Slower maximal walking speed is associated with global cognitive function decline among older adults residing in China (#70851)

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Slower maximal walking speed is associated with global cognitive function decline among older adults residing in China

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Background: Maintaining both walking speed and cognitive function are essential for active, healthy aging. This study aimed to investigate the changes in walking speed and global cognitive function with aging and the association between them among older adults residing in a developing country. **Methods:** This cross-sectional study measured the usual walking speed (UWS) and the maximal walking speed (MWS) of participants walking at their usual and fastest paces for 10 meters. The Chinese version of the Montreal Cognitive Assessment was used to evaluate global cognition through face-to-face interviews. Cut points defining mild cognitive impairment were based on those previously used for older adults in Chinese communities. Analyses of variance were used to compare the differences in UWS, MWS, and global cognition between genders and age groups. Multiple linear regression models were used to determine the associations between walking speeds and global cognitive function across all participants. **Results:** In total, 791 older Chinese adults (252 men and 539 women) 60–89 years of age were included in this study. Sharp decreases in UWS and global cognitive function were observed for both genders among adults ≥80 years of age. MWS decreased rapidly in men ≥85 years of age and in women ≥80 years of age. There was a significant gender difference in MWS—with men walking faster than women—but not in UWS or in the prevalence of MCI. Linear regression results adjusted for confounding factors of gender, height, weight, educational level, and chronic disease indicated that MWS, but not UWS, was significantly associated with global cognitive function (β = 0.081, [0.006, 0.157], P = 0.036) such that slower maximal walking speed was associated with cognitive decline. **Conclusion:** This cross-sectional study found that both UWS and MWS decreased with age in a population of older adults in China. Cognitive function declined rapidly and the prevalence of MCI increased after 80 years of age. After controlling for confounding variables, slower MWS, but not UWS, was associated with global cognitive function decline. Future longitudinal studies are needed to determine

the causal relationship between walking speed and cognition to provide potential avenues for development of interventions to address mobility impairment and cognitive decline in older adults.

Slower maximal walking speed is associated with global cognitive function decline among older adults residing in China

Running title: walking speed and cognition

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Abstract

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Methods: This cross-sectional study measured the usual walking speed (UWS) and the maximal walking speed (MWS) of participants walking at their usual and fastest paces for 10 meters. The Chinese version of the Montreal Cognitive Assessment was used to evaluate global cognition through face-to-face interviews. Cut points defining mild cognitive impairment were based on those previously used for older adults in Chinese communities. Analyses of variance were used to compare the differences in UWS, MWS, and global cognition between genders and age groups. Multiple linear regression models were used to determine the associations between walking speeds and global cognitive function across all participants.

Results: In total, 791 older Chinese adults (252 men and 539 women) 60 – 89 years of age were included in this study. Sharp decreases in UWS and global cognitive function were observed for both genders among adults ≥80 years of age. MWS decreased rapidly in men ≥85 years of age and in women ≥80 years of age. There was a significant gender difference in MWS—with men walking faster than women—but not in UWS or in the prevalence of MCI. Linear regression results adjusted for confounding factors of gender, height, weight, educational level, and chronic disease indicated that MWS, but not UWS, was significantly associated with global cognitive function ($\beta = 0.081$, [0.006, 0.157], $P = 0.036$) such that slower maximal walking speed was associated with cognitive decline.

Conclusion: This cross-sectional study found that both UWS and MWS decreased with age in a population of older adults in China. Cognitive function declined rapidly and the prevalence of MCI increased after 80 years of age. After controlling for confounding variables, slower MWS, but not UWS, was associated with global cognitive function decline. Future longitudinal studies are needed to determine the causal relationship between walking speed and cognition to provide potential avenues for development of interventions to address mobility impairment and cognitive decline in older adults.

Keywords: older adults, aging, walking speed, cognition, mild cognitive impairment, cross-sectional study

Introduction

The global population is aging, and aging is often accompanied by impaired physical and cognitive functions (Sofi et al.,2011; Clouston et al., 2013) that may lead to decreased abilities to perform activities of daily living. Walking, the most basic activity of daily living and an important determinant of the quality of life in later years, requires the coordination of multiple systems. Walking speed is considered the sixth vital sign (Fritz and Lusardi, 2009), after respiration, heartbeat, blood pressure, body temperature, and pain, and is a core indicator of health and functional ability in aging and disease (Montero-Odasso et al.,2019; Stenholm et al.,2019; Rosso et al.,2013; Verghese et al.,2013; Verghese et al.,2019) . A slower walking speed may reflect a damaged system, a high energy cost of walking, and diminished motor control (Studenski et al.,2011). Therefore, maintenance of a normal and steady ability to walk for older adults is important for the prevention of adverse events in later life. Both ~~the~~ usual and maximal walking speeds have been used to predict ~~future~~ frailty, falls, and mobility impairment in older adults (White et al.,2013).

Cognitive function refers to the process of acquiring or applying knowledge, or ~~to~~ information processing (Hunt.,1989)~~, and is the most basic human mental process~~. Safe and effective walking requires input from higher cognition areas (Hausdorff et al.,2005). Significant reduction in cognitive processing abilities have been shown among people with a slow gait, suggesting that gait speed may serve as a simple, noninvasive biomarker for early identification of cognitive decline(Hunt.,1989; Viccaro, Perera, and Studenski,2011; Hirono et al.,2021).

One previous cross-sectional study assessed the trajectory of walking speed with age among persons 60–79 years of age (Hirono et al.,2021). Another study examined gender differences in preferred gait speed among older adults (Callisaya et al.,2008). Cognitive aging has also been studied from the perspective of the "cognitive clock." (Boyle et al.,2021) Studies investigating the association between walking speed and cognitive function have been conducted in several countries, including Japan(Fitzpatrick et al.,2007; Hao et al.,2021), Italy (Deshpande et al.,2009), and Spain (Garcia - Pinillos et al.,2016). Consistent with other studies, Demnitz et al.(Demnitz et al.,2016) showed that individuals with faster gaits perform better on overall cognitive measures.

The methods used to measure cognition and walking speed as well as the sensitivities of these methods to various states of health may affect study results. Previous studies (Fitzpatrick et al.,2007; Hao et al.,2021; Deshpande et al.,2009; Garcia - Pinillos et al.,2016) have focused primarily on populations with differing health states who reside in developed countries, and the range of ages assessed has been limited. In addition, knowledge regarding the associations among changes in walking speed, global cognitive aging, and gender remain limited, with walking speed and cognition rarely being measured simultaneously in the same study. Maintaining both walking speed and cognitive function are essential for active, healthy aging.

Understanding the patterns of different walking speeds associated with cognitive decline in older adults, as well as understanding cognitive decline in older adults from a mobility perspective, is important for both clinical and theoretical purposes. The aim of the present study was to address some of these gaps in the literature by exploring the associations between walking speed and cognitive decline within a single study involving a large sample of older adults residing in a developing country.

Materials & Methods

Participants

The study population was drawn from older adults in eight communities in Shanghai. The inclusion criteria were community-dwelling older adults (aged ≥60 years) who had sufficient communication skills to complete the study, were able to independently complete the walking and cognitive assessments, and agreed to participate in this study. The exclusion criteria were (1) failing to understand or participate in the evaluation test; (2) having an obvious gait disorder (such as that due to recent lower limb fracture, severe osteoarthritis, Parkinson's disease, dementia, and stroke); or (3) not agreeing to participate in the study. This study was approved by the Ethics Committee of Shanghai University of Sport (No. 102772021RT067). All participants provided written informed consent.

Assessment of Walking Speed

The 10-meter walk test is a common method for assessing walking speed (Peters et al.,2013;Perera et al.,2006). Participants walked 10 m without assistance. The timer started when the toe of the forefoot crossed the 2-m mark and ended when the toe of the forefoot crossed the 8-m mark. The time needed to walk the middle 6 m was recorded to avoid the influence on the pace of the starting acceleration in the first 2 m and the braking deceleration in the last 2 m. The usual walking speed (UWS) and the maximal walking speed (MWS) were evaluated. Time was measured with a stopwatch. Peters et al.(Peters, Fritz and Krotish,2013) showed that a handheld stopwatch is as reliable as an automatic timer when measuring walking speed. Each measurement was taken twice, and the average time was recorded, accurate to 0.01 s. The final walking speed was calculated by dividing 6 m by the time required to complete the test. The step speed was accurate to 0.01 $m \cdot s^{-1}$.

Assessment of Cognition Function

The Chinese version of the Montreal Cognitive Assessment (MoCA-C) was used to evaluate global cognition through face-to-face interviews. MoCA-C was evaluated by uniformly trained psychology researchers. The scale consisted of a total of 30 points: visual space and executive function (5 points); attention (6 points); delayed recall, memory (5 points); naming (3 points); language (3 points); abstract reasoning (2 points); and orientation (6 points). The cutoff points for defining mild cognitive impairment (MCI) in this study were based on the divisions developed by Lu et al.(Lu et al.,2011) for older adults in Chinese communities: ≤13 points for people with illiteracy; ≤19 points for people with an elementary school education; and ≤24 points for people with a junior high school or higher educational level. The MoCA-C has high sensitivity (80%–100%) and specificity (50%–76%) for identifying MCI (Chinese Cooperative

Group of Guidelines for Diagnosis and Treatment of Dementia and Cognitive Impairment.,2018).

Confounders

Participants were invited to participate in face-to-face interviews to answer a questionnaire that included questions about their age, gender, weight, height, and medical history, which included history or physician diagnosis of hypertension, diabetes, hyperlipidemia, and heart disease. These variables were considered confounders.

Statistical Analysis

Continuous variables are presented as the mean ± standard deviation, and non-normally distributed continuous variables, such as MoCA-C scores, are expressed as medians and quartiles. Baseline UWS, MWS, and MoCA-C scores as well as demographic characteristics were analyzed by independent-samples t-tests, Pearson's chi-square tests, or Mann-Whitney tests. Bonferroni post-hoc tests and independent-samples t-tests were performed to compare the differences in variables between age groups of each gender for the presence of the main effects of age and gender. A Kruskal-Wallis one-way ANOVA was used to compare the differences in global cognition between the age groups. The Mann-Whitney test was used to compare the differences in variables between genders.

Multiple linear regression models were used to determine the association between walking speed and global cognitive function for all participants. The main confounders included age, sex, weight, height, education, hypertension, diabetes, hyperlipemia, and heart disease. All statistical analyses were performed using SPSS, version 26.0, and $P < 0.05$ was considered statistically significant.

Results

Participant Characteristics

This cross-sectional study included 791 Chinese adults (252 men and 539 women) aged 60–89 years. Their characteristics are given in **Table 1**. There were no statistically significant differences between genders for UWS, prevalence of MCI, and MoCA-C total scores, but there was a significant difference in MWS, with men walking significantly faster than women.

********TABLE 1 AROUND HERE********

Age-Related Changes in Walking Speed

Two-way ANOVA revealed no significant interaction between UWS and MWS. However there were significant main effects of age and gender for MWS and a significant main effect of age, but not gender, for UWS. These results suggested that both UWS and MWS changed with age and that UWS was not affected by gender.

Post-hoc tests assessing age groups of both genders showed that UWS for people in their late 80s (0.84 ± 0.23 m·s^{-1}) was significantly slower than that in the other age groups (**Figure 1**). For women, UWS in the early 80s group (1.04 ± 0.31 m·s^{-1}) was significantly slower than that in the early 60s (1.33 ± 0.25 m·s^{-1}), late 60s (1.23 ± 0.24 m·s^{-1}), and early 70s (1.24 ± 0.25 m·s^{-1}) groups. In addition, UWS in the late 60s and late 70s (1.14 ± 0.27 m·s^{-1}) groups were significantly slower than that in the early 60s group.

******FIGURE 1 AROUND HERE******

For MWS, post-hoc tests for men showed that MWS in the late 80s group (1.25 ± 0.40 $m \cdot s^{-1}$) was significantly slower than that in the other age groups (**Figure 2**). The early 80s group (1.59 ± 0.30 $m \cdot s^{-1}$) had a slower MWS than the early 60s group (1.86 ± 0.38 $m \cdot s^{-1}$). For women, MWS decreased rapidly after the late 70s (1.50 ± 0.38 $m \cdot s^{-1}$). MWS for the late 80s group (1.04 ± 0.26 $m \cdot s^{-1}$) was significantly slower than that in the other age groups (except the early 80s), and MWS for women in the early 80s group (1.28 ± 0.35 $m \cdot s^{-1}$) was significantly slower than that in other age groups (except the late 80s). In addition, MWS for women in the late 70s group was significantly slower than that in the early 60s group (1.72 ± 0.32 $m \cdot s^{-1}$). Post-hoc independent t-tests to compare the differences in MWS between genders showed significant differences between genders in the early and late 60s groups and in the early 80s group.

******FIGURE 2 AROUND HERE******

Age-Related Changes in Global Cognitive Function

This cross-sectional study found that global cognitive function among older adults in this cohort declined significantly after 80 years of age (**Table 2**). The results of Mann-Whitney tests assessing age groups among older men showed that global cognitive functioning scores in the early 80s (median, 24.00 [quartiles, 21.00, 27.00]) and late 80s (23.00 [17.00, 26.50]) groups were significantly lower than those in the early 60s (27.00 [(25.00, 28.00]), late 60s (27.00 [25.00, 28.00]) and early 70s (26.00 [24.00, 28.50]) groups. For women, global cognitive function scores in the early 80s group (24.00 [20.00, 27.00]) were significantly lower than those in the early 60s (27.00 [24.00, 29.00]), late 60s (27.00 [24.00, 28.00]), and early 70s (27.00 [25.00, 29.00]) groups. By contrast, gender differences in global cognitive function were not statistically significant.

The prevalence of MCI increased rapidly after 80 years of age . No gender differences were detected in this cohort of older adults for global cognitive function or in the prevalence of MCI. The prevalence of MCI was 26.23% overall, 26.67% for men, and 26.03% for women.

******TABLE 2 AROUND HERE******

Associations between Walking Speed and Global Cognitive Function

The results of multiple linear regressions indicated no significant association between UWS and global cognitive function ($P > 0.05$) (**Table 3**). By contrast, MWS was significantly associated with global cognitive function in Model 1, which was adjusted for sex, age, height, and weight ($\beta = 0.111$, [0.032, 0.193], $P = 0.006$); in Model 2, adjusted for sex, age, height, weight and educational level ($\beta = 0.085$, [0.010, 0.161], $P = 0.027$); and in Model 3, adjusted for sex, age, height, weight, educational level, hypertension, diabetes, hyperlipemia, and heart disease ($\beta = 0.081$, [0.006, 0.157], $P = 0.036$). These results suggested that faster MWS was associated with higher global cognitive function.

******TABLE 3 AROUND HERE******

Discussion

The current study investigated age-dependent changes in usual and maximal walking speeds and their associations with cognitive function. A sharp decrease in UWS and in global cognitive function were observed for both genders among people ≥80 years of age. MWS was significantly slower after the early 80s for men and after the late 70s for women. The decrease in walking speed was more pronounced in women than in men for both UWS and MWS. There were significant gender differences in MWS in the early and late 60s groups and in the early 80s group. The trend for a decline in overall cognitive function was essentially the same for both genders. There was also no gender difference for the prevalence of MCI. Compared with UWS, MWS was associated more with overall cognitive function.

Our results showing that walking speed decreases with age were consistent with those found worldwide(Tolea et al.,2010; Podsiadlo and Richardson,1991; Bohannon,1997; de Almeida Busch et al.,2015). However, the UWS of the older adults in our study was significantly faster than that of the elderly in other countries (1.08 $m \cdot s^{-1}$) (Cai et al.,2020), and lower than that in a study by Tanimoto et al. (men, 1.39 $m \cdot s^{-1}$; women, 1.31 $m \cdot s^{-1}$) (Tanimoto et al.,2012). These findings suggest that UWS may vary by country and by the health status of older adults. No gender differences in UWS were found in our study. Previous studies have shown that MWS among older Japanese adults decreases rapidly after the age of 70 years (Peters et al.,2013). In the present study, compared with the early 60s group, the MWS of men and women decreased significantly in the early 80s and late 70s groups, respectively. In addition, there were gender differences in MWS, mainly in the early and late 60s and after 80 years of age. Previous studies[11] have shown a more pronounced decrease in walking speed in women than in men, consistent with our study. A study by Guadagnin et al.(Guadagnin et al.,2019) showed that changes in walking speed were strongly associated with the aging process, and these associations were most significant in older women. In that study, walking speed in men was predicted by brain white matter hyperintensity volume rather than by the degree of brain atrophy or magnetization transfer ratio peak height (adjusted for age and brain size). However, in women, slower walking speed was associated with lower magnetization transfer ratio peak height (suggestive of microstructure cerebral changes), increased white matter hyperintensity, and greater brain atrophy (Rosano et al.,2010).

Our study found that global cognitive function decreased rapidly beginning at 80 years, of age which is consistent with previous studies (Chinese Cooperative Group of Guidelines for Diagnosis and Treatment of Dementia and Cognitive Impairment.,2018). In addition, the prevalence of MCI increased rapidly after 80 years of age. No gender differences for overall cognitive function or for the prevalence of MCI were detected in this cohort of older adults. The prevalence of MCI in this study group was similar to the results of a meta-analysis by Wang et al.(Wang et al.,2020) assessing populations in China and consistent with the results of the study by Chen et al.(Chen et al.,2015) assessing the elderly in the central city of Shanghai. In the present study, the prevalence of MCI in each age group was higher than that given in the Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology (Petersen er al.,2018) (hereinafter referred to as the Guideline). That Guideline focuses on idiopathic or neurodegenerative MCI (especially associated with Alzheimer disease) rather than on mild cognitive changes associated with potentially reversible causes (e.g., metabolic, vascular, systemic, or psychiatric disorders), Parkinson's disease-MCI, or vascular cognitive impairment. However, our study included various types of MCI, which may explain the higher prevalence of MCI detected in all age groups in present study. In addition, the prevalence of MCI in the Guideline by age was based on 20 Class I studies and 14 Class II studies. Differences in MCI based on different confirmation methods, neuropsychological measures, measurement thresholds, and requirements for different cognitive deficits—which were compared in this study based on the same measurement tool and uniform thresholds—may be additional reasons for the discrepancies in MCI prevalence. It has also been estimated that 60% of general cognitive ability can be attributed to genetics, with significant differences in age-related cognitive changes across individuals (Harada, Love and Triebel,2013).

After adjusting for confounders in the present study, only MWS, not UWS, was significantly associated with global cognitive function in adults 60–89 years of age. Educational level and chronic diseases may affect walking speed and cognition in older adults. One study showed that MWS was significantly associated with skeletal muscle mass and general health status, whereas UWS was not (Kim, et al.,2016). Another study showed that compared with UWS, MWS was a more sensitive indicator of neuromuscular function (Annweiler et al.,2010). A previous longitudinal study of older Italian adults (Deshpande et al.,2009) and a cross-sectional study of older Japanese adults (Fitzpatrick et al.,2007) both showed that MWS was more associated with cognitive function than UWS was. In addition, some studies (Deshpande et al.,2009) have shown that MWS can predict future cognitive decline better than UWS can. Postural control decreases with age. In addition to the involvement of the sensory system and the musculoskeletal system during postural control, cognitive function is critical for postural stability. The higher demands placed on the balance control system during rapid walking necessitate much higher conscious control and cortical activity in older adults than is required for normal walking speeds. Thus, the ability to maintain good performance during rapid walking may be closely related to the integrity of cortical function, which is associated with good cognitive performance (Deshpande et al.,2009). An association between walking speed and cognitive function can be demonstrated by structural brain mechanisms. On the basis of evidence from magnetic resonance imaging studies (Peel et al.,2019), some lesions in the brain (i.e., an increased proportion of white matter hyperintensities in the periventricular and subcortical white matter, atrophy in the medial temporal area, hippocampal atrophy (Beauchet et al.,2019), or a decrease in gray matter volume in bilateral cortical and subcortical areas), may slow walking speed and impair cognitive function.

The strengths of the present study were that we assessed changes in walking speed, global cognitive function, and MCI prevalence with age divided into 5-year intervals among adults 60–89 years of age and residing in a developing country. Thus, the study assessed both wide and narrow age ranges. Our results provide a reference for other relevant studies, especially in developing countries. This study also has limitations. Because this was a cross-sectional study, we could not explore the causal relationship between walking speed and global cognition. The number of confounding factors affecting the association between MWS and overall cognition was high and should be interpreted with caution. To further understand the association between walking speed and subdomains of cognitive function, future studies should use broad neuropsychological test batteries.

Conclusions

The results of this cross-sectional study indicated that both UWS and MWS decreased with age. Cognitive function declined sharply after 80 years of age in this population, and the prevalence of MCI increased significantly after 80 years of age. There were gender differences for MWS among older adults, but no gender differences were detected for UWS or for global cognitive function. Controlling for gender, age, height, weight, educational level, and common chronic diseases, MWS was significantly associated with global cognitive function, whereas UWS was not. Future studies should be conducted with a larger population size and different age groups to assess gait and multidimensional cognitive function changes. We also propose a longitudinal study be conducted to explore the causal relationship between walking speed and cognition.

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Table 1 Characteristics of the study population

Characteristic	Total (n=791)		Men (n=252)		Women (n=539)		*P* value
Age, (years; mean, SD)	70.40	6.95	71.79	7.33	69.75	6.68	0.000**
Early 60s (n, %)[b]	174	22.00	47	18.70	127	23.60	
Late 60s (n, %)[b]	246	31.10	67	26.60	179	33.20	
Early 70s (n, %)[b]	172	21.70	59	23.40	113	21.00	
Late 70s (n, %)[b]	95	12.00	31	12.30	64	11.90	
Early 80s (n, %)[b]	70	8.80	31	12.30	39	7.20	
Late 80s (n, %)[b]	34	4.30	17	6.70	17	3.20	
Height (m; mean, SD)[a]	1.61	0.08	1.69	0.06	1.57	0.06	0.000**
Weight (kg; mean, SD)[a]	62.44	10.25	69.36	9.51	59.20	8.90	0.000**
BMI (kg·m^{-2}; mean, SD)[a]	24.07	3.25	24.38	2.98	23.93	3.36	0.070
≥12 years of education[b] (n, %)	443	56.00	153	60.71	290	53.80	0.068
Walking speed (m·s^{-1}; mean, SD)							
UWS[a]	1.22	0.27	1.23	0.28	1.22	0.27	0.753
MWS[a]	1.62	0.37	1.67	0.39	1.59	0.36	0.012*
History of disease (n, %)							
hypertension[b]	395	49.94	130	51.59	265	49.17	0.526
diabetes[b]	155	19.60	51	20.24	104	19.29	0.756
hyperlipemia[b]	147	18.58	32	12.70	115	21.34	0.004**
heart disease[b]	200	25.28	60	23.81	140	25.97	0.514
Cognitive function							
MCI (n, %)[b]	186	26.23	60	26.67	126	26.03	0.858
MoCA-C (total score: median, quartiles)[c]	26.00	(24.00-28.00)	26.00	(24.00-28.00)	26.00	(24.00-28.00)	0.818

Note: Early 60s represents ages between 60 and 64 years; late 60s represents ages between 65 and 69 years; early and late years are similarly separated for the 70s and 80s age groups. BMI, body mass index; UWS, usual walking speed; MWS, maximal walking speed; MCI, mild cognitive impairment; MoCA-C, Chinese version of Montreal Cognitive Assessment.

[a] Independent-samples t-test; [b]chi-square test; [c]Mann-Whitney test

*$P < 0.05$, **$P < 0.01$.

Table 2 Changes in total MoCA-C scores and MCI prevalence with age in men and women

	Early 60s	Late 60s	Early 70s	Late 70s	Early 80s	Late 80s
MoCA-C total score, median (quartiles)						
Men	27.00 (25.00, 28.00)	27.00 (25.00, 28.00)	26.00 (24.00, 28.50)	27.00 (26.00, 29.00)	24.00 *†♦ (21.00, 27.00)	23.00 *†♦♦ (17.00, 26.50)
Women	27.00 (24.00, 29.00)	27.00 (24.00, 28.00)	27.00 (25.00, 29.00)	26.00 (23.00, 28.00)	24.00**††§§ (20.00, 27.00)	24.00 (19.00, 27.00)
Both genders	27.00 (24.00, 29.00)	27.00 (25.00, 28.00)	26.00 (25.00, 29.00)	26.00 (24.00, 28.00)	24.00**††§§♦ (20.50, 27.00)	23.50**††§§♦ (17.00, 26.75)
MCI prevalence, n (%)						
Men	7 (17.5)	12 (19.0)	14 (26.4)	3 (11.5)	16 (53.3) **††♦♦	8 (61.5) **††♦♦
Women	31 (26.5)	39 (23.8)	19 (19.2) †	15 (24.2)	16 (51.6) ††§§	6 (54.5) **††§§♦♦
Both genders	38 (24.2)	51 (22.5)	33 (21.7)	18 (20.5)	32 (52.5) **††§§♦♦	14 (58.3%)**††§§♦♦

Note: MoCA-C, Chinese version of Montreal Cognitive Assessment; MCI, mild cognitive impairment; Early 60s represents ages between 60 and 64 years; late 60s represents ages between 65 and 69 years; early and late years are similarly separated for the 70s and 80s age groups.
Significant difference compared with early 60s ($P < 0.05$;** $P < 0.01$). †Significant difference compared with late 60s (†$P < 0.05$;††$P < 0.01$).
§Significant difference compared with early 70s (§§$P < 0.01$). ♦Significant difference compared with late 70s (♦♦$P < 0.01$).

Table 3 Associations between walking speed and global cognitive function in both sexes combined for all participants

Walking speed (m·s^{-1})	Model 1				Model 2				Model 3			
	β	Wald 95% Confidence limits		*P*	β	Wald 95% Confidence limits		*P*	β	Wald 95% Confidence limits		*P*
MWS	0.111**	0.032	0.193	0.006	0.085*	0.010	0.161	0.027	0.081*	0.006	0.157	0.036
UWS	0.010	-0.071	0.090	0.816	−0.007	−0.082	0.068	0.855	−0.008	−0.084	0.067	0.830

Note: UWS, usual walking speed; MWS, maximal walking speed.
Model 1 adjusted for age, sex, weight, height; Model 2 adjusted for age, sex, weight, height, and educational level; Model 3 adjusted for age, sex, weight, height, educational level, hypertension, diabetes, hyperlipemia, and heart disease.
$^*P < 0.05$, $^{**}P < 0.01$

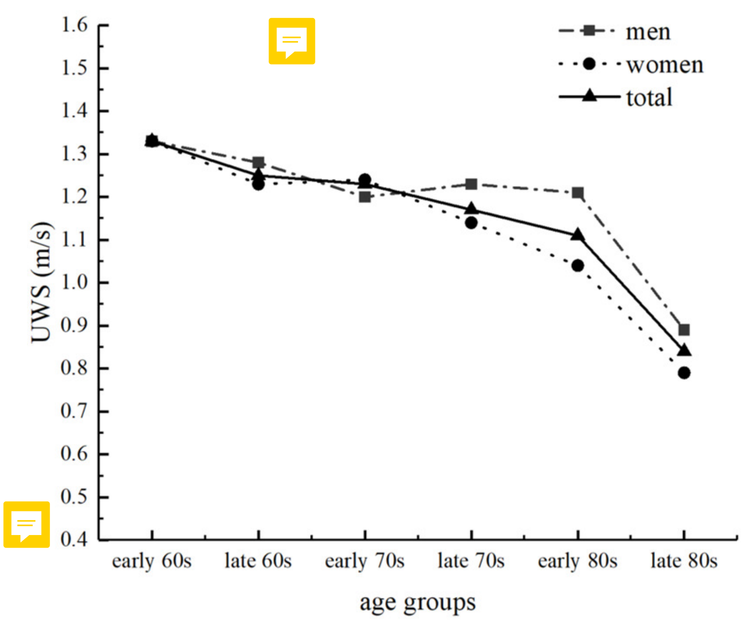

Figure 1. Usual walking speed (UWS) changes with age among older men and women. Early 60s represents ages between 60 and 64 years; late 60s represents ages between 65 and 69 years; early and late years are similarly separated for the 70s and 80s age groups.

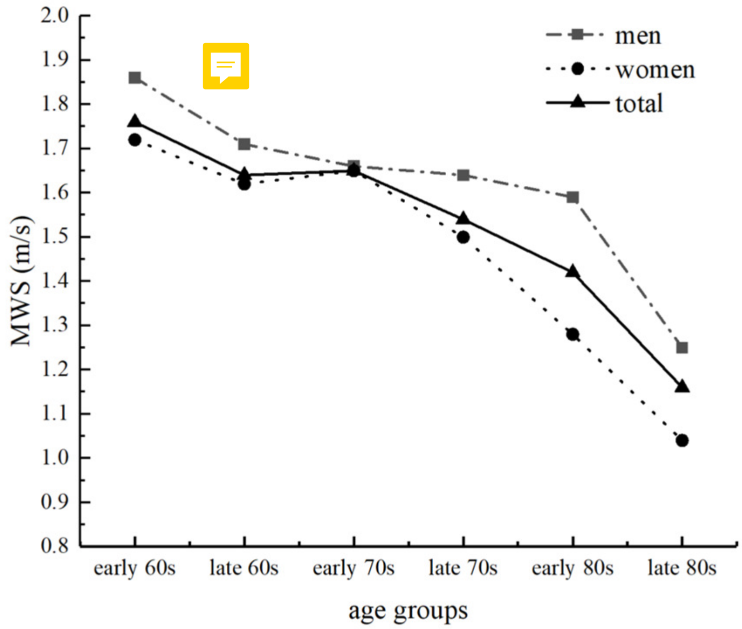

Figure 2. Maximal walking speed (MWS) changes with age among older men and women. Early 60s represents ages between 60 and 64 years; late 60s represents ages between 65 and 69 years; early and late years are similarly separated for the 70s and 80s age groups.

Table 1(on next page)

Characteristics of the study population

Early 60s represents ages between 60 and 64 years; late 60s represents ages between 65 and 69 years; early and late years are similarly separated for the 70s and 80s age groups. BMI, body mass index; UWS, usual walking speed; MWS, maximal walking speed; MCI, mild cognitive impairment; MoCA-C, Chinese version of Montreal Cognitive Assessment. [a] Independent-samples t-test; [b]chi-square test; [c]Mann-Whitney test **P* < 0.05, ***P* < 0.01.

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Table 2 (on next page)

Changes in total MoCA-C scores and MCI prevalence with age in men and women

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Table 3 (on next page)

Associations between walking speed and global cognitive function in both sexes combined for all participants

UWS, usual walking speed; MWS, maximal walking speed. Model 1 adjusted for age, sex, weight, height; Model 2 adjusted for age, sex, weight, height, and educational level; Model 3 adjusted for age, sex, weight, height, educational level, hypertension, diabetes, hyperlipemia, and heart disease. *$P < 0.05$, **$P < 0.01$

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