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Original Article

Association between social capital and physical activity among community-dwelling elderly in Wuhan, China

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SUMMARY

Background: Social capital is important for people's health. Few studies have examined the influence of social capital on physical activity among elderly. This study aimed to explore the association between social capital and physical activity among Chinese community-dwelling elderly.

Methods: A cross-sectional survey was conducted for data collection in 2014. A total of 1210 participants entered the study. Participants were categorized as active or inactive according to self-reported physical activity. Personal Social Capital Scale-16 was used to measure social capital. Logistic regression models were used to examine the association between social capital and physical activity.

Results: The results showed that participants who were physically active had higher social capital scores (45.6 ± 8.2) than those who were physically inactive (38.8 ± 7.9) ($P < .001$). Participants with midlevel and high level bonding social capital were associated with increased odds of physical activity (0.54, 95% CI: 0.37–0.79 and 0.39, 95%CI: 0.21–0.65, respectively), compared to those with low bonding social capital. The data also showed that participants with midlevel and high level bridging social capital were associated with increased odds of physical activity (0.40, 95%CI:0.22–0.76 and 0.27, 95%CI:0.15–0.49, respectively), compared to those with low level bridging social capital.

Conclusion: Both bonding and bridging social capital were associated with physical activity among Chinese elderly. It is suggested that health promotion programs targeting elderly adults' physical activity should consider bonding/bridging social capital factors.

1. Introduction

Physical activity is considered as a healthy lifestyle and can help the elderly individuals to alleviate their psychological stress from both family and society. The evidence has showed that physical activity has strong effects on reducing the risk of premature death and chronic diseases.[1,2] But, in China, many people still do not realize the importance of regular physical activity for health.[3] By the end of 2015, China's total population had reached 1.37 billion, and those 65 years old and above accounted for 10.5%.[4] With the increasing aging population, poorer health status in elderly has become a serious social issue. The increasing expensive medical care is a heavy burden for the elderly in China. Physical activity is easy to implement and is considered as a cheap way to keep one's health. Thus, we should pay more attention to advocate physical activity in Chinese elderly to improve their health and reduce the exorbitant medical expenses in this age group. Hence, in order to formulate health care policies and interventions to enhance physical activity level and to improve the health of the elderly, it is important to investigate the influencing factors of physical activity among elderly. Previous studies have shown that physical activity is associated with socio-demographic, socio-economic status and psychosocial factors, etc.[5,6]

In the last two decades, the concept of social capital has received much attention in the research field of public health.[7] The term of social capital has often been used to express the disparities in individuals' health.[8] Social capital usually emphasizes the role of

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groups or networks,[9] and views as individual stock of social resources.[10] The definition and measurements of social capital remain controversial. However, an emerging update of consensus has defined two dimensions of social capital, bonding and bridging social capital.[11] Bonding social capital refers to links between community residents whose social identities are similar (homogeneous social networks), regardless of their social class, race/ethnicity, and other characteristics; Bridging social capital means connections between community residents whose status and power are different from each other (heterogeneous social networks).[12] Although there is no uniform concept, the core elements of social capital which include social network, social participation, trust, reciprocity and sharing have gradually been accepted by most researchers.[13] Studies have shown that social capital has effects on a wide range of health issues, such as mortality[14], self-rated health status[15] and even violent crime[16].

To date, only few studies have explored the association between social capital and physical activity. Mummery found that physical inactivity is related to low social capital among adults in Australia.[17] Lindström found that social capital has positive associations with spare-time physical activity in Swedish adults after multiple adjustments.[18] However, there is an obvious absence of research on the relationship between social capital and physical activity focusing on the elderly. Due to the difference of social and cultural backgrounds, the Chinese elderly place large value on possession and expenditure of social resources,[19] which suggests that social capital may have effects on physical activity. Besides, there is no study to distinguish between bonding social capital and bridging social capital while investigating the association between social capital and physical activity.[20,21] Thus, we hypothesized that social capital would be associated with physical activity among community-dwelling elderly in China. In this study, we aimed to investigate the association between two components of social capital (i.e. bonding and bridging social capital) and physical activity among Chinese community-dwelling elderly.

2. Materials and methods

2.1. Ethics statement

The protocol of the study was approved by the Ethics Committee of School of Health Sciences, Wuhan University. The purpose of the survey is fully explained to the participants, and all participants gave written, informed consent before participating in the study.

2.2. Design and participants

This is a cross-sectional community-based study conducted in July 2014 in Wuhan city. Wuhan, the capital of Hubei province, is located in Central China, with a geographic area of 8494.41 km^2. Its total population reached 10.33 million by the end of 2014. Population of 65 years old and above accounted for 15.10%. The target population of the present study is elderly residents living in urban communities. Inclusion criteria were as the following: participants should (*a*) age ≥65 years; (*b*) residents who have been living in Wuhan for more than six months; and (*c*) agreed to join in the study. Potential participants were excluded while they (*a*) suffered from severe dementia, schizophrenia, or severe mental disorders in their medical records; (*b*) had severe vision, hearing, or speaking difficulties; or (*c*) had severe movement disability and were unable to perform normal social interaction. Based on estimated physical inactivity prevalence rates ranging from 40% to 80%,[22] and considering the cluster sampling and possible loss rate of 20%, the required sample size was calculated to be 1080. Stratified cluster sampling was used in this study. First, two districts were selected randomly out of 13 districts in Wuhan city. Second, one subdistrict was randomly selected from each district. Third, three neighborhood committees were randomly selected from each subdistrict. A total of 1799 potential respondents were identified using a government-maintained residents list. Among them, 450 could not be reached (removed, passed away, traveling and hospitalization), 79 refused to participate, 60 were not able to answer the questionnaire (suffered from dementia, schizophrenia, deafness, vision disorder and dumbness). Finally, 1210 residents were enrolled in the study. This study used face to face questionnaire method. The investigators of this study were the graduate students from School of Health Sciences, Wuhan University, and they had been well trained before the investigation conducted.

2.3. Assessment of social capital

The Chinese Version of Personal Social Capital Scale (PSCS-16) was selected as the assessment tool for social capital because of its suitability for quantitative survey about health behavior and social capital.[23] The acceptable reliability and validity of PSCS-16 were established in China.[23] The PSCS-16 consists of 16 items covering two key social capital domains, bonding social capital and bridging social capital. Bonding social capital focuses on (*a*) the perceived network size, (*b*) the number of network members who are perceived as trustful, (*c*) the number of network members possessing resources, such as professional job and social influence, and (*d*) the number of network members who are reciprocal. Bridging social capital focuses on (*a*) the perceived group size, (*b*) whether the groups represent personal rights and interests, (*c*) the resources possessed by these groups, and (*d*) the likelihood to receive assistance from the groups on request. These four dimensions were assessed using a 5-point Likert scale, with an overall range of 8–40 points (higher score indicates possession of more social capital). According to quartiles of the total scores, each type of social capital score was categorized as follows: 8 to 16 points, 17 to 24 points, 25 to 32 points, and ≥33 points. In this study, because the number of participants in the lowest quartile of bonding social capital and the highest quartile of bridging social capital is so small (less than 2%), we merged it into the second quartile of bonding social capital and highest quartile of bridging social capital, respectively. Therefore, according to the data distribution, bonding social capital score was categorized as low (8–24 points), mid (25–32 points) and high level (≥33 points); bridging social capital score was categorized as low (8–16 points), mid (17–24 points) and high level (≥25 points).

2.4. Assessment of physical activity

In our study, physical activity levels were determined by individual self-report on weekly frequency, intensity and time engaged in the following activities: walking, jogging or running, square dance, playing Tai Chi, swimming and so on[24]. According to Health Guideline for the Chinese Elderly,[25] participants who do physical exercises at least three times a week and each exercise lasts at least 30 min (leading to sweating or exhausted) were defined as physical activity, while the others whose physical exercises did not meet the above standards were defined as physical inactivity.

2.5. Independent variables

General information of participants was obtained from a standardized face to face questionnaire interview, including age, gender, marital status (married or single), dwelling condition (whether living alone or not), educational level, personal income and activities of daily living (ADL). Educational level was categorized as follows: no formal, primary, junior, and college education. Personal income was

categorized as follows: <1000, 1001 to 2000, 2001 to 3000, and >3000 RMB per month. Daily living activities were assessed by using the Activity of Daily Living Scale (ADLs), which includes Physical Self-maintenance Scale (PSMS)and Instrumental Activities of Daily Living Scale (IADL).[26,27] The PSMS includes using toilet, eating, dressing, washing, walking and bathing. The IADL includes telephone use, shopping, cooking, doing daily housework, using public transportation, washing clothes, taking medicine and financial management. Each answer was divided into 4 responses as follows: "can do it by myself", "have some difficulties", "need help" and "cannot do it". People who reported have any difficulty in any item were classified as having functional decline.[28,29]

2.6. Statistics analysis

Descriptive statistics were calculated for the entire sample by gender, age, marital status, dwelling condition, education levels, personal income, ADLs, social capital levels and physical activity categories. Univariate relationships between gender, age, marital status, dwelling condition, education, income, ADLs, social capital levels and physical activity were explored by using Chi-square test. Multiple logistic regression was used to examine the association between social capital and physical activity after adjusting simultaneously for all other elements in the analysis. All data were analyzed using SPSS for Windows V13.0 with a 95% CI and a significance level of .05.

3. Results

3.1. Demographic characteristics

Overall, 1210 participants were enrolled in current study, resulting in a response rate of 67.3%. Among these 1210 residents, 538 (44.5%) were men and 672 (55.5%) were women. The mean age was 74.3 (SD = 6.26) years, and nearly half of participants received junior education (42.9%); 352 participants (29.1%) were classified as physical inactivity. The following characteristics were found to be significantly different across the two groups (physical activity and physical inactivity): age, gender, marital status, educational level, personal income, and ADLs score. Compared with the physical activity, those with physical inactivity were more likely to be older, single, lower personal income level and lower performance on the ADLs (Table 1).

3.2. Distribution of social capital level among participants with physical activity and physical inactivity

Table 2 showed that participants with physical inactivity had a significantly lower social capital scores (38.8 ± 7.9, mean ± SD) compared to those who were physically active (45.6 ± 8.2, mean ± SD) ($P < .001$). Those with higher levels of both bonding and bridging social capital reported lower prevalence of physical inactivity (P < .001) (Table 2).

3.3. Cross-sectional relationship between social capital and physical activity

The results of logistic regression models for the association between social capital and physical inactivity are presented in Table 3. Model 3 showed that participants with midlevel bonding social capital had an odds ratio (OR) for physical inactivity of 0.54 (95% CI = 0.37–0.79) and those with high level bonding social capital had an OR for physical inactivity of 0.39 (95% CI = 0.21–0.65) compared with low level bonding social capital. Model 3 also showed that participants with a midlevel bridging social capital had an odds ratio (OR) for physical inactivity of 0.40 (95% CI = 0.22–0.76) and those with high level bridging social capital had an OR for physical inactivity of 0.27 (95% CI = 0.15–0.49) compared with low level bridging social capital. All of three models indicated that there were inverse relationships between the midlevel and high level, with the low level of both bonding and bridging social capital treated as the reference (Table 3).

4. Discussion

In the present study, we based on Putnam's description to measure social capital.[30] The social capital is divided into two dimensions, i.e. bonding and bridging social capital. Our results showed that both bonding and bridging social capital were

Table 1
Demographic and social economic characteristics of physical activity and physical inactivity.

	Physical activity (n = 858)	Physical inactivity (n = 352)	*p*
Age, years, means ± SD	73.2 ± 5.8	75.9 ± 6.6	<.001
Gender, n (%)			0.003
Male	405 (47.2)	133 (37.8)	
Female	453 (52.8)	219 (62.2)	
Marital status, n (%)			<.001
Married	598 (69.7)	199 (56.5)	
Single	260 (30.3)	153 (43.5)	
Dwelling condition, n (%)			0.09
Living alone	148 (17.2)	47 (13.4)	
Not living along	710 (82.8)	305 (86.6)	
Educational level, n (%)			0.003
No normal education	153 (17.8)	45 (12.8)	
Primary education	235 (27.4)	132 (37.5)	
Junior education	380 (44.3)	139 (39.5)	
College or above	90 (10.5)	36 (10.2)	
Personal income (Yuan, RMB)[a], n (%)			<.001
<1000	95 (11.1)	85 (24.1)	
1001–2000	512 (59.7)	227 (64.5)	
2001–3000	216 (25.2)	34 (9.7)	
>3000	35 (4.1)	6 (1.7)	
ADLs, n (%)			<.001
Completely normal	711 (82.9)	250 (71.0)	
Functional decline	147 (17.1)	102 (29.0)	

Abbreviations: ADLs, Activity of Daily Living Scale.
[a] According to a government notice, China set the poverty line at an annual income of 2300 RMB per capita in 2011.

Table 2
The distribution of bonding/bridging social capital level among participants with physical activity and physical inactivity.

	Physical activity (n = 858)	Physical inactivity (n = 352)	*p*
Social capital score, mean ± SD	45.6 ± 8.2	38.8 ± 7.9	<.001
Bonding social capital score, mean ± SD	29.3 ± 4.9	25.3 ± 5.4	<.001
Low, n (%)	224 (26.1)	144 (40.9)	
Mid, n (%)	484 (56.4)	187 (53.1)	
High, n (%)	150 (17.5)	21 (6.0)	
Bridging social capital score, mean ± SD	16.3 ± 5.0	13.5 ± 6.5	<.001
Low, n (%)	184 (21.4)	172 (48.9)	<.001
Mid, n (%)	532 (62.0)	139 (39.5)	
High, n (%)	142 (16.6)	41 (11.6)	

Table 3
Odds ratio for bonding/bridging social capital among participants with different physical activity conditions (physical inactivity and activity).

	Model 1, OR (95%)	Model 2, OR (95%)	Model 3, OR (95%)
Gender (Ref: male)			
Female		0.71 (0.48–1.13)	0.65 (0.40–1.05)
Age (ref: 65–69)			
70–74		1.55 (0.81–2.97)	1.44 (0.75–2.76)
75–79		2.15 (1.15–4.03)	1.94 (1.03–3.67)
≥80		2.91 (1.46–5.78)	2.51 (1.25–5.06)
Marital status (Ref: married)			
Single		0.74 (0.46–1.20)	0.65 (0.40–1.07)
Educational level (Ref: no normal education)			
Primary education		0.93 (0.54–1.58)	0.98 (0.57–1.69)
Junior education		0.37 (0.19–0.70)	0.45 (0.23–0.87)
College or above		0.20 (0.11–0.42)	0.29 (0.16–0.63)
Personal income (Yuan, RMB), (Ref: <1000)			
1001–2000		0.80 (0.48–1.35)	0.84 (0.49–1.43)
2001–3000		0.36 (0.19–0.70)	0.40 (0.20–0.79)
>3000		0.26 (0.09–0.72)	0.26 (0.11–0.73)
ADLs, (Ref: completely normal)			
Functional decline			2.48 (1.49–4.13)
Bonding social capital (Ref: low)			
Mid	0.61 (0.44–0.86)	0.58 (0.40–0.83)	0.54 (0.37–0.79)
High	0.41 (0.23–0.73)	0.44 (0.24–0.80)	0.39 (0.21–0.65)
Bridging social capital (Ref: low)			
Mid	0.35 (0.20–0.63)	0.34 (0.18–0.61)	0.40 (0.22–0.76)
High	0.27 (0.16–0.45)	0.24 (0.13–0.41)	0.27 (0.15–0.49)

Abbreviations: OR, odds ratio.
Variables were selected by stepwise multiple logistic regression analysis. Model 1: crude model. Model 2: multivariate logistic regression model, adjusted for gender, age, marital status, educational level and personal income. Model 3: multivariate logistic regression model, adjusted for gender, age, marital status, educational level, personal income, and ADL.

associated with physical activity among elderly. The results remained after adjusting for possible confounding factors such as gender, age, marital status, educational level, personal income, and ADL. These results might promote further study on the association between bonding/bridging social capital and physical activity, and provide useful information for health promotion of aging society.

In this study, bonding social capital mainly measured as the size of the social network, the trust among neighbors and friends, and assistant obtained from them have positive effects on physical activity among Chinese elderly. This result is consistent with a cross-sectional study conducted in Switzerland, which found that low social support affected the physical activity.[31] There are some mechanisms to explain the relationship between bonding social capital and physical activity. First, in China, the majority of the elderly choose to do exercise in a way of walking accompanied by family members or friends.[3] Lack of companionship is an important influencing factor of physical inactivity among Chinese elderly.[32] The elderly with strong bonding social capital could get more support from family members, neighbors and friends and could be likely to do more physical activity in their company. Second, higher level bonding capital can also promote the dissemination of health information, and foster health behavior norms among those with similar sociodemographic characteristics in a community.[33] Such health information and health behavior norms would have a positive influence on physical activity level of elderly. Third, after retirement, the social network of the elderly was gradually narrowed, and homogeneous social networks played a key role in providing social resources, which can enhance the social identity and solidarity of members. The elderly with higher bonding social capital tend to get more social trust from homogeneous social network, such as relatives, neighbors and close friends. A trust atmosphere is considered to be conducive to the promotion of healthy behaviors.[34] People with strong bonding social capital have higher social trust, which might affect elderly adults' health-related behavior, e.g. physical activity. According to our findings, in order to improve physical activity level, the community workers should provide practical assistance program to help the elderly with low bonding social capital to establish good relationship with their family members or neighborhoods so as to strengthen their support behaviors among peers. Besides, the community physicians should provide health education to both the elderly and their family members or friends. This might enhance the elderly adults' health awareness and help them to establish the healthy behavioral norms.

Bridging social capital mainly measured as the perception of community groups and assistance obtained from social organizations also has positive effects on physical activity in our study. This result is consistent with Lindström's finding. They

found people who had more resource from organizations were often physically active.[34] Some possible mechanisms may explain this finding. One possible explanation is that bridging social capital may be directly associated with physical activity through social participation. Social participation may involve individuals in joining some community sports clubs such as square dance and table tennis team. Indirectly, greater network diversity can extend the range of information sources which could improve social support system, and provide greater access to materials and resources.[35] The strong heterogeneous social networks may enhance the diffusion of health promotion information throughout the population. Therefore, bridging social capital may have beneficial effects on physical activity. It is suggested that the community should create good conditions for social interaction and social participation of elderly through establishing sports club and developing cultural activities. Moreover, the local government should cultivate a favorable environment for various non-governmental organizations and social groups, and encourage the elderly to take part in social activities. These measures might increase the physical activity level of elderly by improving individuals' bridging social capital.

This study has some limitations. Firstly, the concept and measurement of social capital are controversial. Though there are many ways to measure social capital, each method and measuring instrument may have limitations and no concept can cover all fields of social capital. Secondly, the survey was a face to face interview and the answers based on participants' self-report, which lead to a risk of information bias due to false or inaccurate responses. Individuals are sometimes inclined to underreporting behaviors that are against the healthy norms. Thirdly, our study was a cross-sectional study, we could not examine the causal relationship between social capital and physical inactivity. Lastly, this study could not include several confounding factors such as depression and body mass index (BMI) which may influence participants' physical activity. These should be considered in the future studies.

In conclusion, our findings highlighted that there was a link between bonding/bridging social capital and physical activity among Chinese community-dwelling elderly. After adjustment for socio-demographic factors, socio-economic characteristics and ADL, both bonding and bridging social capital were inversely associated with physical inactivity. It is suggested that health promotion programs targeting elderly adults' physical activity should consider the factors of both bonding and bridging social capital.

Declaration of Conflicting Interests

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