

Physical Exercise, Social Integration, and Urban Hukou Acquisition Decision-Making in China's Floating Population

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Abstract

This paper uses data from the 2014 and 2016 China Labor Force Survey to investigate the relationship between physical exercise, social integration and urban hukou acquisition decision-making in the floating population. We find that physical exercise and social integration can directly promote the acquisition of urban hukou in floating populations, and physical exercise promotes the acquisition of urban hukou in floating populations by increasing their degree of social integration. So, social integration is the intermediary between the floating population's physical exercise and urban hukou acquisition decision-making. Specifically, the mediating effect is most pronounced in the non-agricultural and female floating population. The results suggest that the construction of amenities for physical exercise and communal physical activities can not only promote the development of a harmonious society, but also effectively encourage the floating population to acquire urban hukou in their city of work and promote the development of the new urbanization of China.

JEL classifications: G80-05, J15, R23

1 Introduction

Physical exercise is not only an important way to improve physical fitness, but also plays a role in expanding interpersonal communication, enhancing mutual trust, and promoting mutual exchange and integration of residents. In 2016, the China State Council successively promulgated the "plan to promote the acquiring of urban hukou of 100 Million non-registered urban dwellers in cities" (No.72) and the "national population development plan (2016-2030)" (No.87), clearly stressed the promotion of urban population integration, and further promoted transferred agricultural populations and other permanent urban residents to acquire urban hukou in cities and towns, and optimize the quality of urbanization. As the most important part of the non-registered urban population, the floating population reached 241 million people in 2018. However, only 36.1% of the Chinese floating population wish to acquire urban hukou¹. Therefore, exploring how to increase the acquisition of urban hukou in the floating population in cities has important policy significance for reaching the target of registering 100 million non-registered people in cities. Physical exercise has been shown to play a positive role in promoting interpersonal communication, social trust, and social capital among university students, and the elderly^{2,3}. However, research on physical exercise's role in social communication, integration and acquisition of urban hukou in floating populations is scarce. So, this study asks: Does physical exercise play a role in promoting social communication, integration, and acquisition of urban hukou in China's floating population? The discussion on this issue is enlightening for the makers of China's population and urbanization development policies, and it also makes important academic contributions to research in the areas of exercise and labor mobility, and even has value as a reference for the construction of harmonious communities.

Physical exercise plays a role in promoting physical and mental health^{4,5}. In addition, physical exercise also has a positive impact on improving life satisfaction and subjective well-being⁶⁻⁸. Moljord et al.⁹ found that the higher the frequency of physical exercise, the higher the individual's happiness level. Blomstrand et al.¹⁰ follow-up survey of middle-aged women in the Netherlands also showed that there is a strong positive relationship between physical exercise during leisure time and subjective well-being. Edwards¹¹ found that regular physical exercise can not only significantly improve happiness, but also fortify individuals' stress resistance and mental health. Moreover, participating in physical exercise has a significant positive impact on improving self-discipline and self-confidence.

People who have participated extensively in outdoor physical exercise and those who have been involved in physical exercise for a longer period of time often have wider social networks, higher achievement levels, and a higher sense of belonging¹². Federico et al.¹³ research on Italian adults also found that groups who participated more frequently in physical exercise were also groups with higher education levels. Di Bartolomeo & Papa¹⁴ found that, in the short-term, participants who have been exposed to physical exercise show more trust and are more prominently friendly. In addition, rather than individual-centered physical exercise, participation in collective physical exercise, such as team sports, is more likely to create wider social networks through mutual communication¹⁵. Similarly, Perks¹⁶ and Brown et al.¹⁷ found that trust is strengthened among members participating in physical exercise in the same community.

Specifically, physical exercise has a positive impact on the degree of community integration¹⁸. This positive effect will be strengthened by an increase in the level of community interaction^{19,20}. Some studies have found that the positive relationship between physical exercise and social integration is most significant among women²¹. At the same time, the degree of community integration plays a mediating role between participation in physical exercise and community safety perception²². Therefore, increasing the construction of sports facilities and promoting the integration of the community will effectively promote the stability and harmony of the community.

Social integration is an important factor affecting the decisions of floating populations concerning acquiring urban hukou²³. Xiao & Xu²⁴ research on migrant workers' urban hukou acquisition behavior in Beijing, Shanghai, and other cities in China, found that social integration has a positive relationship with the acquisition of urban hukou. That means that the higher the degree of social integration, the higher the willingness to acquire urban hukou among migrant workers in cities²⁵. A sense of belonging and the degree of community integration of the floating populations are the key factors in their acquisition of urban hukou decision-making^{26,27}. When the floating populations have a higher level of acceptance of locals, a stronger sense of social identity, and a higher degree of social integration^{28,29}, their willingness to acquire urban hukou in the long term is higher³⁰. Furthermore, Sun, Li & Qi³¹ found that the higher the social integration of migrant workers in small cities, the more they prefer to acquire urban hukou in cities.

Besides social integration, the characteristics of demography, family, and city also have an impact on the floating population's urban hukou decision-making³². For example, Gu et al.³³ found that the higher the education level, the higher the income level, and the more children in the family, the less likely is acquisition of urban hukou. Secondly, the migration distance also has a negative effect on the acquisition of urban hukou in the floating population. Zhu & Chen³⁴ research on the settlement decisions of migrants showed that women and highly educated migrants engaged in non-productive work are more willing to settle and acquire urban hukou in work cities in China. Therefore, there is a significant gender difference in the floating population in terms of acquiring urban hukou; women's willingness to acquire urban hukou is significantly higher than men's³⁵. Additionally, migration time and house prices are also important factors influencing urban hukou decision making. For example, Hu et al.³⁶ used data from a comprehensive survey of Chinese society to find that the longer the migration time, the higher the willingness of floating populations to acquire urban hukou in the work city. A study by Whalley & Zhang³⁷ of 31 provinces in China showed that the higher the price of housing in a city, the more likely rural-urban migrants are to acquire urban hukou in the city.

Overall, physical exercise is conducive to the improvement of individual wellbeing and has strong social benefits, which are conducive to the development of individual careers, enhancing social capital, promoting harmonious communities, and harmonious social development. Then, does physical exercise have an impact on individual urban hukou acquisition decision-making? In other words, will the physical exercise of an individual in a city affect his or her choice of acquiring urban hukou in that city? The social effect of physical exercise has been shown to effectively improve community communication, community trust, community belonging, and the social integration of exercisers. So, does this social effect also exist in different groups, in particular in the floating population. Next, if physical exercise can promote the social integration of the floating population, and directly affects their acquisition of urban hukou, will physical exercise further influence the acquisition behavior through the intermediary factor of social integration? To address these questions, this paper uses the latest China Labor Force Dynamics Survey data to explore the impact of physical exercise and social integration on the decision-making of the floating population in acquiring urban hukou.

2 Background, Data And Methods

2.1 Background

In 1958, China promulgated the "Regulations on the Registration of Household Registration in the People's Republic of China", which determined the implementation of the household registration management system throughout the country³⁸. In the form of national laws, it applies to registration and cancellation of household registration, household registration and procedures, and permanent population and temporary residence registration. However, there are clear regulations restricting farmers from switching from agricultural to urban hukou. Beginning in 2001, the reform of the Chinese household registration system has gradually begun to relax the conditions for the migration of rural hukou holders to small towns and allows localities to gradually reform the local household registration system. In 2014, the State Council issued the Opinions on Further Promoting the Reform of the Household Registration System, which stated that agricultural and non-agricultural hukou should be abolished and a unified urban and rural hukou registration system should be established³⁹. In March 2019, the National Development and Reform Commission issued a notice on "The Tasks for New-type Urbanization Construction in 2019", which clearly stated that the household registration restrictions in large cities should be fully liberalized. This shows that China's household registration system has undergone a transformation from strict restrictions to gradual relaxation^{40,41}. A phenomenon that has accompanied the reform of the household registration system is rural-urban migration. Meanwhile, the size of the floating population is gradually increasing. According to statistics, in 2000, China's total floating population exceeded 100 million people. The floating population had increased to 247 million by 2015. It should be noted that various public services are linked to China's dual household registration system. For a long time, the non-urban hukou floating population in a

city have not been able to acquire the public services of the city until they acquire the city's urban household registration. Then, the clarification of the relationship between physical exercise, social integration and the decision-making of the Chinese floating population in acquiring urban hukou will provide a new perspective for understanding the urban hukou decision-making of the Chinese floating population. At the same time, this study has important reference value for promoting the development of a new type of urbanization in China and the exploration of the laws around acquiring urban hukou.

2.2 Data

The data in this article comes from the China Labor Force Dynamics Survey (CLDS) conducted nationwide by Sun Yat-Sen University in 2014 and 2016. When the investigation was launched at Sun Yat-Sen University, the informed consent of the respondents was obtained. Therefore, we declare that the CLDS2014 and 2016 data used in this article have obtained the informed consent of the respondents. All researches in this article are conducted in accordance with relevant guidelines/regulations. China Labor Force Dynamics Survey data have been publicly available. We have been granted access to CLDS2014 and CLDS2016 data. You can also find the data on the website: <http://css.sysu.edu.cn/Data>.

It is China's first nationwide survey focusing on labor, covering education, work, migration, and health. The survey uses a multi-stage, multi-layered probability sampling method that is proportional to the size of the labor force. The sample covers 25 provinces and 4 municipalities across the country (except Hong Kong, etc.). The survey object is the entire labor force of the sample households (15-64 years old). A total of 47,188 samples from the 2014 and 2016 China Labor Force Dynamics Survey data were collected. The questionnaire asked about interviewees' physical exercise, community communication, urban hukou acquisition decision-making, education, and work information, which is very useful for this study. In order to reduce the estimation bias as much as possible, we cleaned up the invalid samples (i.e., "refusal to answer", "not applicable", "unclear") in the original data table. Combining the definition given by the National Health and Family Planning Commission, the floating population is defined in this paper as the working population between 16 and 65 working in a place different to where they have household registration (hukou). Finally, we obtained 5,261 valid samples, of which 58.45% had agricultural hukou and 41.55% had non-agricultural hukou.

2.3 Variables

Physical exercise (PE). In the CLDS, surveys were conducted on whether the respondent had taken physical exercise in the last month, and the duration and frequency of that exercise. Due to the abnormal values of more than 360 minutes per exercise and more than 14 instances of exercise per week in the study sample, referring to the practices of Killgore & Schwab⁴², we performed 1% sample tailing processing. Then, through calculation, we obtained the average duration (minutes) and frequency of physical exercise per month. We took the natural logarithm of the average monthly physical exercise duration and frequency.

Social integration. Regarding the degree of social integration, the trust and familiarity between the respondents and their neighbors were investigated in the CLDS. With reference to the practices of Kim et al.⁴³, this paper used neighborhood trust and familiarity to characterize the respondents' social integration. Because the respondents answered the above two questions on a 5-point Likert scale, these two variables were summed to obtain the social integration index of the respondent. Again, we took the natural logarithm of it. In order to verify the robustness of the empirical results, we used these two variables as the representative variables of social integration.

Acquisition of urban hukou decision-making. In the CLDS, a survey was conducted of respondents' decision-making in acquiring urban hukou in the work city. Respondents to this question could choose, 'willing', 'unwilling', or 'uncertain'. This paper used this variable to represent the respondents' decision-making in acquiring urban hukou⁴⁴. For the selection of uncertain samples, we classified them into the unwilling sample group in the basic regression model. However, in order to ensure that the research results in this article were more robust, we deleted the uncertain samples, and we analyzed the basial model again which can be regarded as the robustness analysis results.

Control variables. In order to accurately identify the impact of physical exercise and social integration on the respondents' decision to acquire urban hukou, this paper controlled the demographic and family characteristics of the respondents. Specifically, the demographic characteristics mainly include: gender, age, education level, political status, type of hukou, health status, and work status. Family characteristics mainly include parents' educational level. Table 1 shows the descriptive statistics of all the variables.

Table 1
Variables' definitions and basic characteristics

Variables	Definition	Mean	SD
Acquire urban hukou	Plan to acquire urban hukou(willing:1;unwilling:0)	0.211	0.408
Participation PE	Whether respondent takes part in physical exercise (yes: 1;no: 0)	0.280	0.449
Minutes of PE	The average duration of physical exercise (minutes/month)	57.137	41.348
Frequency of PE	The average frequency of physical exercise (times/month)	19.076	10.131
Social integration	Actual number	6.231	1.698
Gender	Male: 1;female: 0	0.457	0.498
Age	Age of respondent in years	38.19	12.545
Edu	Education of respondent. (Under primary school:1; primary school:2; middle school :3; high school :4; junior college :5; undergraduate :6; postgraduate :7)	3.805	1.407
Political status	Whether the respondent is a CPC member (yes:1;no:0)	0.103	0.304
Hukou	Non-agricultural hukou:1;agricultural hukou:0	0.416	0.493
Health	The health level of the respondent. (Very unhealthy: 1; unhealthy: 2; average: 3; healthy: 4; very healthy: 5)	3.855	0.886
Work	Whether have worked in the last year (yes:1;no:0)	0.868	0.338
Edu of parents	Education of respondents' parents. (Under primary school:1; primary school:2; middle school :3; high school :4; junior college :5; undergraduate :6; postgraduate :7)	2.534	1.515

2.4 Methods

Referring to the research by Zang et al.⁴⁵ and C. Wang et al.⁴⁶, this paper constructed the following empirical model:

$$residence_{it} = \alpha_0 + \alpha_1 physical_{it} + \sum \alpha_i X_{it} + city_i \delta_i + year_i \gamma_i + \epsilon_{it} \quad (1)$$

$$residence_{it} = \beta_0 + \beta_1 social_{it} + \sum \beta_i X_{it} + city_i \delta_i + year_i \gamma_i + \xi_{it} \quad (2)$$

Among them, $residence_{it}$ represents the willingness of individual i to acquire urban hukou at time t ; $physical_{it}$ represents the physical exercise of individual i at time t ; $social_{it}$ represents the degree of social integration of individual i at time t ; X_{it} represents the control variables, including: age, gender, etc.; δ_i and γ_i are unobservable cities and time fixed effects; ϵ_{it} and ξ_{it} are random error terms.

2.5 Ethical considerations

No separate ethical approval was needed as the study is based on secondary data obtained from the 2014 and 2016 the China Labor Force Dynamics Survey (CLDS). CLDS data was collected following all the ethical clearance guidelines and norms. Its protocol was approved by the Institutional of Ethics Committee in China.

3 Results

3.1 Basial results

Table 2 reports the analysis results of physical exercise on the decision-making of the floating population in acquiring urban hukou. Columns (1)-(3) contain the regression results that did not include in the control variables, cities and time unobservable factors.

Columns (4)-(6) list the regression results that included control variables and unobservable factors of cities and time. Column (4) shows that the impact of participation in physical exercise on the decision-making of the floating population in acquiring urban hukou is 0.026, which is significant at the level of 1%. Its economic significance is that the probability of participating in physical exercise increases by one standard deviation, and the willingness of the floating population acquiring urban hukou in the work city increases by 0.0073 percentage points. Similarly, Columns (5) and (6) show that the impact of the minutes of physical exercises on the decision-making of the floating population in acquiring urban hukou is 0.008, and the impact of the frequency of physical exercise on the decision-making of the floating population in acquiring urban hukou is 0.007, both of which are significant at the level of 1%. The economic significance is that if the minutes and frequency of physical exercise increase by one standard deviation, the willingness of the floating population acquiring urban hukou in the work city will increase by 0.153 and 0.399 percentage points, respectively. This proves that physical exercise can promote the acquisition of urban hukou in the floating population in the work city.

Table 2
Physical exercise and residents' decisions: Baseline results

Variables	Acquisition of urban hukou decision-making					
	(1)	(2)	(3)	(4)	(5)	(6)
Participation PE	0.032*** (0.001)			0.026*** (0.001)		
Minutes of PE		0.009*** (0.000)			0.008*** (0.000)	
Frequency of PE			0.007*** (0.000)			0.007*** (0.000)
Gender				0.026*** (0.002)	0.026*** (0.002)	0.026*** (0.002)
Age				-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Edu				-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)
Political type				0.013*** (0.000)	0.013*** (0.000)	0.013*** (0.000)
Hukou type				0.013*** (0.002)	0.013*** (0.002)	0.014*** (0.002)
Health				-0.012*** (0.001)	-0.012*** (0.001)	-0.012*** (0.001)
Work				-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)
Edu of parents				-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)
Cities Fixed effects	No	No	No	Yes	Yes	Yes
Year Fixed effects	No	No	No	Yes	Yes	Yes
R ²	0.001	0.002	0.002	0.106	0.107	0.106
Observation	5,261	5,261	5,261	5,261	5,261	5,261

Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses.

Table 3 presents the results of social integration analysis on the decision-making of the floating population in acquiring urban hukou. Columns (1)-(3) list the regression results that do not include the control variables and unobservable factors of cities and time. Columns (4)-(6) list the regression results that included control variables and unobservable factors of cities and time. Column (4) shows that the impact of social integration on the decision-making of the floating population in acquiring urban hukou is 0.008, which is significant at the level of 1%. Its economic significance is that if the degree of social integration increases by one standard deviation, the willingness of the floating population to acquire urban hukou in the work city will increase by 0.0001 percentage points. Similarly, Columns (5) and (6) show that the impact of the representative variable of neighborhood trust on the decision-making of the floating

population in acquiring urban hukou is 0.014, and the impact of neighborhood familiarity is 0.011, both at the 1% significance level. Its economic significance is that if neighborhood trust and neighborhood familiarity increase by one standard deviation, the willingness of the floating population to acquire urban hukou in the work city will increase by 0.045 and 0.033 percentage points, respectively. This proves that the degree of social integration can promote the acquisition of urban hukou in the floating population in the work city.

Table 3
Social integration and residents' decisions: Baseline results

Variables	Acquisition of urban hukou decision-making					
	(1)	(2)	(3)	(4)	(5)	(6)
Social integration	0.003*** (0.000)			0.008*** (0.000)		
Trust of neighbor.		0.005*** (0.000)			0.014*** (0.000)	
Familiar of neighbor.			0.004*** (0.001)			0.011*** (0.000)
Gender				0.027*** (0.002)	0.026*** (0.002)	0.027*** (0.002)
Age				-0.004*** (0.000)	-0.004*** (0.000)	-0.004*** (0.000)
Edu				-0.008*** (0.001)	-0.008*** (0.001)	-0.008*** (0.001)
Political type				0.013*** (0.000)	0.013*** (0.000)	0.013*** (0.000)
Hukou type				0.015*** (0.002)	0.015*** (0.002)	0.015*** (0.002)
Health				-0.012*** (0.001)	-0.012*** (0.001)	-0.011*** (0.001)
Work				-0.006** (0.003)	-0.005** (0.003)	-0.006** (0.003)
Edu of parents				-0.009*** (0.001)	-0.009*** (0.001)	-0.009*** (0.001)
Cities Fixed effects	No	No	No	Yes	Yes	Yes
Year Fixed effects	No	No	No	Yes	Yes	Yes
R ²	0.001	0.001	0.001	0.107	0.106	0.106
Observation	5,261	5,261	5,261	5,261	5,261	5,261

Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses.

3.2 Mechanism analysis

Using the test of the mediation effect⁴⁷, we verified and measured the mediating effect of physical exercise on the acquisition of urban hukou decision-making in the floating population through social integration. Equations (3)-(5) were used to test the path of "physical exercise–social integration–decision-making in the floating population in acquiring urban hukou". Specifically, the first step was to test the impact of physical exercise on the decision-making of the floating population in acquiring urban hukou, which is the coefficient α_1 in Equation (3). The second step was to test the impact of physical exercise on social integration, which is the coefficient β_1 in Equation (4). The third step was to test the impact of physical exercise and social integration on the decision-making of the floating population in acquiring urban hukou, that is, coefficients ϕ_1 and ϕ_2 in Equation (5). When the coefficient ϕ_1 is statistically significant, it indicates that there is a mediating effect. In the case where the coefficients β_1 and ϕ_2 are significant at the same time, if the coefficient ϕ_1 is significant and the impact of physical exercise on the decision-making of the floating population in acquiring urban hukou becomes smaller, it indicates that there is a partial mediation effect. On the contrary, if the coefficient is not significant, there is a complete mediation effect. Furthermore, if at least one of the coefficients β_1 and ϕ_2 is not significant, the Sobel test is required to determine the significance of the mediation effect ($\beta_1 \times \phi_2$). The meaning of other variables is consistent with Equation (1).

$$residence_{it} = \alpha_0 + \alpha_1 physical_{it} + \sum \alpha_i X_{it} + city_i \delta_i + year_i \gamma_i + \epsilon_{it} \quad (3)$$

$$social_{it} = \beta_0 + \beta_1 physical_{it} + \sum \beta_i X_{it} + city_i \delta_i + year_i \gamma_i + \varsigma_{it} \quad (4)$$

$$residence_{it} = \phi_0 + \phi_1 physical_{it} + \phi_2 social_{it} + \sum \phi_i X_{it} + city_i \delta_i + year_i \gamma_i + \xi_{it} \quad (5)$$

Table 4 shows the results of the verification and calculation of the path "physical exercise–social integration–decision-making of the floating population in acquiring urban hukou". Columns (1)-(3) verify and measure the path "participate in physical exercise–social integration–decision-making of the floating population in acquiring urban hukou". Column (1) shows the test results that do not include the intermediary factor (social integration). The coefficient is positive and significant. Column (2) shows the impact of participation in physical exercise on social integration; the coefficient is positive and significant, indicating that participation in physical exercise can indeed promote social integration. Column (3) shows the test results that include both the intermediary factor (social integration) and participation in physical exercise; the regression coefficients are significantly positive at the level of 1%, indicating that the higher the degree of social integration, the greater the willingness of the floating population to acquire urban hukou in the work city. And the coefficient (ϕ_1) is less than α_1 , indicating that social integration is a part of the mediating factors that affect the decision-making of the floating population in acquiring urban hukou through participating in physical exercise, and the mediating effect accounts for 1.95%. Furthermore, we used the Sobel test to verify the significance of the mediation effect, and the Z statistics all passed a 5% statistical test, which again confirmed that the mediation effect was significant. Similarly, in Columns (4)-(9), the paths "the minutes of physical exercise–social integration–decision-making of the floating population in acquiring urban hukou" and "the frequency of physical exercise–social integration–decision-making of the floating population in acquiring urban hukou" were tested respectively. It can be seen that social integration is a part of the mediating factor of the minutes of physical exercise and the frequency of physical exercise, with the mediating effects accounting for 1.56% and 1.80%, respectively. And the Sobel Z statistics all passed the statistical test at the level of 10%. To sum up, physical exercise can promote the degree of social integration of the floating population, and ultimately, increase the willingness of the floating population to acquire urban hukou in the work city.

Table 4
Physical exercise and acquiring of urban hukou decision-making: mediate effect

Variables	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Participation PE	0.026** (0.013)	0.167*** (0.051)	0.024* (0.013)						
Social integration			0.008** (0.004)						
Minutes of PE				0.008** (0.003)	0.040*** (0.013)	0.007** (0.003)			
Social integration					0.008** (0.004)				
Frequency of PE						0.010** (0.004)	0.044** (0.018)	0.009** (0.004)	
Social integration								0.009*** (0.003)	
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cities Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sobel Z value	1.696*			1.696*			1.698*		
Mediating effect	1.95%			1.56%			1.80%		
R ²	0.106	0.189	0.107	0.107	0.189	0.107	0.053	0.186	0.054
Observation	5,261	5,261	5,261	5,261	5,261	5,261	5,261	5,261	5,261

Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses; The proportion of the mediating effect of the Sobel Z statistic was obtained using the Sgmediation command in Stata15.

3.3 Heterogeneity analysis

In the above sections, we considered the floating population as individuals with exactly the same preferences for acquiring urban hukou, and obtained relevant analysis results through empirical model calculations. In this section, we introduce the heterogeneity of the floating population, focusing on the two dimensions of gender and the type of hukou and the impact of physical exercise and social integration on the acquisition of urban hukou decision-making of the floating population. Table 5 reports the empirical results of how physical exercise and social integration impact on the acquisition of urban hukou decision-making for males and females, and the non-agricultural and rural floating populations. Specifically, Columns (1)-(6) show the impact of participation in physical exercise, and the minutes and frequency of physical exercise on acquisition of urban hukou decision-making in the male and female floating

populations. Overall, the impact of physical exercise on acquisition of urban hukou decision-making of the female floating population is greater than on the male floating population. Similarly, Columns (7)-(12) show the impact of social integration on acquisition of urban hukou decision-making for the male and female floating populations. The differences between the two groups are relatively small; 0.006 and 0.01, respectively. Columns (13)-(18) show the effects of non-agricultural and agricultural hukou and physical exercise on acquisition of urban hukou decision-making. It can clearly be seen that the non-agricultural and agricultural hukou floating population has significant coefficients of 1% on the coefficients of participation in physical exercise, minutes and frequency of physical exercise. In addition, for the non-agricultural hukou floating population, physical exercise has a greater impact on acquisition of urban hukou decision-making (0.065 V.S. 0.030). Furthermore, in Columns (19)-(24), the effects of social integration on acquisition of urban hukou decision-making are shown in the non-agricultural and agricultural hukou floating populations. It can be seen that the positive effect of social integration on acquisition of urban hukou decision-making for the non-agricultural hukou floating population is greater than that for the agricultural hukou floating population (0.018 V.S. 0.002). Overall, there is a significant positive relationship between social integration and acquisition of urban hukou decision-making in the two groups. However, the positive impact of social integration and acquisition of urban hukou decision-making on the non-agricultural hukou floating population is greater than that on the agricultural hukou floating population.

Table 5
Heterogeneity results: baseline results

Variables	Acquiring urban hukou decision-making					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Participation PE	0.029*** (0.004)			0.059*** (0.001)		
Minutes of PE		0.008*** (0.001)			0.017*** (0.000)	
Numbers of PE			0.009*** (0.002)			0.017*** (0.001)
Observation	2,403	2,403	2,403	2,858	2,858	2,858
Variables	Male			Female		
	(7)	(8)	(9)	(10)	(11)	(12)
Social integration	0.006*** (0.000)			0.010*** (0.000)		
Trust of neighbor.		0.013*** (0.000)			0.014*** (0.001)	
Familiar of neighbor.			0.008*** (0.001)			0.016*** (0.001)
Observation	2,403	2,403	2,403	2,858	2,858	2,858
Variables	Non-agricultural Hukou			Agricultural Hukou		
	(13)	(14)	(15)	(16)	(17)	(18)
Participation PE	0.065*** (0.004)			0.030*** (0.000)		
Minutes of PE		0.017*** (0.001)			0.009*** (0.000)	
Numbers of PE			0.022*** (0.001)			0.006*** (0.000)
Observation	2,186	2,186	2,186	3,075	3,075	3,075
Variables	Non-agricultural Hukou			Agricultural Hukou		
	(19)	(20)	(21)	(22)	(23)	(24)
Social integration	0.018*** (0.000)			0.002*** (0.000)		
Trust of neighbor.		0.042*** (0.000)			-0.005*** (0.001)	

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively; robust standard errors in parentheses.

Variables	Acquiring urban hukou decision-making					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Familiar of neighbor.			0.021***			0.007***
			(0.000)			(0.000)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Cities Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observation	2,186	2,186	2,186	3,075	3,075	3,075

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively; robust standard errors in parentheses.

Table 6 documents the mediating effects of social integration in physical exercise and acquisition of urban hukou decision-making in the male and female, and non-agricultural and agricultural hukou floating populations. First of all, from the perspective of gender, the mediating effect of female floating population social integration is generally greater than that of males' (2.285%, 2.607% > 1.800%, 0.978%) in the path "participation in physical exercise/the frequency of physical exercise–social integration–acquisition of urban hukou decision-making". Secondly, from the perspective of the type of hukou, the mediating effect of social integration of the agricultural hukou floating population does not exist, that is, physical exercise will not increase the willingness of the agricultural hukou floating population to acquire urban hukou by promoting the improvement of social integration. In contrast, in the non-agricultural hukou floating population, the mediating effect of social integration is common in the path "participating in physical exercise/minutes of physical exercises /frequency of physical exercise–social integration–acquisition of urban hukou decision", with the mediating effect reaching 1.515%, 1.036% and 0.395%. At the same time, the Sobel Z statistics all passed a 10% statistical test, which again confirmed that the mediation effect was significant.

Table 6
Heterogeneity results: mediate effect

Variables	Male								
	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making
Participation PE	0.028*** (0.004)	0.078*** (0.003)	0.027*** (0.004)						
Social integration			0.006*** (0.000)			0.006*** (0.000)			0.006*** (0.000)
Minutes of PE				0.007*** (0.001)	0.023*** (0.000)	0.006*** (0.001)			
Frequency of PE							0.009*** (0.002)	0.013*** (0.001)	0.008*** (0.002)
Observation	2,403	2,403	2,403	2,403	2,403	2,403	2,403	2,403	2,403
Sobel Z value			8.881**			8.872**			8.910**
Mediating effect			1.800%			1.969%			0.978%
Variables	Female								
	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making
Participation PE	0.059*** (0.001)	0.145*** (0.014)	0.057*** (0.001)						
Social integration			0.009*** (0.000)			0.009*** (0.000)			0.009*** (0.000)
Minutes of PE				0.016*** (0.000)	0.027*** (0.004)	0.015*** (0.000)			
Frequency of PE							0.017*** (0.001)	0.047*** (0.005)	0.016*** (0.001)
Observation	2,850	2,850	2,850	2,850	2,850	2,850	2,850	2,850	2,850
Sobel Z value			1.699* 2.285%			1.695* 1.531%			1.674* 2.607%
Mediating effect									
Variables	Non-agricultural hukou								

Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses; The proportion of the mediating effect of the Sobel Z statistic was obtained using the Sgmediation command in Stata15.

Variables		Male							
		Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration
	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making
Participation PE	0.062*** (0.004)	0.052*** (0.007)	0.061*** (0.004)						
Social integration			0.018*** (0.000)			0.018*** (0.000)			0.018*** (0.000)
Minutes of PE				0.016*** (0.001)	0.009*** (0.002)	0.015*** (0.001)			
Frequency of PE							0.021*** (0.001)	0.004* (0.002)	0.020*** (0.001)
Observation	2,186	2,186	2,186	2,186	2,186	2,186	2,186	2,186	2,186
Sobel Z value			1.729* (0.000)			1.690* (0.000)			1.714* (0.000)
Mediating effect			1.515% (0.000)			1.036% (0.000)			0.395% (0.000)
Variables		Agricultural hukou							
		Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration
Participation PE	0.032*** (0.000)	0.148*** (0.006)	0.032*** (0.000)						0.032*** (0.000)
Social integration			0.001*** (0.000)			0.001*** (0.000)			0.001*** (0.000)
Minutes of PE				0.010*** (0.000)	0.035*** (0.002)	0.010*** (0.000)			
Frequency of PE							0.007*** (0.000)	0.052*** (0.002)	0.007*** (0.000)
Cities Fixed effects	Yes								
Year Fixed effects	Yes								
Control variables	Yes								
Observation	3,063	3,063	3,063	3,063	3,063	3,063	3,063	3,063	3,063
Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses; The proportion of the mediating effect of the Sobel Z statistic was obtained using the Sgmediation command in Stata15.									

Variables	Male								
	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making	Decision-making	Social integration	Decision-making
Sobel Z value	0.244				0.239				0.268
Mediating effect	0.502%				0.375%				0.873%
Note: *, **, and *** indicate significant statistical levels of 10%, 5%, and 1%, respectively; Robust standard error in parentheses; The proportion of the mediating effect of the Sobel Z statistic was obtained using the Sgmediation command in Stata15.									

3.4 Robustness Checks

In the robustness analysis section, we deleted the "uncertain" answers, in terms of acquisition of urban hukou, from the sample. We reexamined the mediating effects of physical exercise and acquisition of urban hukou decision-making, social integration and acquisition of urban hukou decision-making, and physical exercise, social integration and acquisition of urban hukou decision-making. Table 7 reports the robustness results. The results show that the positive relationship between physical exercise, social integration, and acquisition of urban hukou decision-making still exists, and is significant at the 1% level. In addition, the coefficients of each variable are larger than those estimated above, which shows that we have previously underestimated the impact of physical exercise and social integration on the decision-making of the floating population in acquiring urban hukou. Similarly, the mediating effects of physical exercise, social integration, and decision-making of the floating population in acquiring urban hukou still exist, and are significant at the 10% level. Overall, this shows that our estimation results are very robust.

Table 7
Robustness results

Variables		Acquiring urban hukou decision-making					
		(1)	(2)	(3)	(4)	(5)	(6)
Participation PE		0.060*** (0.001)			0.033*** (0.000)		
Minutes of PE			0.017*** (0.000)			0.010*** (0.000)	
Frequency of PE				0.017*** (0.000)			0.009*** (0.000)
Cities Fixed effects	No	No	No	Yes	Yes	Yes	Yes
Year Fixed effects	No	No	No	Yes	Yes	Yes	Yes
Observation	3,845	3,845	3,845	3,845	3,845	3,845	3,845
Variables	Acquiring urban hukou decision-making						
	(7)	(8)	(9)	(10)	(11)	(12)	
Social integration	0.004*** (0.000)			0.010*** (0.000)			
Trust of neighbor.		0.006*** (0.000)			0.014*** (0.000)		
Familiar of neighbor.			0.007*** (0.001)			0.016*** (0.001)	
Cities Fixed effects	No	No	No	Yes	Yes	Yes	Yes
Year Fixed effects	No	No	No	Yes	Yes	Yes	Yes
Observation	3,845	3,845	3,845	3,845	3,845	3,845	3,845
Variables	Decision-making (13)	Social integration (14)	Decision-making (15)	Decision-making (16)	Social integration (17)	Decision-making (18)	
Participation PE	0.033** (0.017)	0.140** (0.062)	0.031* (0.017)				
Social integration			0.009** (0.004)				
Minutes of PE				0.010** (0.004)	0.029* (0.016)	0.009** (0.004)	
Social integration						0.009**	

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively; robust standard errors in parentheses. Due to space limitations, the test results of the mediating effects of the numbers of physical exercise, social integration, and decision-making in the floating population are not included in the table. The results show that in this path, the mediating effect accounts for 1.744% of the direct effect, and the Z statistic is 1.781.

Variables	Acquiring urban hukou decision-making					
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.004)					
Cities Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observation	3,845	3,845	3,845	3,845	3,845	3,845
Sobel Z value			1.671*			1.690*
Mediate effect			1.859%			1.222%

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively; robust standard errors in parentheses. Due to space limitations, the test results of the mediating effects of the numbers of physical exercise, social integration, and decision-making in the floating population are not included in the table. The results show that in this path, the mediating effect accounts for 1.744% of the direct effect, and the Z statistic is 1.781.

4 Discussion

Existing studies have basically explored the relationship between physical exercise and social integration, and social integration and acquisition of urban hukou decision-making. But the research samples have been relatively small and the representativeness relatively weak. In this paper, physical exercise, social integration, and acquisition of urban hukou decision-making were combined, and the nationally representative data of the China Labor Force Dynamics Survey were used to explore the mechanism of physical exercise, social integration, and acquisition of urban hukou decision-making in the floating population. First of all, the positive relationships between physical exercise and the decision-making of the floating population in acquiring urban hukou, and social integration and the decision-making of the floating population in acquiring urban hukou were verified. That is, when the floating population participates in physical exercise, it has a higher degree of social integration with urban residents and is more willing to acquire urban hukou in the working cities. Furthermore, the improvement of social integration will directly promote the acquisition of urban hukou by migrants in the work city, which is basically consistent with the conclusions of Cao et al.⁴⁸.

Next, considering the influence of control variables on the decision-making of the floating population in acquiring urban hukou, our research results are consistent with Hu et al.³⁶, Zang et al.⁴⁵, Xiang³⁵, and L. Zhang & Tao⁴⁹. There is a significant negative relationship between age and acquisition of urban hukou decision-making, which is consistent with Liu et al.⁴⁴. That is, the older the floating population is, the less willing they are to acquire urban hukou in the work city. This may be mainly a symptom of the Chinese household registration system. China's household registration system sets requirements for education level, skill level, etc. The older floating population are often those with a lower level of education and lower skill levels. Therefore, this type of floating population is less willingness to acquire urban hukou in cities.

Secondly, the mediating effects of social integration through physical exercise and acquisition of urban hukou decision-making of the floating population are discussed. The study of Tonts⁵⁰ only emphasized that physical exercise is an important way to create rural community communication and maintain harmony in rural communities, but did not further analyze the impact of physical exercise on the acquisition of urban hukou in the floating population. Then, this article makes a very important academic contribution concerning the mediating effect of social integration. We link these three factors and verify their existence in China's floating population. On the one hand, this provides empirical evidence for the positive role of physical exercise in the construction of a harmonious socialist society; it provides new ideas for promoting China's new urbanization construction. Additionally, it enriches the research on the factors influencing acquisition of urban hukou decision-making in the floating population. Also, studies by An et al.⁵¹ and Gay & Trevarthen⁵² point out that the environment of community exercise has an important impact on the exercise behavior of community residents, and that the richer the facilities for community exercise and the more continuous the participation of adults in the community, the higher the probability of physical exercise. It can be seen that it is not enough to just improve participation in physical exercise; the construction of community physical exercise facilities should be improved²⁹, and an atmosphere of community participation in exercise should be fostered.

Third, we compared the relationship between physical exercise, social integration, and acquisition of urban hukou decision-making in terms of gender and rural or urban hukou status. It was found that physical exercise has a greater impact on the decision-making in acquiring urban hukou among female migrant groups, and the mediating effect of social integration is also stronger among female groups. In addition, it is worth noting that the intermediary effect of social integration does not exist in the floating population with agricultural hukou, and the mechanism by which physical exercise affects the decision of the floating population in acquiring urban hukou through social integration is significant in the non-agricultural hukou floating population. One possible reason is that the proportion of the floating population with agricultural hukou participating in physical exercise is low. Therefore, the degree of social integration promoted by physical exercise is relatively low, and as a result, the mediating effect of social integration cannot be exerted.

Finally, although physical exercise has a positive effect on social integration and acquisition of urban hukou decision-making in the floating population, the reality of low awareness and low participation rates in physical exercise directly limits the role of physical exercise in the development of a harmonious society and new urbanization. Our data shows that only 28% of migrants participate in physical exercise (see Table 1).

5 Conclusions And Policy Implications

Based on the 2014 and 2016 China Labor Force Dynamics Survey data, this paper studies the relationship between physical exercise, social integration, and decision-making in the floating population in acquiring urban hukou, further examines the mediating effects of social integration, and validates the effect of physical exercise on decision-making of the floating population in acquiring urban hukou. The results show that the participation of the floating population in physical exercise increases the frequency and duration of physical exercise, which promotes the willingness to acquire urban hukou in the work city. Meanwhile, social integration can also directly encourage the floating population to acquire urban hukou in the work city. Further mechanism analysis shows that physical exercise can be an important medium for promoting the integration of local and floating populations and social harmony, and it can increase the willingness of the floating population to acquire urban hukou in the work city by promoting the degree of social integration. And, the positive mediation effect is quite significant. Finally, we also find that the mediating effect of physical exercise on the decision-making of the floating population in acquiring urban hukou through social integration is most significant in the non-agricultural hukou and female floating population.

This paper has the following policy implications. (1) When promoting the floating populations in cities, government should increase awareness of physical exercise among gloating populations and guide them to participate in physical exercise, especially to increase the proportion of agricultural hukou holders participating in physical exercise. This will promote social integration and a healthy lifestyle. (2) The government should increase the construction of community sports facilities, provide basic conditions for the floating population to participate in physical exercise, and promote public health. (3) Communities should hold collective sports activities. While strengthening the mutual exchanges among the residents of the community. This can also promote a harmonious community. (4) Focus should be placed on sports activities with the non-agricultural hukou floating population as the mainstay, tapping the potential of the floating population with agricultural hukou to acquire urban hukou in cities. This can promote the urbanization of the non-urban hukou floating population in China.

Declarations

Data availability

The datasets used and/or analyzed during the current study are not publicly available because of privacy issues but are available when you have applied. The application website is: <http://css.sysu.edu.cn/Data>.

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Authors contributions

Chong Lu conceptualized the idea and prepared the methodology of the paper. Ailin Wu did the wrote the initial draft of the paper. Both the authors revised, read and finalized the final manuscript.

Competing interests

The authors declare no competing interests.

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