92* (0.86, 0.99)	0.92* (0.85, 0.98)
Age	0.02*** (0.02, 0.02)	0.02*** (0.02, 0.02)	0.95*** (0.95, 0.95)	0.95*** (0.95, 0.95)
Education (ref: junior high school or lower)				
Senior high school	0.59*** (0.52, 0.65)	0.58*** (0.51, 0.64)	1.06 (1.00, 1.13)	1.07* (1.00, 1.14)
College or higher	1.14*** (1.06, 1.22)	1.11*** (1.04, 1.19)	1.08 (1.00, 1.16)	1.09* (1.01, 1.18)
Occupation (ref: manual workers)				
service personnel	0.58*** (0.51, 0.64)	0.56*** (0.50, 0.62)	0.93* (0.88, 0.98)	0.94* (0.89, 0.99)
self-employed workers	0.51*** (0.42, 0.60)	0.47*** (0.38, 0.56)	0.97 (0.90, 1.05)	0.98 (0.91, 1.07)
professionals	0.54*** (0.45, 0.63)	0.53*** (0.44, 0.61)	0.98 (0.90, 1.07)	0.99 (0.91, 1.07)
Household income	0.01** (0.00, 0.01)	0.01** (0.00, 0.01)	1.01*** (1.01, 1.02)	1.01*** (1.01, 1.02)

Note: Model 3 included the interaction term for housing tenure and affordability. Model 4 included the interaction term for housing tenure and affordability, and the interaction term for social integration and housing affordability. Unstandardized β coefficients and odds ratios (OR) and 95% confidence intervals (95% CI) were reported. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

–0.040], $p < 0.001$).

3.3. Robustness analyses

To examine the robustness of our main results, three robust checks were conducted. First, homeowners without a mortgage were excluded, and the housing tenure variable only included private renters and

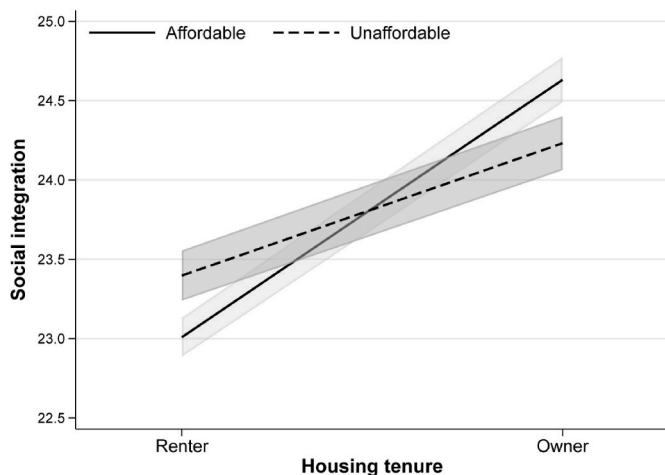


Fig. 2. A simple slopes analysis for the interaction of housing tenure with housing affordability on social integration.

homeowners with a mortgage (Tables S2 and S3). Second, considering that the housing affordability issue of migrants is the most prominent in large cities, 35 large and medium-sized cities in China were selected from 351 cities of the full sample (Tables S4 and S5). Third, considering the spatial distribution of the sample, the Yangtze River Delta region with the largest migrants was selected (Tables S6 and S7). The moderated mediation models were repeated. Generally, the results were consistent with our main results.

4. Discussion

Findings from this large-scale study based on China’s migrants showed that social integration partly mediated the association between housing tenure and self-rated health. Specifically, owning a home had a positive impact on social integration, which further promoted migrants’ health. Moreover, migrants with strong housing affordability were associated with better health compared with those with poor housing affordability. Housing affordability moderated the mediating effect of social integration between housing tenure and self-rated health, mainly due to the moderating effect of housing affordability on the association between housing tenure and social integration. To be specific, the mediating effects of social integration between housing tenure and self-rated health were stronger among migrants living in affordable housing, relative to those living in unaffordable housing. In other words, housing discrimination (i.e., the unequal rights between homeowners and renters) could amplify the health gap among migrants with different housing affordability through social integration.

For migrants in China, buying a house can bring enormous financial and psychological stress and be detrimental to their health (Fong et al., 2021). And our results manifest that migrant owners were associated with poorer self-rated health compared with migrant renters, which is consistent with previous literature (Jia et al., 2023; Zhou & Guo, 2023b). Also, in line with past literature (Chen et al., 2017; Lee et al., 2023), social integration could improve health status. As hypothesized

(H1), our results demonstrated that the association between housing tenure and self-rated health was partly mediated by social integration after adjustment for sociodemographic and socioeconomic factors. The mechanism that social integration could alleviate the negative health effect of owning a home can be explained in several ways. First, due to housing discrimination (i.e., the unequal rights between homeowners and renters) in China, migrants who own a home in the host city can enjoy priorities such as the priority of enrolling in public schools for their kids (Feng & Lu, 2013), which could increase their settlement intention and integration willingness. Second, homeownership can be considered as an emotional investment and indicates a sense of membership in the destination (Wu & Logan, 2016), which could improve migrants’ sense of belonging and make them more easily involved in communities. Third, homeownership can also be considered as a financial investment (Lin et al., 2023). When housing prices rise rapidly, owning a home represents an increase in household wealth (Dong et al., 2017), which could enhance the sense of control and self-identity of migrants. Finally, from the perspective of residence-based housing (Wang et al., 2019), owning a home in the host city means residential stability, and can promote a sense of security and settlement intention. All of these can facilitate social integration and further improve their health.

As hypothesized (H2), the mediating pathway between housing tenure and self-rated health through social integration was moderated by housing affordability. Specifically, our results showed that the association between housing tenure and social integration was weaker among migrants with poor housing affordability, relative to those with strong housing affordability. This may be because, compared with migrants living in affordable housing, those living in unaffordable housing more easily experience financial strains, which may result in longer work time to pay off housing costs and less time to invest in social interaction and participation in the host city (Newman & Holupka, 2015). These social activities have been found to have a positive association with social integration (Harder et al., 2018) and can further protect health. However, our results suggested that housing affordability did not moderate the association between social integration and self-rated health. This might imply that social integration may be an essential psychosocial asset (Lee et al., 2023) from which migrants, whether with unaffordable housing or not, could obtain the same health benefit once integrated into society in host cities, regardless of the quantity and quality of their social interactions.

The main strengths of this study are the large size of the sample and the complementary nature of the statistical approaches. However, this study also has several limitations that warrant further reflection. First, the cross-sectional study design was insufficient to establish causal inferences. Thus, further longitudinal research is needed to better clarify the temporal association among housing tenure, housing affordability, social integration, and health. Second, although the “30 percent” rule of housing affordability measurement has been widely used (Bentley et al., 2016; Li & Liu, 2018), it does not take into account the compromises that households make to reduce housing-related and other necessary expenditures. As a result, it is not certain whether a household that falls outside the affordability threshold is exposed to housing affordability stress (Daniel et al., 2018; Haffner & Boumeester, 2014). Subsequent research could further consider adopting a more nuanced measure (i.e.,

Table 3
Bootstrap results for the moderated mediation (N = 62,268).

Housing tenure (ref: renter)	Total effect		Indirect effect through social integration		Difference in indirect effect (ref: affordable)	
	β	95 % CI	β	95 % CI ^a	β	95 % CI ^a
Owner	Self-rated health					
Affordable	-0.097**	(-0.160, -0.035)	0.105***	(0.093,0.118)	0	
Unaffordable	-0.148***	(-0.211, -0.085)	0.054***	(0.043,0.066)	-0.051***	(-0.064, -0.040)

Note: Sociodemographic factors and socioeconomic factors were adjusted. CI^a: bias-corrected confidence interval with 5000 bootstrap samples. The effect is statistically significant if the 95% CI does not include zero. *p < 0.05, **p < 0.01, ***p < 0.001.

residual income approach) that includes additional information about non-shelter necessities to measure housing affordability (Stone, 2006). Third, due to the availability of data, physical housing features and neighbourhood environment were not included, which were found to be potential confounders of the association between housing tenure and health (Wang, 2023). It may partly explain why owning a home was negatively related to self-rated health in our analyses. More comprehensive confounding variables are warranted in future studies. Despite these limitations, this study provides interesting insight into the risk of health inequalities among China's migrants.

5. Conclusion

Overall, this study revealed that social integration played a significant mediating role in the relationship between housing tenure and migrants' self-rated health and that this mediating effect was especially beneficial for migrants with strong housing affordability. Our findings highlight that the housing affordability crisis and the unequal rights between homeowners and renters caused by housing discrimination may not only impact migrants' health but may also further reinforce the health inequalities among migrants. Policies and interventions (e.g., allowing renters to enjoy the same rights as homeowners, and providing housing assistance for middle and low-income migrants) should be designed to improve social integration and housing affordability, and ultimately narrow the health inequalities among migrants.

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Declarations of interest

none.

Ethical statement

All data analyzed in the current research were obtained from publicly available datasets. Ethical approval and written consent were not required for this type of study.

Availability of data and materials

The datasets are available in the China Migrants Dynamic Survey (2017), which was commissioned by the National Health Commission and coordinated by the China Population and Development Research Centre. <https://chinaldrk.org.cn/wjw/#/home>.

Ethical statement

All data analyzed in the current research were obtained from publicly available datasets. Ethical approval and written consent were not required for this type of study.

CRedit authorship contribution statement

Fulin Jia: Writing – review & editing, Supervision, Software, Methodology, Formal analysis, Conceptualization. **Xiaonan Liu:** Writing – review & editing, Writing – original draft. **Yuxiang Wang:** Writing – review & editing, Writing – original draft, Software, Methodology.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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References

- Andersen, M. J., Williamson, A. B., Fernando, P., Wright, D., & Redman, S. (2017). Housing conditions of urban households with Aboriginal children in NSW Australia: Tenure type matters. *BMC Public Health*, 18. <https://doi.org/10.1186/s12889-017-4607-y>. Article 70.
- Arundel, R., Li, A., Baker, E., & Bentley, R. (2022). Housing unaffordability and mental health: Dynamics across age and tenure. *International Journal of Housing Policy*. <https://doi.org/10.1080/19491247.2022.2106541>
- Baker, E., Bentley, R., Lester, L., & Beer, A. (2016). Housing affordability and residential mobility as drivers of locational inequality. *Applied Geography*, 72, 65–75. <https://doi.org/10.1016/j.apgeog.2016.05.007>
- Baker, E., Bentley, R., & Mason, K. (2013). The mental health effects of housing tenure: Causal or compositional? *Urban Studies*, 50(2), 426–442. <https://doi.org/10.1177/0042098012446992>
- Bentley, R. J., Pevalin, D., Baker, E., Mason, K., Reeves, A., & Beer, A. (2016). Housing affordability, tenure and mental health in Australia and the United Kingdom: A comparative panel analysis. *Housing Studies*, 31(2), 208–222. <https://doi.org/10.1080/02673037.2015.1070796>
- Chen, W., Ling, L., & Renzaho, A. M. N. (2017). Building a new life in Australia: An analysis of the first wave of the longitudinal study of humanitarian migrants in Australia to assess the association between social integration and self-rated health. *BMJ Open*, 7(3), Article e014313. <https://doi.org/10.1136/bmjopen-2016-014313>
- Chung, R. Y.-N., Chung, G. K.-K., Gordon, D., Mak, J. K.-L., Zhang, L.-F., Chan, D., Lai, F. T. T., Wong, H., & Wong, S. Y.-S. (2020). Housing affordability effects on physical and mental health: Household survey in a population with the world's greatest housing affordability stress. *Journal of Epidemiology & Community Health*, 74(2), 164–172. <https://doi.org/10.1136/jech-2019-212286>
- Clair, A., & Hughes, A. (2019). Housing and health: New evidence using biomarker data MAS. *Journal of Epidemiology & Community Health*, 73(3), 256–262. <https://doi.org/10.1136/jech-2018-211431>
- Daniel, L., Baker, E., & Lester, L. (2018). Measuring housing affordability stress: Can deprivation capture risk made real? *Urban Policy and Research*, 36(3), 271–286. <https://doi.org/10.1080/0811146.2018.1460267>
- Dong, Z., Hui, E. C. M., & Jia, S. (2017). How does housing price affect consumption in China: Wealth effect or substitution effect? *Cities*, 64, 1–8. <https://doi.org/10.1016/j.cities.2017.01.006>
- Fafard St-Germain, A.-A., & Tarasuk, V. (2020). Homeownership status and risk of food insecurity: Examining the role of housing debt, housing expenditure and housing asset using a cross-sectional population-based survey of Canadian households. *International Journal for Equity in Health*, 19(1). <https://doi.org/10.1186/s12939-019-1114-z>. Article 5.
- Fei, C., Zhu, Y., Jiang, L., Zhou, H., & Yu, H. (2023). Social integration, physical and mental health and subjective well-being in the floating population—a moderated mediation analysis. *Frontiers in Public Health*, 11, Article 1167537. <https://doi.org/10.3389/fpubh.2023.1167537>
- Feng, H., & Lu, M. (2013). School quality and housing prices: Empirical evidence from a natural experiment in Shanghai, China. *Journal of Housing Economics*, 22(4), 291–307. <https://doi.org/10.1016/j.jhe.2013.10.003>
- Fong, E., Yuan, Y., & Gan, Y. (2021). Homeownership and happiness in urban China. *Journal of Housing and the Built Environment*, 36(1), 153–170. <https://doi.org/10.1007/s10901-020-09728-6>
- Fuente, A., & Herrero, J. (2012). Social integration of Latin-American immigrants in Spain: The influence of the community context. *Spanish Journal of Psychology*, 15(3), 1201–1209. https://doi.org/10.5209/rev_SJOP.2012.v15.n3.39407
- Haffner, M., & Boumeester, H. (2014). Is renting unaffordable in The Netherlands? *International Journal of Housing Policy*, 14(2), 117–140.
- Harder, N., Figueroa, L., Gillum, R. M., Hangartner, D., Laitin, D. D., & Hainmueller, J. (2018). Multidimensional measure of immigrant integration. *Proceedings of the National Academy of Sciences of the United States of America*, 115(45), 11483–11488. <https://doi.org/10.1073/pnas.1808793115>
- Hayes, A. F. (2013). Mediation, moderation, and conditional process analysis. *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*, 1, 20.
- Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology*, 67(3), 451–470. <https://doi.org/10.1111/bmsp.12028>
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, 7(7), Article e1000316. <https://doi.org/10.1371/journal.pmed.1000316>

- Huang, Y., & Yi, C. (2015). Invisible migrant enclaves in Chinese cities: Underground living in Beijing, China. *Urban Studies*, 52(15), 2948–2973. <https://doi.org/10.1177/0042098014564535>
- Jeanty, P. W., Partridge, M., & Irwin, E. (2010). Estimation of a spatial simultaneous equation model of population migration and housing price dynamics. *Regional Science and Urban Economics*, 40(5), 343–352. <https://doi.org/10.1016/j.regsciurbeo.2010.01.002>
- Jia, F., Liu, X., Wang, Y., & Ma, M. (2023). The effect of housing tenure on health status of migrant populations in China: Are health service utilization and social integration mediating factors? *Archives of Public Health*, 81(1), Article 200. <https://doi.org/10.1186/s13690-023-01218-9>
- Kavanagh, A. M., Aitken, Z., Baker, E., LaMontagne, A. D., Milner, A., & Bentley, R. (2016). Housing tenure and affordability and mental health following disability acquisition in adulthood. *Social Science & Medicine*, 151, 225–232. <https://doi.org/10.1016/j.socscimed.2016.01.010>
- Lee, H. H., Okuzono, S. S., Trudel-Fitzgerald, C., James, P., Koga, H. K., Sims, M., Grodstein, F., & Kubzansky, L. D. (2023). Social integration and risk of mortality among african-Americans: The jackson heart study. *Social Psychiatry and Psychiatric Epidemiology*. <https://doi.org/10.1007/s00127-023-02485-1>
- Leishman, C., & Rowley, S. (2012). *Affordable housing. The Sage handbook of housing studies*.
- Li, A., Baker, E., & Bentley, R. (2022). Understanding the mental health effects of instability in the private rental sector: A longitudinal analysis of a national cohort. *Social Science & Medicine*, 296, Article 114778. <https://doi.org/10.1016/j.socscimed.2022.114778>
- Li, X., Deng, L., Yang, H., & Wang, H. (2020). Effect of socioeconomic status on the healthcare-seeking behavior of migrant workers in China. *PLoS One*, 15(8), Article e0237867. <https://doi.org/10.1371/journal.pone.0237867>
- Li, J., & Liu, Z. (2018). Housing stress and mental health of migrant populations in urban China. *Cities*, 81, 172–179. <https://doi.org/10.1016/j.cities.2018.04.006>
- Lin, S., Wu, F., Wang, Y., & Li, Z. (2023). Migrants' perceived social integration in different housing tenures in urban China. *Geoforum*, 139, Article 103693. <https://doi.org/10.1016/j.geoforum.2023.103693>
- Lin, Y., Zhang, Q., Chen, W., & Ling, L. (2017). The social income inequality, social integration and health status of internal migrants in China. *International Journal for Equity in Health*, 16. <https://doi.org/10.1186/s12939-017-0640-9>. Article 139.
- Liu, L., Huang, Y., & Zhang, W. (2018). Residential segregation and perceptions of social integration in Shanghai, China. *Urban Studies*, 55(7), 1484–1503. <https://doi.org/10.1177/0042098016689012>
- Liu, R., Li, T., & Greene, R. (2020). Migration and inequality in rental housing: Affordability stress in the Chinese cities. *Applied Geography*, 115. <https://doi.org/10.1016/j.apgeog.2019.102138>. Article 102138.
- Mason, K. E., Baker, E., Blakely, T., & Bentley, R. J. (2013). Housing affordability and mental health: Does the relationship differ for renters and home purchasers? *Social Science & Medicine*, 94, 91–97. <https://doi.org/10.1016/j.socscimed.2013.06.023>
- Newman, S. J., & Holupka, C. S. (2015). Housing affordability and child well-being. *Housing Policy Debate*, 25(1), 116–151. <https://doi.org/10.1080/10511482.2014.899261>
- Park, G.-R., & Jung, Y. (2019). Housing insecurity and health among people in South Korea: Focusing on tenure and affordability. *Public Health*, 171, 116–122. <https://doi.org/10.1016/j.puhe.2019.02.017>
- Park, G.-R., & Seo, B. K. (2021). Mental health among the Korean older population: How is it related to asset-based welfare? *Journal of Applied Gerontology*, 40(2), 142–151. <https://doi.org/10.1177/0733464820917295>. Article 0733464820917295.
- Pledger, M., McDonald, J., Dunn, P., Cumming, J., & Saville-Smith, K. (2019). The health of older New Zealanders in relation to housing tenure: Analysis of pooled data from three consecutive, annual New Zealand health surveys. *Australian & New Zealand Journal of Public Health*, 43(2), 182–189. <https://doi.org/10.1111/1753-6405.12875>
- Pollack, C. E., von dem Knesebeck, O., & Siegrist, J. (2004). Housing and health in Germany. *Journal of Epidemiology & Community Health*, 58(3), 216–222. <https://doi.org/10.1136/jech.2003.012781>
- Praeg, P., Mills, M. C., & Wittek, R. (2016). Subjective socioeconomic status and health in cross-national comparison. *Social Science & Medicine*, 149, 84–92. <https://doi.org/10.1016/j.socscimed.2015.11.044>
- Raitakari, S., Haahtela, R., & Juhila, K. (2016). Tackling community integration in mental health home visit integration in Finland. *Health and Social Care in the Community*, 24(5), E53–E62. <https://doi.org/10.1111/hsc.12246>
- Routhier, G. (2019). Beyond worst case needs: Measuring the breadth and severity of housing insecurity among urban renters. *Housing Policy Debate*, 29(2), 235–249. <https://doi.org/10.1080/10511482.2018.1509228>
- Sheng, M., Gu, C., & Wu, W. (2019). To move or to stay in a migrant enclave in Beijing: The role of neighborhood social bonds. *Journal of Urban Affairs*, 41(3), 338–353. <https://doi.org/10.1080/07352166.2017.1324248>
- Spencer-Oatey, H. (2018). Transformative learning for social integration: Overcoming the challenge of greetings. *Intercultural Education*, 29(2), 301–315. <https://doi.org/10.1080/14675986.2018.1425828>
- Stahre, M., VanEenwyk, J., Siegel, P., & Njai, R. (2015). Housing insecurity and the association with health outcomes and unhealthy behaviors, Washington state, 2011. *Preventing Chronic Disease*, 12. <https://doi.org/10.5888/pcd12.140511>. Article E109.
- Stone, M. E. (2006). A housing affordability standard for the UK. *Housing Studies*, 21(4), 453–476. <https://doi.org/10.1080/02673030600708886>
- Swope, C. B., & Hernandez, D. (2019). Housing as a determinant of health equity: A conceptual model. *Social Science & Medicine*, 243. <https://doi.org/10.1016/j.socscimed.2019.112571>. Article 112571.
- Tomioka, K., Kurumatani, N., & Saeki, K. (2019). Association between housing tenure and self-rated health in Japan: Findings from a nationwide cross-sectional survey. *PLoS One*, 14(11). <https://doi.org/10.1371/journal.pone.0224821>. Article e0224821.
- Tong, L., & Kawachi, I. (2020). Experiences of discrimination and self-reported health in Chinese migrants: A structural equation model. *BMC Public Health*, 20(1). <https://doi.org/10.1186/s12889-020-09588-3>. Article 1477.
- Vasquez-Vera, H., Leon-Gomez, B. B., Palencia, L., Perez, K., & Borrell, C. (2021). Health effects of housing insecurity and unaffordability in the general population in barcelona, Spain. *Journal of Urban Health-Bulletin of the New York Academy of Medicine*, 98(4), 496–504. <https://doi.org/10.1007/s11524-021-00546-x>
- Wang, Y. (2023). Housing cost burden, homeownership, and self-rated health among migrant workers in Chinese cities: The confounding effect of residence duration. *Cities*, 133, Article 104128. <https://doi.org/10.1016/j.cities.2022.104128>
- Wang, S., Cheng, C., & Tan, S. (2019). Housing determinants of health in urban China: A structural equation modeling analysis. *Social Indicators Research*, 143(3), 1245–1270. <https://doi.org/10.1007/s11205-018-2022-0>
- Wang, X.-R., Hui, E. C.-M., & Sun, J.-X. (2017). Population migration, urbanization and housing prices: Evidence from the cities in China. *Habitat International*, 66, 49–56. <https://doi.org/10.1016/j.habitatint.2017.05.010>
- Wang, Q., Shen, J. J., Sotero, M., Li, C. A., & Hou, Z. (2018). Income, occupation and education: Are they related to smoking behaviors in China? *PLoS One*, 13(2), Article e0192571. <https://doi.org/10.1371/journal.pone.0192571>
- Wang, Z., Wu, Q., & Ming, J. (2020). The relationship between homeownership and the utilization of local public health services among rural migrants in China: A nationwide cross-sectional study. *Frontiers in Public Health*, 8. <https://doi.org/10.3389/fpubh.2020.589038>. Article 589038.
- Ware, N. C., Hopper, K., Tugenberg, T., Dickey, B., & Fisher, D. (2008). A theory of social integration as quality of life. *Psychiatric Services*, 59(1), 27–33. <https://doi.org/10.1176/appi.ps.59.1.27>
- Wu, F., & Logan, J. (2016). Do rural migrants 'float' in urban China? Neighbouring and neighbourhood sentiment in Beijing. *Urban Studies*, 53(14), 2973–2990. <https://doi.org/10.1177/0042098015598745>
- Xia, Y., & Ma, Z. (2020). Social integration, perceived stress, locus of control, and psychological wellbeing among Chinese emerging adult migrants: A conditional process analysis. *Journal of Affective Disorders*, 267, 9–16. <https://doi.org/10.1016/j.jad.2020.02.016>
- Xie, Z., Poon, A. N., Wu, Z., Jian, W., & Chan, K. Y. (2015). Is occupation a good predictor of self-rated health in China? *PLoS One*, 10(5), Article e0125274. <https://doi.org/10.1371/journal.pone.0125274>
- Zabel, J. E. (2012). Migration, housing market, and labor market responses to employment shocks. *Journal of Urban Economics*, 72(2–3), 267–284. <https://doi.org/10.1016/j.jue.2012.05.006>
- Zhang, M., & Chen, J. (2018). Unequal school enrollment rights, rent yields gap, and increased inequality: The case of Shanghai. *China Economic Review*, 49, 229–240. <https://doi.org/10.1016/j.chieco.2017.04.007>
- Zhang, T., Li, X., & Liu, J. (2023). How does housing tenure mix affect residents' mental health through a social environment lens? An empirical examination from guangzhou (China). *Frontiers in Public Health*, 10. <https://doi.org/10.3389/fpubh.2022.1024796>. Article 1024796.
- Zhong, H., Xu, J., & Piquero, A. R. (2017). Internal migration, social exclusion, and victimization: An analysis of Chinese rural-to-urban migrants. *Journal of Research in Crime and Delinquency*, 54(4), 479–514. <https://doi.org/10.1177/0022427816676861>
- Zhou, M., & Guo, W. (2023a). Housing characteristics and health in urban China: A comparative study of rural migrants and urban locals. *Population, Space and Place*, 29(1), Article e2600. <https://doi.org/10.1002/psp.2600>
- Zhou, M., & Guo, W. (2023b). Self-rated health and objective health status among rural-to-urban migrants in China: A healthy housing perspective. *Population Research and Policy Review*, 42(1). <https://doi.org/10.1007/s11113-023-09752-8>. Article 2.
- Zhou, J., Zhu, L., & Zhang, J. (2022). Social integration and health among young migrants in China: Mediated by social mentality and moderated by gender. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.863443>. Article 863443.
- Ziersch, A., & Due, C. (2018). A mixed methods systematic review of studies examining the relationship between housing and health for people from refugee and asylum seeking backgrounds. *Social Science & Medicine*, 213, 199–219. <https://doi.org/10.1016/j.socscimed.2018.07.045>
- Zou, J., & Deng, X. (2022). Housing tenure choice and socio-economic integration of migrants in rising cities of China. *China Economic Review*, 74. <https://doi.org/10.1016/j.chieco.2022.101830>. Article 101830.