

# Do Physical Activity-Related Knowledge, Attitudes, and Behaviors Play a Role in the Elderly's Mental Health? A Cross-Sectional Study from the China Health and Nutrition Survey

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## Research article

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# Abstract

**Background:** Physical activity (PA)-related knowledge, attitudes, and behaviors (KABs) are important content of health management. We conducted this study to (a) describe PA-related KABs of Chinese older adults, and (b) examine the association between PA-related KABs and mental health.

**Methods:** This study used data from the 2015 China Health and Nutrition Survey (CHNS). 4048 residents aged 60 years and older were included as study subjects, assessing their PA-related knowledge, attitudes, behaviors, and mental health. Comparison of PA-related KABs in urban and rural areas, as well as in different mental health groups were conducted using chi-square test. Ordinal logistic regression analysis was applied to assess the associations between PA-related KABs and mental health.

**Results:** The proportion for knowing about the benefits of physical activity, knowing about appropriate exercise intensity, and knowing about healthy weight were 76.7%, 44.3%, and 75.4%, respectively. 89.2% of the participants hold positive attitude towards physical activity. 45.0%, 12.1%, and 12.9% of the participants reported preferring walking & Tai Chi, ball games, and body building, respectively. Participants in urban areas had significantly better PA-related KABs than those in rural areas (all  $p$ -values < 0.001). Adjusted  $OR$ s with 95%  $CI$  showed that participants who knew about the benefits of physical activity ( $OR = 1.19$ , 95%  $CI = 1.02$ - $1.38$ ); hold positive attitude towards physical activity ( $OR = 1.31$ , 95%  $CI = 1.08$ - $1.59$ ); and reported preferring walking & Tai Chi ( $OR = 1.40$ , 95%  $CI = 1.23$ - $1.60$ ), ball games ( $OR = 1.45$ , 95%  $CI = 1.17$ - $1.79$ ), body building ( $OR = 1.33$ , 95%  $CI = 1.09$ - $1.63$ ) had significant better mental health.

**Conclusions:** Elderly residents in rural areas experienced significant poorer PA-related KABs than those in urban areas, especially for PA-related behaviors. Better PA-related knowledge, attitudes, and behaviors were associated with higher mental health in Chinese elderly residents.

## Background

China has the largest elderly population in the world and also is one of the most rapidly aging societies in the world. By the end of 2018, there were 249 million older adults aged 60 years and older in China which accounted for 17.9% of the total Chinese population [1]. With the decline of physical function caused by increasing age, elderly people are more likely to suffer from chronic diseases and catch various mental health problems [2]. Forty percent of the Chinese elderly (74.0 million) have higher level of depressive symptom [3]. Improving the elderly's mental health has become an important topic in China.

Worldwide, the prevalence of insufficient physical activity (PA) was 27.5% in 2016 [4]. Physical inactivity has become the fourth leading health risk factor and accounts for 6% of the global deaths [5, 6]. In China, only 15% of the adult residents exercise regularly which is much lower than Singapore and the United States [7]. Zhou et al. [8] reported a prevalence of 63.1% for physical inactivity among Chinese middle-aged and older people. To promote physical activity and improve elderly health, Chinese government

implemented “Healthy China Action (2019–2030)” in July 2019, in which “Fitness-for-all Campaign” and “Elderly Health Promotion Action” were involved as major actions [9].

The theory of Knowledge, Attitude/Belief, and Behavior/Practice (KAB) was originally proposed to emphasize the vital role of knowledge, attitudes, and behaviors in health management [10]. KAB theory holds that individual health behavior is composed of three consecutive processes: acquiring knowledge, generating beliefs, and forming behaviors. KAB evaluation, which is considered the first step of health education, can help health educators grasp individuals’ understanding, health beliefs, and actions taken regarding a specific health issue, and provide the scientific basis for intervention plans. Doyle et al. [11] have emphasized the importance of improving PA-related knowledge and strengthening the awareness of PA’s benefits for mental health. In our previous study [12], we indicated the possibility that behavioral intervention from the perspective of knowledge, attitudes, and behaviors could help improve individual health. Thus, assessing PA-related knowledge, attitudes, and behaviors might be of vital importance in elderly health promotion in China.

PA was recognized as an effective tool to relieve mental disorders (stress, anxiety, depression, etc.) and reduce mental health burden [13–15]. Previous studies have explored the influence of PA on the elderly’s mental health. Kadariya et al. [16] reported the role of PA for protecting against depression and improving sleep quality among older adults in South and Southeast Asia. Takayanagi et al. [17] found significant association between the change in light physical activity time and the elderly’s mental component summary score. Aguiñaga et al. [18] revealed the effect of PA on reducing depression and anxiety of older adults. However, few studies have focused on knowledge and attitudes towards PA [19]. No study has investigated the association between PA and the elderly’s mental health from the KAB theory perspective. For these considerations, we conducted this study to (a) describe the condition of PA among Chinese elderly residents from the perspective of knowledge, attitudes, and behaviors, and (b) examine the association between PA-related KABs and mental health.

## Methods

### Data sources

The sample for this study came from the China Health and Nutrition Survey (CHNS). CHNS is an open cohort with multistage and random cluster procedures which has been conducted since 1989. It was designed to explore the effects of the health, nutrition, and family planning policies and programs implemented by national and local governments. CHNS collects data on social and economic conditions, overall health, health behaviors, and nutrition status, etc. of Chinese residents. In the 2015 CHNS data, 15,291 individuals were surveyed from nine provinces (Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou) and three municipalities (Beijing, Chongqing, and Shanghai).

This study used the 2015 CHNS data. Individuals aged 60 years and older were included as study subjects ( $n = 4566$ ). This study aimed to assess the association between PA-related KABs and mental health, thus we excluded subjects with no relevant information ( $n = 518$ ). A total of 4048 elderly individuals were involved in the final analysis.

## Variables

### Demographic characteristics

Participants' socio-demographic characteristics were collected as covariates, including age, gender, body mass index (BMI), education level, marital status, work status, and place of residence. Age was classified into 60–69, 70–79, and  $\geq 80$ . BMI was divided into three categories ( $< 20.0 \text{ kg/m}^2$ ,  $20.0\text{--}26.9 \text{ kg/m}^2$ , and  $\geq 27.0 \text{ kg/m}^2$ ) based on the BMI criteria for Chinese elderly from Chinese Nutrition Society (CNS), i.e., the elderly's BMI is preferably not less than  $20.0 \text{ kg/m}^2$  and not more than  $26.9 \text{ kg/m}^2$ . Education level included primary school and below, middle school, high school, and college and above. Marital status was dichotomized into married and others (single, divorced, widowed, and separated). Work status was dichotomized into employed and unemployed or retired. Place of residence included urban areas and rural areas.

### PA-related KABs

Three indicators were used to assess PA-related knowledge: knowing about the benefits of physical activity, knowing about appropriate exercise intensity, and knowing about healthy weight. There are three corresponding statements for the three indicators above: “(1) physical activities are good for one's health”, “(2) sweaty sports or other intense physical activities are not good for one's health”, and “(3) the heavier one's body is, the healthier he or she is”. For each of the three statements, participants were asked: “Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with this statement?” For the first two positive statements, the response of “strongly agree” or “agree” represented correct answer. For the last negative statement, the response of “somewhat disagree” or “strongly disagree” represented was considered as correct answer.

The view on the importance of being physically active was selected as the indicator of PA-related attitudes. Participants were asked: “How important is being physically active priority in your life: the most important, very important, neutral, not very important, or not important at all?” The response of “the most important” or “very important” represented positive attitude.

PA-related behaviors were measured by three indicators: walking & Tai Chi, ball games (ping pong, badminton, tennis, soccer, basketball, volleyball, etc.), and body building. For each of the three physical activities, participants were asked: “How much do you like to participate in this activity: strongly like, like, neutral, dislike, or strongly dislike?” The response of “strongly like” or “like” was considered as positive behavior.

### Mental health

Three structured questions regarding vitality, happiness, and optimism were applied to assess mental health. There were three statements: “(1) I have as much pep as I had in 2014 (vitality)”, “(2) I am as happy now as I was younger (happiness)”, and “(3) As I get older, things are better than I thought they would be (optimism)”. For each of the three statements, participants were asked: “If you strongly disagree, somewhat disagree, neutral, somewhat agree, or strongly agree with this statement ?” 5-point Likert scale from “strongly disagree” to “strongly agree” was used for each statement. The total score ranges from 3 to 15, with higher score indicating better mental health. In this study, we divided mental health into three categories according to the 80/20 rule (also known as the Pareto principle) [20]. Individuals scored 1–8, 9–11, and 12–15 were recognized as poor, moderate, and good mental health, respectively. Cronbach’s alpha for the three structured questions was 0.79 in this sample.

## Statistical analysis

Statistical analyses were conducted using IBM SPSS Statistics Version 23.0 (SPSS, Inc., Chicago, IL). Participants’ demographic characteristics were summarized via descriptive analysis with frequency ( $n$ ) and percentage (%). Chi-squared test was used to compare the differences of PA-related KABs in urban and rural areas, as well as in different mental health groups. Ordinal logistic regression analysis was applied to assess the associations between PA-related KABs and mental health. In all analyses, a  $p$ -value of  $< 0.05$  was considered significant.

## Results

### Demographic characteristics

A total of 4048 elderly individuals aged 60 years and older were involved in the final analysis. Among the participants, 63.5% ( $n = 2570$ ) were between 60 and 69 years old, 46.5% ( $n = 1884$ ) were male, 67.6% ( $n = 2735$ ) with an BMI between 20 and 26.9 kg/m<sup>2</sup>, 55.0% ( $n = 2227$ ) had an education level of primary school and below, 83.0% ( $n = 3360$ ) were married, 83.1% ( $n = 3365$ ) were currently unemployed or retired, 58.0% ( $n = 2347$ ) lived in rural areas. Participants’ demographic characteristics are presented in Table 1.

Table 1  
Participants' demographic characteristics.

Characteristics	Categories	Frequency (n)	Percentage (%)
Age (years)	60–69	2570	63.5
	70–79	1159	28.6
	≥ 80	319	7.9
Gender	Male	1884	46.5
	Female	2164	53.5
BMI (kg/m <sup>2</sup> )	< 20.0	477	11.8
	20-26.9	2735	67.6
	≥ 27.0	836	20.7
Education level	Primary school and below	2227	55.0
	Middle school	937	23.1
	High school	619	15.3
	College and above	265	6.5
Marital status	Married	3360	83.0
	Others	688	17.0
Work status	Employed	683	16.9
	Unemployed or retired	3365	83.1
Place of residence	Urban	1701	42.0
	Rural	2347	58.0

## PA-related KABs

Table 2 shows the results of PA-related KABs. The proportion for knowing about the benefits of physical activity, knowing about appropriate exercise intensity, and knowing about healthy weight were 76.7%, 44.3%, and 75.4%, respectively. 89.2% of the participants hold positive attitude towards physical activity. 45.0%, 12.1%, and 12.9% of the participants reported preferring walking & Tai Chi, ball games, and body building, respectively.

Table 2  
PA-related KABs in urban and rural areas.

Variables	All participants ( <i>n</i> = 4048)	Urban ( <i>n</i> = 1701)	Rural ( <i>n</i> = 2347)	$\chi^2$	<i>p</i> -value
<b>Knowledge</b>					
Knowing about the benefits of physical activity	3103 (76.7)	1370 (80.5)	1733 (73.8)	24.75	< 0.001
Knowing about appropriate exercise intensity	1792 (44.3)	839 (49.3)	953 (40.6)	30.39	< 0.001
Knowing about healthy weight	3052 (75.4)	1370 (80.5)	1682 (71.7)	41.87	< 0.001
<b>Attitudes</b>					
Holding positive attitude physical activity	3612 (89.2)	1556 (91.5)	2056 (87.6)	15.40	< 0.001
<b>Behaviors</b>					
Preferring walking & Tai Chi	1821 (45.0)	1033 (60.7)	788 (33.6)	293.83	< 0.001
Preferring ball games	491 (12.1)	305 (17.9)	186 (7.9)	92.64	< 0.001
Preferring body building	523 (12.9)	320 (18.8)	203 (8.6)	90.54	< 0.001

Comparative analysis indicated that participants in urban areas had significantly better PA-related KABs than those in rural areas (all *p*-values < 0.001). Notably, the proportion of reporting preferring walking & Tai Chi in urban elderly (60.7%) was almost double of which in rural elderly (33.6%) ( $\chi^2 = 293.83$ , *p* < 0.001). The proportion of reporting preferring ball games (17.9% vs. 7.9%) and body building (18.8% vs. 8.6%) in urban participants were more than twice of which in rural participants (all *p*-values < 0.001).

## Association between PA-related KABs and mental health

Among the participants, 26.9% (*n* = 1087), 48.6% (*n* = 1968), and 24.5% (*n* = 993) self-reported poor, moderate, and good mental health. The results of chi-square tests are presented in Table 3. Pearson chi-square test showed that there was a difference between PA-related KABs and mental health (all *p*-values < 0.001). Mantel-Haenszel chi-square test showed a significant increase in PA-related KABs for linear trend (all *p*-values < 0.001).

Table 3  
PA-related KABs among participants with different mental health level.

Variables	Poor ( <i>n</i> = 1087, 26.9%)	Moderate ( <i>n</i> = 1968, 48.6%)	Good ( <i>n</i> = 993, 24.5%)	Pearson $\chi^2$	MH $\chi^2$
<b>Knowledge</b>					
Knowing about the benefits of physical activity	808 (74.3)	1435 (72.9)	860 (86.6)	73.60***	41.38***
Knowing about appropriate exercise intensity	453 (41.7)	810 (41.2)	529 (53.3)	43.31***	26.98***
Knowing about healthy weight	792 (72.9)	1419 (72.1)	841 (84.7)	61.53***	37.27***
<b>Attitudes</b>					
Holding positive attitude physical activity	923 (84.9)	1767 (89.8)	922 (92.8)	35.26***	34.39***
<b>Behaviors</b>					
Preferring walking & Tai Chi	386 (35.5)	824 (41.9)	611 (61.5)	156.99***	138.90***
Preferring ball games	70 (6.4)	219 (11.1)	202 (20.3)	97.71***	92.84***
Preferring body building	85 (7.8)	230 (11.7)	208 (20.9)	84.66***	78.11***
MH: Mantel-Haenszel chi-square test. *** <i>p</i> -value < 0.001.					

*ORs* and with 95% *CI* were computed via ordinal logistic regression analyses to examining the relationship between PA-related KABs and mental health (Table 4). Participants who knew about the benefits of physical activity (*OR* = 1.19, 95% *CI* = 1.02–1.38), appropriate exercise intensity (*OR* = 1.17, 95% *CI* = 1.03–1.32), healthy weight (*OR* = 1.21, 95% *CI* = 1.04–1.40); hold positive attitude towards physical activity (*OR* = 1.39, 95% *CI* = 1.14–1.68); and reported preferring walking & Tai Chi (*OR* = 1.62, 95% *CI* = 1.43–1.84), ball games (*OR* = 1.59, 95% *CI* = 1.29–1.96), body building (*OR* = 1.48, 95% *CI* = 1.21–1.80) had significant better mental health. After adjusting for confounding factors (model 2), no significant association was observed between knowing about appropriate exercise intensity (*OR* = 1.12, 95% *CI* = 0.99–1.26), knowing about healthy weight (*OR* = 1.12, 95% *CI* = 0.97–1.30) and mental health.



Table 4

Ordinal logistic regression predicting the association between PA-related KABs and mental health.

Variables	Model 1, <i>OR</i> (95% <i>CI</i> )	Model 2, <i>OR</i> (95% <i>CI</i> )
<b>Knowledge</b>		
Knowing about the benefits of physical activity	1.19 (1.02–1.38) *	1.19 (1.02–1.38) *
Knowing about appropriate exercise intensity	1.17 (1.03–1.32) *	1.12 (0.99–1.26)
Knowing about healthy weight	1.21 (1.04–1.40) *	1.12 (0.97–1.30)
<b>Attitudes</b>		
Holding positive attitude physical activity	1.39 (1.14–1.68) **	1.31 (1.08–1.59) **
<b>Behaviors</b>		
Preferring walking & Tai Chi	1.62 (1.43–1.84) ***	1.40 (1.23–1.60) ***
Preferring ball games	1.59 (1.29–1.96) ***	1.45 (1.17–1.79) **
Preferring body building	1.48 (1.21–1.80) ***	1.33 (1.09–1.63) **
* <i>p</i> -value < 0.05, ** <i>p</i> -value < 0.01, *** <i>p</i> -value < 0.001. Model 1 is the crude model. Model 2 is adjusted for age, gender, BMI, education level, marital status, work status, and place of residence.		

## Discussion

Chinese elderly are undergoing unoptimistic PA condition and mental health status. Advocating fitness for all and promoting elderly health have become important topics in current China. In this study, we found that elderly people in rural areas had significantly poorer PA-related KABs than those in urban areas, especially for PA-related behaviors. PA-related KABs were associated with the elderly's mental health.

This study reported the proportion of 76.7% for knowing about the benefits of physical activity, 44.3% for knowing about appropriate exercise intensity, and 75.4% for knowing about healthy weight. The results were generally consistent with previous studies [21–23]. Almost 90% of the participants hold positive attitude towards physical activity, which is much higher than Doyle et al. [11] reported in Emirati university students. Knowledge and attitudes are the basis of behaviors. PA-related knowledge and attitudes may affect individuals' choice of PA-related behavior [24]. Future health education is needed to help elderly people acquire PA-related knowledge and hold positive attitudes towards PA.

This study included three PA-related behaviors, including walking & Tai Chi, ball games, and body building. We found that 45.0% of the elderly individuals reported preferring walking & Tai. Only 12.1% and 12.9% of the participants reported preferring ball games and body building. Yang et al. [25] also reported

apparent differences in types of exercises among community residents in China. People were mainly engaged in traditional leisure activities and the participation of competitive sports was relatively low. Nakagawa et al. [26] found that more frequent vigorous- and moderate-intensity PA rather than walking (considered low to moderate intensity) was associated with better cognitive and mental health measures. Thus, behavioral interventions focused on vigorous- and moderate-intensity PA might make more sense in Chinese elderly population.

Comparison analysis indicated that elderly residents in rural areas had significantly poorer PA-related KABs than those in urban areas, especially for PA-related behaviors. The result is in line with Deng et al.'s [27] study in middle-aged and older Chinese adults. Bu et al. [28] and Li et al. [29] also mentioned the substantial rural-urban disparities in PA among Chinese residents. However, contrary findings were reported in several studies from the United States [30, 31], South African [32], and India [33]. This inconsistency might be related to different national conditions. In China, there is an obvious urban-rural dualistic structure in PA-related KABs, which might be due to the difference in accessibility for sports resources and awareness for activity participation between urban and rural regions [34]. Thus, policy interventions are warranted to improve the accessibility and affordability of local exercise facilities in rural areas as a way to reduce urban-rural disparities in PA.

The results of regression analysis showed that PA-related KABs were associated with higher mental health in Chinese elderly, except for the knowledge on appropriate exercise intensity and healthy weight. Previous studies have confirmed this finding that PA-related behaviors had positive correlation with the elderly's mental health [35–37]. According to the KAB theory, individuals who have better knowledge and hold positive attitude are more likely to adopt healthy behaviors [10]. Campos et al. [24] also reported that PA-related knowledge can be a protective factor against sedentariness and physical inactivity. Thus, behavioral intervention related to PA might be taken as an important supplementary measure for mental health promotion of the elderly, and the role of PA-related knowledge and attitudes should not be ignored. Moreover, previous studies suggested that different types of physical activity had variant impacts on mental health [26, 38, 39]. Thus, personalized behavioral guidance regarding PA for elderly people might make sense in mental health promotion.

Chinese government implemented “Fitness-for-all Campaign”, “Elderly Health Promotion Action”, and “Mental Health Promotion Action” as part of the “Healthy China Action (2019–2030)” [9]. Improving physical activity and mental health of the elderly is not an easy task in China. From the KAB theory perspective, this study reinforced the importance of creating good conditions for PA-related health resources, especially in rural areas. Our findings also indicate the possibility that PA-related interventions and programs could help improve the elderly's mental health. Such interventions and programs should be target three physical activity dimensions: knowledge, attitudes, and behaviors.

Several potential limitations should be mentioned regarding this study. Firstly, limited by the data structure and content of the CHNS database, we only selected several variables to evaluate PA-related knowledge and behaviors. Future studies are needed to comprehensively assess PA-related KABs.

Secondly, all variables included in this study were obtained through participants' self-report, thus are likely to cause measurement errors. Thirdly, the cross-sectional nature of this study may be considered a weakness, as no causal inferences can be drawn from the results. Despite these limitations, this study is the first to explore the association between PA-related knowledge, attitudes, behaviors, and mental health of elderly people from the perspective of KAB theory. The result might be a valuable reference for the implementation of the current "Fitness-for-all Campaign" and "Elderly Health Promotion Action", as well as for further relevant research.

## Conclusions

This study found that Chinese elderly residents in rural areas had poorer PA-related KABs than those in urban areas, especially for PA-related behaviors. Better PA-related knowledge, attitudes, and behaviors were associated with higher mental health in Chinese elderly, except for knowledge on appropriate exercise intensity and healthy weight. Our findings indicate the possibility that PA-related interventions and programs could help improve the elderly's mental health. Such interventions and programs should be target three physical activity dimensions: knowledge, attitudes, and behaviors. Moreover, the focus of interventions on rural areas to address the urban-rural gap in physical activity might make great sense.

## Abbreviations

BMI: Body mass index; CHNS: China Health and Nutrition Survey; *CI*: Confidence interval; CNS: Chinese Nutrition Society; KABs: Knowledge, attitudes, and behaviors; *OR*: Odds ratio; PA: Physical activity

## Declarations

## Ethics approval and consent to participate

Protocols, instruments, and the process used to obtain informed consent in CHNS were approved by the institutional review committees of the University of North Carolina at Chapel Hill, as well as the National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention. All subjects gave written informed consent for their participation in the survey. All participants provided written informed consent. Details about the design of CHNS are available elsewhere [40].

## Consent for publication

Not applicable.

## Availability of data and materials

The datasets generated and/or analysed during the current study are available from the official CHNS website (<https://www.cpc.unc.edu/projects/china>).

## Competing interests

The authors declare that they have no competing interests.

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This work was supported by the Global Health Institute, Wuhan University, China. The role of funding body included designing the study, analysis and interpretation of data, and writing the manuscript.

## Authors' contributions

YY, LW, QL, and ZM designed this study. LW, DH, and BH analyzed and interpreted the data. YY, LW, DH, BH, and QL drafted the paper. YY, LW, QL, and ZM revised the manuscript. All authors have read and approved the submitted manuscript.

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