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Journal of Sport and Health Science 5 (2016) 281–286

www.jshs.org.cn

Review

Physical activity among older Chinese adults living in urban and rural areas: A review

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Received 1 March 2016; revised 20 May 2016; accepted 21 May 2016

Available online 11 July 2016

Abstract

With an increase in rural-to-urban migration, a rapidly aging population, and the rising risk of developing noncommunicable diseases in China, it is important to understand the epidemiology of physical activity (PA) and health in the context of disease prevention and population health. Despite its public health importance, there is a significant lack of knowledge about PA in older Chinese adults that may hamper primary prevention efforts of health promotion in an increasingly aging population. To fill this gap, this article presents a narrative review of PA in the older Chinese adult population with a special focus on residential settings (i.e., urban and rural). Using existing studies, the review examines overall PA patterns and their correlates and discusses public health implications and future research. Although there are some preliminary indications of urban and rural differences in PA in the aging population in China, continued research efforts are needed to facilitate primary prevention efforts aimed at reducing noncommunicable diseases and promoting an active lifestyle among the largest population of older people in the world.

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Keywords: China; Exercise; Older adults; Physical activity; Public health; Urbanization

1. Introduction

Three decades of open reforms in China have brought significant changes in industrialization and urbanization, which have begun to exert an impact on the living environment, health care, and lifestyles.^{1,2} The unprecedented economic development has also brought with it an increase in both the burden of noncommunicable diseases (e.g., coronary heart disease, stroke, hypertension, cancer, and type 2 diabetes) and unhealthy lifestyles (e.g., physical inactivity, fatty food intake, and smoking) among the Chinese population.^{1,3,4} Physical inactivity, which has been recognized as a high risk factor for disease—contributing 12%–19% of the risk associated with major noncommunicable diseases^{5–8}—has been on the rise in China^{2,9} and was responsible for at least 15% of health care-related costs of major diseases in 2007.¹⁰ This situation has created an urgent need for primary prevention efforts aimed at promoting an active lifestyle, including physical activity (PA), and preventing noncommunicable diseases among the aging Chinese population.

The current literature on PA among older Chinese adult populations is sparse and is limited in both scope and quality. Of special concern is the inadequate scientific knowledge we have on the prevalence and patterns of PA and the relationships between PA and health risk factors among older adults living in urban and rural areas. The lack of advances in these research areas may have created significant barriers to developing urgently needed health initiatives and intervention strategies for addressing the modifiable behavioral risk of physical inactivity and thus curbing the rising noncommunicable disease rate in China. In filling this significant knowledge gap, this review provides a narrative overview of epidemiologic research on PA among Chinese adults, with a major focus on community-dwelling older adults living in urban and rural areas. The article ends with a brief discussion of public health implications and recommendations for future research.

2. PA and sedentary time among the general Chinese population

As the level of PA has declined globally¹¹ during recent decades, China has also experienced a decrease in energy expenditure across various domains of PA in both urban and rural areas. In a prospective study,⁹ the China Health and Nutrition

Peer review under responsibility of Shanghai University of Sport.

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Survey showed that during the 20-year period from 1991 to 2011, overall PA among Chinese adults aged 18 to 60 years, sampled from a mix of rural, urban, and suburban areas, fell from 382 to 264 metabolic equivalent hours per week (MET-h/week) among men and from 420 to 243 MET-h/week among women. A similar decline was also reported in a later study using the same survey dataset.¹²

In a study involving rural and urban residents, the International Collaborative Study of Cardiovascular Disease in Asia¹³ reported that about 66% of individuals between 35 and 75 years old were physically active, as defined by spending 30 min or more participating in daily moderate or vigorous PA (MVPA). Across various types of activities, work-related PA was most dominant (63%), followed by leisure-time PA (24%). There was, however, a remarkable difference in prevalence in urban and rural areas. A large percentage of rural residents (78.1%) reported being physically active compared with only 21.8% of those living in urban areas. A similar pattern was observed for domain-specific activities: 75.8% of rural residents reported participating in work-related PAs, whereas only 16.5% of urban residents reported doing so; 28.9% of rural residents reported participating in leisure-time activities *vs.* only 7.9% of urban dwellers.

Two other cross-sectional studies have observed significant rural and urban differences in PA.^{14,15} In the China Kadoorie Biobank study,¹⁴ researchers showed that on average, rural residents had approximately 20% more PA and 5% less sedentary leisure time compared with urban residents. In another study,¹⁵ residents in rural areas were reported to have higher levels of vigorous PA compared with those living in urban areas. However, the study also showed that urban residents had a higher level of moderate PA compared with their rural-resident counterparts. Some interesting results on domain-specific PA levels were also observed, with rural residents having a higher level of occupational activity (81.8 METs for rural residents *vs.* 64.7 METs for urban residents) and urban residents showing a higher level of transportation use (24.7 METs) and leisure-time activity (10.6 METs) compared with rural residents, who expended 15.1 METs and 3.1 METs, respectively, on these activities.

In China, rapid urbanization and the massive rural-to-urban migration movement^{16,17} have been linked to an increasingly sedentary lifestyle and reduced levels of PA. For example, a study of PA among migrant factory workers aged 17 to 59 years in Shenzhen found that a vast majority of the workers (69%) reported a low level of PA, defined as less than 30 min/week of MVPA.¹⁸ Sedentary behavior has been identified as an independent health risk factor for developing noncommunicable diseases, including overweight/obesity, diabetes, metabolic syndrome, and cognitive impairment.^{19–22} For example, in a study of PA and sedentary behaviors among rural adults in Suixi,²³ researchers found that the subjects had low levels of leisure-time PA and high levels of TV viewing time, averaging 12 h/week. Another study of urban residents aged 40 to 74 years in Shanghai showed that sedentary behaviors occupied the most time per day (509 min/day by accelerometer, 349 min/day by self-report).²⁴ The study also reported that women spent more

time in performing light-intensity PA and less time in sedentary behaviors than their male counterparts. A reduction in total PA was found to be associated with age, with older adults being more sedentary than younger adults.

3. PA and sedentary time among older Chinese adults

3.1. General patterns

To date, there have been few epidemiologic studies that have examined the levels of PA and sedentary behaviors in older Chinese adults. A systematic review of PA in older adults²⁵ indicated that the proportion of older Chinese adults who met the PA recommendation (at least 30 min/day for 5 days or more per week, or an equal amount) ranged from 25.30% to 47.44%. The range for urban residents was 9.8% to 82.6%, and for rural residents it was 52.7% to 60.9%. These statistics can be compared with the widely ranging percentage of older Western adults who meet the PA recommendation (2.4%²⁶–83.0%²⁷). Other studies have reported that 20% to 60% of the sample populations met the recommendation.²⁵

In the China Kadoorie Biobank study,¹⁴ the MET-h/day spent on work, transportation, housework, and nonsedentary recreational activities were measured, via self-reports, among 466,605 adults. The average PA of the entire study cohort was 22 MET-h/day, and average sedentary time was 3.0 h/day. The average PA level was lower for the 60- to 79-year-old cohort, which averaged 13.38 MET-h/day, compared with the younger cohort (aged 30–59 years), which averaged 24.35 MET-h/day. The main types of PA were occupational PA (62%), followed by domestic PA (26%) and leisure-time PA (4%). Using accelerometer measurements, the Shanghai Physical Activity Study reported that adults aged 60 years or older had a median of 64 min of daily MVPA, 215 min of daily light PA, and 540 min of daily sedentary behavior.²⁴

In a national survey conducted by the Chinese Center for Disease Control and Prevention,²⁸ it was reported that 71% of older adults (defined as 60 years or older) reported no participation in any leisure-time MVPA. The overall PA level of the entire sample was also low, with 75% of participants reporting low levels of PA. Older adults reported spending an average of 4.2 h/day in sedentary time and 1.8 h/day viewing TV. There were also notable differences in the levels of PA and sedentary behavior. Older adults who lived in urban areas and had higher levels of education or household income reported spending more time in sedentary behaviors (4.5 h/day) and viewing TV (2.1 h/day) than did those living in rural areas (4.1 h/day for sedentary behaviors, 1.6 h/day for TV viewing).

3.2. Urban and rural differences in PA

Although many studies involve older adults living in urban and rural areas,^{9,14,15,28} differences in prevalence and levels of PA by residential setting (*i.e.*, rural *vs.* urban) among older adults are often not the major focus of these studies, making it difficult to extract the relevant information in this area. However, the study by Muntner *et al.*¹³ was one of the first to shed light on rural and urban differences in prevalence of PA. With respect to older adults, the overall PA prevalence data

from the study (Fig. 2A in Muntner's article) showed that older adults (aged 65–74 years) living in urban areas were less physically active (9.8%) compared with those living in rural areas (52.7%). In addition, differences were noted in specific PAs. The study indicated that a lower percentage of urban residents took part in work-related (1.0%) and leisure-time PAs (5.5%) than did rural-dwelling adults (46.2% and 15.6%, respectively). Differing levels of PA were also reported in an earlier national survey, which showed that the percentage of participants reporting low levels of PA (defined as performing MVPA less than 3 times/week) was lower among urban older residents than among rural dwellers. Older adults living in urban areas also reported participating in a higher level of moderate and high PA compared with those living in the rural areas.²⁸

4. Correlates of PA in Chinese adults

4.1. Built and social environmental correlates of PA

Research has indicated that PA among Chinese adults is related to built environmental features.²⁹ For example, a study examined correlates of active transport (cycling) among rural elderly individuals living in the Zhongshan Metropolitan Area in Guangdong province.³⁰ The results indicated that in addition to other factors (e.g., cycling attitude and vehicle ownership), living in a neighborhood with a low-density elderly population (60 years or older), abundant bike lanes, and dense land use with mixed development was associated with an increase in both the frequency and duration of older adults' cycling activities (measured by trips). Another study examined the association between the built environment and walking activity in older adults and showed that availability of sidewalks, density of bus stops, accessible commercial establishments, and green land space were associated with increased walking activities in older adults.³¹

Two studies examined PA and the built environment in a metropolitan city—Shanghai. In 1 study,³² built environmental features such as street connectivity, river proximity, open spaces, parks, and land use mix were all positively associated with PA among middle-aged and older adults. Another cross-sectional study, also conducted in Shanghai, examined the relationship between older adults' perceptions of social and built environmental characteristics and their leisure-time PA.³³ The results of this study showed that older adults who perceived their neighborhoods as having high social cohesion and who participated in frequent social activities were associated with higher levels (at least 150 min/week) of leisure-time PA. In addition, those who perceived that their neighborhoods had good walkability also reported higher levels of leisure-time PA.

Decades of urbanization have also been shown to correlate with PA. For example, using data from the China Health and Nutrition Survey,³⁴ 1 longitudinal study examined whether change in urbanization over time was associated with an increased likelihood of engaging in light (*vs.* heavy) occupational PA in adults living in urban and suburban areas.³⁴ Urbanization was measured by a mix of indicators, including community-level social, physical, cultural, and built environment characteristics. The results showed that with increasing

urbanization over time, there was a significant decline in the level of reported light occupational activity among Chinese men and women. The impact of urbanization was also investigated in a study by Ng and colleagues,³⁵ who showed that expanded or improved community infrastructures, such as educational institutions, housing complexes, and sanitation facilities, were associated with declines in both occupational PA (1991–2006) and total PA (1997–2006), measured in MET-h/week, among Chinese men and women.

4.2. Individual-level correlates of PA

A number of cross-sectional studies have examined individual-level correlates of PA and health outcomes. For example, a study of older adults' quality of life showed that among other characteristics, insufficient PA was a major factor associated with poor health-related quality of life.³⁶ On the other hand, some degree of PA, even when performed at a low level of intensity, was associated with a likelihood of reduced depressive symptoms,³⁷ and participating in MVPA was related to lower diabetes risk among middle-aged and older adults, especially among abdominally obese individuals.³⁸ A study on the prevalence of noncommunicable chronic diseases in rural older adults showed that PA was associated with a reduced likelihood of suffering major chronic diseases.³⁹

Several studies have examined the relationship between PA and sociodemographic and/or lifestyle factors. For example, in an international study, Bauman and colleagues⁴⁰ showed that leisure-time PA increased with age in China, especially after retirement, and that adults who lived in urban areas and had higher educational attainment and income were more likely to be physically active during leisure-time but less active at work or during daily commutes. The Shanghai Women's Health Study,⁴¹ which involved Chinese women aged 40–70 years, found that age was positively associated with leisure-time and domestic PA; dietary energy intake was positively associated with total PA; and high socioeconomic status, unemployment, retirement, and not smoking were positively associated with leisure-time PA. Similar findings were reported in the Shanghai Men's Health Study,⁴² with a cohort of Chinese men aged 40–74 years, showing that education, income, and total energy intake were positively associated with leisure-time and domestic PA. In addition, the study showed that men with higher body mass index but lower waist-to-hip ratio participated in more leisure-time PA. In contrast, men who smoked were less physically active compared with their counterpart nonsmokers.

4.3. Mechanisms of PA

Few studies have focused on the biological mechanisms underlying the health benefits of PA. However, in a recent study, researchers reported that adults who had high levels of PA showed lower levels of amino acids in valine, leucine, and isoleucine metabolism and had lower levels of carbohydrates in sugar metabolism. A similarly positive metabolic pattern was found for other indicators, including energy expenditure, time spent in light activity, and duration of physically active time when higher levels of activity were present, whereas the

metabolic signature associated with sedentary time negatively mirrored this pattern (i.e., higher levels of acids and carbohydrates when a larger amount of sedentary time was spent).⁴³

5. Public health implications

Despite the mounting evidence for the health benefits gained from PA among older adults,⁴⁴ there remain significant challenges to promoting PA in China, especially among older adults.⁴⁵ For example, even with the national initiative of the Sport for All Program,^{46,47} rural residents still have limited access to program benefits. Fewer public facilities are built in distant rural villages in the mid-west areas of China. Many newly developed community living facilities are not equipped with adequate space for sports and exercise. Participation in leisure-time PA among older adults is still hindered by safety factors and inconveniences related to the built environment of local neighborhoods. Investment by the government in sports and exercise programs is still limited, and more multichannel funds from nongovernmental organizations are needed.

There is an ongoing need to invest in interventions and policies that promote leisure-time and transportation-related PA among older adults in China. This will require thoughtful planning for and creation of accessible public spaces, such as sports and PA facilities and neighborhood parks and green spaces. Improvements in public transportation and public safety are also needed. These initiatives should take into account other emerging needs, including environmental concerns such as air and noise pollution.⁴⁸ Additional exercise and sports facilities should be built in rural areas to promote the PA and fitness levels of rural residents.

Community programs and social initiatives should be developed to promote leisure-time PAs and prevent increases in sedentary behaviors in both urban and rural areas. Effective strategies for promoting PAs and improving health levels among older Chinese adults should be implemented in combination with current health and medical care services and personal insurance programs. Taking these steps could have significant implications for public health by improving the quality of life of older Chinese adults, thereby reducing the economic costs and social burdens of nonchronic diseases brought about by low levels of PA. Furthermore, the Sport for All Program should strive to renew the Chinese population's enthusiasm for exercise and sports, which in turn could help the nation's sports industry flourish, including the production and sale of sports gear and equipment, venue rentals, and sports training services.

6. Future research

Future research in China should focus on improved assessment of PA and its correlates. In this respect, the use of objective-based instruments (e.g., accelerometers) and audits of social and built environmental features are needed. National standards for the measurement of PA levels would allow for comparison of studies conducted in different geographic regions, in varying social and cultural contexts, and in urban and rural settings. Longitudinal prospective studies will be necessary to understand change in PA over time and to examine

time-variant and time-invariant correlates and predictors of change in PA in older adults across urban and rural settings. Future research efforts should also consider social, physical, and built-environment factors associated with various types of PA, including leisure-time activity, activity intensity (i.e., light, moderate, vigorous), and transportation, among older Chinese adults across residential settings. Given massive rural-to-urban migration,¹⁷ research is also needed to understand how older adults make the transition to a new lifestyle, including changes in their PA levels, and to living in urban settings where their quality of life may be compromised.⁴⁹

Given the increase in noncommunicable diseases among older Chinese adults,^{1,3,50} ecological-based studies are needed to develop community-based exercise interventions aimed at reducing rural and urban health disparities, preventing the incidence of diseases, and improving this population's quality of life. In China, there are many traditional sports and activities that have been shown to promote health and prevent health-related diseases.^{51,52} Multilevel PA interventions are needed that will significantly increase PA levels and reduce sedentary behaviors among older Chinese adults. The design of the interventions should include individuals, community service representatives, policymakers, health care providers, and others involved in improving the quality of life of this particular population.

7. Limitations of the review

This review has 2 notable limitations. First, given the limited number of epidemiologic studies available, especially studies that involve older Chinese adults, a systematic review of the literature was not conducted. Second, the review may not cover all published studies included in the literature. Nevertheless, this review provides an initial narrative review of research on PA in urban and rural settings and may be useful in establishing a foundation for future systematic reviews and meta-analyses of available evidence.

8. Conclusion

There has been a downward trend in the overall level of PA among older Chinese adults, with notable differences existing between residents living in rural areas and those living in urban areas. The total amount of PA practiced by urban residents was relatively low in all its forms (including occupational, domestic, and leisure-time), whereas rural residents showed low levels primarily in leisure-time PA and MVPA. Various individual characteristics, along with certain physical and built-environment factors, were found to be associated with levels of PA among older Chinese adults. Studies of PA and its impact on the health of older Chinese populations are scarce, and additional epidemiologic research is needed on the relationship between PA and urban and rural populations.

Acknowledgments

This study was supported by the Fundamental Research Funds for the Central Universities (GK201603122, GK201603128, and GK201603129). The authors thank Dr.

Fuzhong Li for his constructive comments and assistance during the various stages of writing this manuscript.

Authors' contributions

WZ carried out the literature review and drafted the manuscript; AC helped to do the literature search, and reviewed and edited the manuscript; YS helped to draft the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

None of the authors declare competing financial interests.

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