



Brief Communication

Coexistence of Slow Gait Speed and Depressed State is Associated with Poor Health-Related Quality of Life in Community-Dwelling Older Adults

*Daisuke Ishiyama^{1,2}, Mizue Suzuki¹, Shingo Koyama¹, Takeo Ichikawa¹, Hiroaki Masuda¹, Iwao Kojima¹, Minoru Yamada¹

¹Graduate School of Comprehensive Human Sciences, University of Tsukuba, Tsukuba, Japan

²Department of Rehabilitation, Nippon Medical School Hospital, Tokyo, Japan

***Correspondence**

Mr. Daisuke Ishiyama
 Graduate School of
 Comprehensive Human
 Sciences, University of
 Tsukuba, Tsukuba, Japan
 E-mail:
d-ishiyama@nms.ac.jp

Received 23 September 2021
 Accepted 18 January 2022

Keywords

Health-related quality of life,
 gait speed, depressed state.

ABSTRACT

This one-year follow-up study aimed to examine the effect of a combination of slow gait speed (GS) and depressed state on physical health-related quality of life (HRQoL). We included 84 community-dwelling older adults. The outcome was poor HRQoL, defined as the lowest tertile of physical component score (PCS) in Short Form-8 at follow-up. The participants were classified into four groups according to the presence or absence of slow GS (<0.8 m/s) and depressed state (GDS-5=2 or greater). Multivariate logistic regression models were used to assess the relationship between poor HRQoL and these groups. As the results, the slow GS and depressed group increased risk of poor HRQoL (PCS<38.1 points) compared to the normal GS and non-depressed group, and the odds ratio (95% confidence interval) was 9.61 (1.86-49.82) after adjustment for covariates. The coexistence of slow gait speed and depressed state might be associated with a risk of poor physical HRQoL.

ISSN 2663-8851/Copyright © 2022, Asian Association for Frailty and Sarcopenia and Taiwan Association for Integrated Care. Published by Full Universe Integrated Marketing Limited.

1. INTRODUCTION

Healthy aging is an essential issue in an aging society, such as in Japan. Healthy aging can be expected to improve quality of life and reduce social security expenses. Promoting healthy aging is contributed by physical, mental, and social factors, and the influence of physical factors is significant. Health-related QoL (HRQoL) is a representative indicator of healthy aging and is often used to measure physical well-being.¹

Physical function is one of the factors related to HRQoL. A good relationship between physical function and HRQoL has been reported in the

literature, and this relationship is remarkable in the physical component of HRQoL.² Gait speed is considered a leading index of physical function because it is related to various health outcomes such as disability, cognitive decline, falls, and mortality.³ Furthermore, several cross-sectional studies have reported a relationship between gait speed and HRQoL.^{4,5} Thus, slow gait speed might be a significant predictor of poor HRQoL; however, this prospective relationship is not well established for older adults.

Depressed state is a factor related to adverse health outcomes such as falls, QoL, disability, and mortality.⁶⁻⁹ In particular, there is a strong relationship between depressive symptoms and HRQoL, and there is an

interactive relationship between mental states and physical activity/functions. Therefore, a depressed state may affect not only mental, but also physical component,⁷ which might cause a decrease in the physical component of HRQoL.

Thus, slow gait speed and depressed state are factors that decrease the physical component of HRQoL, and this combination may cause even worse outcomes. However, to our knowledge, the longitudinal effect of this combination on physical HRQoL is unclear. Therefore, this study aimed to prospectively examine the impact of a combination of slow gait speed and depressed state on the physical component of HRQoL. We hypothesize that the coexistence of slow gait speed and depressed state increases the risk of subsequent poor HRQoL.

2. METHODS

2.1. Study Design and Participants

This prospective cohort study was conducted on community-dwelling older adults recruited through an advertisement in the local press and a poster at a senior center. This study was performed over one year, and the baseline and follow-up investigations were performed in May 2018 and May 2019, respectively. We enrolled subjects who participated in both investigations for the analysis. The inclusion criteria were age 65 years or older and ability to walk independently. The exclusion criteria were severe cognitive or psychiatric impairment and stroke with hemiplegia. This study was conducted per the guidelines of the Declaration of Helsinki. The study protocol was reviewed and approved by the Ethics Committee of Tsukuba University Graduate School of Comprehensive Human Sciences (No.30-53). All participants provided written informed consent. The authors declare that they have no funding support and conflict of interest.

2.2. Health-Related Quality of Life (HRQoL)

HRQoL was measured with the Medical Outcome Study 8-item Short Form questionnaire (SF-8) Japanese version,¹⁰ which consisted of eight scaled scores at baseline and follow-up. This questionnaire measures eight generic health categories: physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH). The SF-8 is normatively scored as having a mean of 50 and a standard deviation of 10. Higher scores indicated greater HRQoL. We calculated a physical component score (PCS) that indicated physical problems using these eight scores and defined the lowest tertile of PCS score at the follow-up as poor HRQoL for this study outcome.

2.3. Gait Speed (GS)

We measured GS using a 5-m usual gait speed at the baseline. The participants walked 11-m at the usual pace. The time required to walk 5-m (between 3-m and 8-m points) was measured using a stopwatch. Gait speed was calculated as 5-m divided by the time required (m/s). Slow GS was defined as less than 0.8 m/sec.¹¹

2.4. Depressed State

We measured the depressed state using a 5-item version of the Geriatric Depression Scale (GDS-5) at baseline. The GDS-5 consists of five items and has a "Yes/No" response format with a two-point rating scale from 0 to 1, with a score ranging from 0 to 5 points. Higher scores indicated more significant depression. The depressed state was defined as two points or a greater.¹²

2.5. Other Variables

We investigated body mass index (BMI), comorbidities, handgrip strength, and cognitive function at baseline and defined four or more comorbidities as multimorbidity.¹³ Low handgrip strength was defined as less than 26kg in men and 18kg in women.¹¹ Cognitive function was measured using the Mini-Mental State Examination (MMSE).

2.6. Data Analysis

We examined the influence of the combination of low GS and depressed state on poor HRQoL. The participants were classified into four groups according to the presence or absence of slow GS and depressed state: group 1, normal GS and non-depressed; group 2, normal GS and depressed; group 3, slow GS and non-depressed; and group 4, slow GS and depressed. The normality of variables was assessed using the Shapiro-Wilk test. One-way analysis of variance, Kruskal-Wallis test, and chi-squared test were used to examine the differences among the four groups. We used logistic regression models to explore the relationship between the presence and absence of slow GS and depressed state to poor HRQoL. The four groups of participants were used as independent variables (reference group 1). We assessed odds ratios and 95% confidence intervals in univariate (model 1) and multivariate models (models 2-4). Model 2 was adjusted for PCS at baseline. Model 3 was further adjusted for age based on Model 2, and Model 4 was further adjusted for multimorbidity based on Model 3. Statistical significance was defined as $P < 0.05$ for all analyses. Statistical analyses were performed using SPSS version 21 (IBM SPSS Japan, Tokyo, Japan).

3. RESULTS

Of the 97 participants enrolled, 84 participants were included in the analysis, and 13 participants were excluded due to missing data. The mean (standard deviation) age of these participants was 83.5 (5.5) years, and 70.2% comprised women. The presence of low handgrip strength was 46.4%. As cognition, the median (interquartile range) of MMSE score was 26.0 (24.0-28.0) and was lower than the value of community-dwelling older adults of the same age in the previous study.¹⁴

According to the presence or absence of slow GS and depressed state, comparisons of characteristics among the four groups are shown in Table 1. The incidence of poor HRQoL (the lowest tertile of PCS at follow-up=less than 38.1 points) was significantly different among the four groups, and the highest incidence was observed in group 4. In the SF-8 categories at follow-up, significant differences in VT and MH subscales were observed among the four groups ($p < 0.05$).

The results of logistic regression models to examine the influence of the combination of slow GS and

depressed state on poor HRQoL are shown in Table 2. In the univariate model (Model 1), groups 3 and 4 had significantly increased risks of poor HRQoL compared to group 1 ($p < 0.05$). In the multivariate models (Models 2–4), group 4 had a significantly increased risk of poor HRQoL compared to group 1 ($p < 0.05$). After adjustment for PCS at baseline, age, and multimorbidity (Model 4), the odds ratio (95% confidence interval) of group 4 compared to group 1 was 9.61 (1.86-49.82).

4. DISCUSSION

The main finding of this study was that the coexistence of slow gait speed and depressed state significantly increases the risk of subsequent poor HRQoL in community-dwelling older adults, as we hypothesized. This trend was maintained after adjusting for several covariates. The findings that clarified these follow-up changes might provide valuable information for preventive interventions to maintain and improve HRQoL.

The results of this study showing the risk of poor

Table 1. Characteristics of participants

	Overall (n=84)	Group 1 Normal GS & non-depressed (n=39)	Group 2 Normal GS & depressed (n=16)	Group 3 Slow GS & non-depressed (n=18)	Group 4 Slow GS & depressed (n=11)	p
Age [years], mean (SD)	83.5 (5.5)	82.5 (5.6)	86.5 (5.6)	82.6 (5.1)	84.0 (4.7)	0.083
Gender						0.469
Men, n (%)	25 (29.8%)	10 (25.6%)	7 (43.8%)	4 (22.2%)	4 (36.4%)	
Women, n (%)	59 (70.2%)	29 (74.4%)	9 (56.3%)	14 (77.8%)	7 (63.6%)	
BMI [kg/m ²], mean (SD)	23.0 (3.9)	22.9 (3.8)	22.2 (3.6)	23.6 (4.8)	23.7 (2.9)	0.697
Number of comorbidities, median (IQR)	2.0 (1.0-3.0)	2.0 (1.0-3.0)	2.0 (1.0-3.0)	2.0 (1.8-3.0)	3.0 (2.0-3.0)	0.491
Multimorbidity (4 or more), n (%)	9 (10.7%)	5 (12.8%)	1 (6.3%)	1 (5.6%)	2 (18.2%)	0.647
Handgrip strength [kg], median (IQR)	20.4 (15.9-24.6)	20.7 (17.3-24.4)	20.4 (17.0-24.9)	18.7 (14.4-24.6)	21.5 (15.0-27.9)	0.651
Low handgrip strength (men <26kg, women <18kg), n (%)	39 (46.4%)	15 (38.5%)	9 (56.3%)	10 (55.6%)	5 (45.5%)	0.527
Usual gait speed [m/s], mean (SD)	0.92 (0.23)	1.08 (0.16)	0.97 (0.12)	0.67 (0.11)	0.67 (0.13)	<0.001
GDS-5, median (IQR)	1.0 (0-2.0)	1.0 (0-1.0)	2.0 (2.0-3.8)	1.0 (0-1.0)	3.0 (2.0-3.0)	<0.001
MMSE, median (IQR)	26.0 (23.0-28.0)	27.0 (24.0-29.0)	24.5 (21.3-27.0)	25.5 (22.8-29.0)	26.0 (25.0-29.0)	0.220
PCS of the SF-8 at baseline, mean (SD)	42.1 (7.6)	42.9 (8.3)	40.7 (6.0)	40.0 (7.5)	44.2 (6.5)	0.357
Poor HRQoL at the follow-up, n (%)	28 (33.3%)	7 (17.9%)	7 (43.8%)	8 (44.4%)	6 (54.5%)	0.043
GH subscales	50.3 (40.4-50.3)	50.3 (40.4-50.3)	50.3 (40.4-50.3)	50.3 (40.4-50.3)	50.3 (40.4-50.3)	0.611
PF subscales	44.6 (41.5-53.5)	47.7 (41.5-53.5)	41.5 (41.5-47.7)	41.5 (27.6-53.5)	41.5 (27.6-47.7)	0.061
RP subscales	47.4 (40.7-54.1)	47.4 (40.7-54.1)	47.4 (31.1-54.1)	40.7 (27.9-54.1)	40.7 (27.9-47.4)	0.186
BP subscales	46.1 (38.2-58.4)	46.1 (38.2-60.4)	46.1 (38.2-50.9)	46.1 (38.2-60.4)	46.1 (38.2-52.5)	0.410
VT subscales	44.5 (44.5-53.7)	44.5 (44.5-53.7)	44.5 (38.5-44.5)	44.5 (44.5-53.7)	44.5 (44.5-44.5)	0.025
SF subscales	45.6 (37.7-55.1)	55.1 (37.7-55.1)	41.6 (37.7-55.1)	50.4 (37.7-55.1)	37.7 (37.7-55.1)	0.174
MH subscales	50.7 (44.9-56.9)	50.7 (50.7-56.9)	44.9 (44.9-50.7)	53.8 (49.3-56.9)	50.7 (44.9-50.7)	0.013
RE subscales	48.0 (42.2-54.2)	48.0 (42.2-54.2)	48.0 (42.2-54.2)	54.2 (42.2-54.2)	48.0 (42.2-54.2)	0.717

SD, standard deviation; IQR, interquartile range; BMI, body mass index; GDS, Geriatric Depression Scale; MMSE, Mini-Mental State Examination; PCS, physical component summary; SF-8, Short Form-8; HRQoL, health-related quality of life; GH, general health; PF, physical function; RP, role (physical); BP, bodily pain; VT, vitality; SF, social function; MH, general mental health; RE, role (emotional); GS, gait speed. Poor HRQoL is defined as the lowest tertile of PCS at the follow-up (<38.1 points).

Table 2. Logistic regression models to examine the influence of the combination of slow GS and depressed state on poor HRQoL (the lowest tertile of PCS score) at one-year follow-up

	Model 1		Model 2		Model 3		Model 4	
	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
Groups according to GS & depressed state								
Group 1 (Normal GS & non-depressed)	1.00 (Reference)		1.00 (Reference)		1.00 (Reference)		1.00 (Reference)	
Group 2 (Normal GS & depressed)	3.56 (0.99-12.82)	0.053	3.50 (0.88-13.88)	0.074	4.03 (0.94-17.24)	0.060	4.09 (0.96-17.49)	0.057
Group 3 (Slow GS & non-depressed)	3.66 (1.06-12.62)	0.040	3.23 (0.84-12.43)	0.088	3.34 (0.86-12.88)	0.080	3.41 (0.87-13.33)	0.078
Group 4 (Slow GS & depressed)	5.49 (1.30-23.18)	0.016	9.20 (1.80-47.07)	0.008	9.70 (1.88-50.08)	0.007	9.61 (1.86-49.82)	0.007

Model 1 is unadjusted. Model 2 is adjusted for PCS at baseline. Model 3 based on Model 2 further adjusted for age. Model 4 based on Model 3 further adjusted for multimorbidity.
HRQoL, health-related quality of life; PCS, physical component summary; GS, gait speed; OR, odds ratio; CI, confidence interval.

HRQoL due to the coexistence of slow gait speed and depressed state support those of previous studies. It is well known about gait speed and depressed state were associated with the physical component of HRQoL, respectively.^{4,5,7} Additionally, psychological frailty, which refers to the coexistence of physical frailty and depression, increases the risk of adverse physical conditions such as disability and loss of lifestyle activities.¹⁵ Thus, it may be the amplification effect of combined low physical function and depressed state on adverse physical outcomes, and our results supported this effect.

This study had both strengths and limitations. The strength of this study is that it may help screen the risk of poor HRQoL because simple measurements such as usual gait speed and GDS-5 are used. However, it should be noted that detailed assessments of physical and psychological functions could not be performed. And we were unable to perform an analysis adjusted enough confounding factors due to insufficient sample size. Therefore, more extensive and thorough research is needed to confirm these preliminary results and elucidate the synergistic effect between physical and psychological functions on HRQoL among older adults.

Therefore, the coexistence of slow gait speed and a depressed state might be associated with a higher risk of poor physical HRQoL in community-dwelling older adults. Consequently, it is necessary to focus on physical functions (centered on gait speed) and the depressed state to maintain HRQoL in community-dwelling older adults.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- Rejeski WJ, Mihalko SL. Physical activity and quality of life in older adults. *J Gerontol A Biol Sci Med Sci*. 2001;**56**(suppl_2):23-35.
- Hall SA, Chiu GR, Williams RE, Clark RV, Araujo AB. Physical function and health-related quality-of-life in a population-based sample. *Aging Male*. 2011;**14**(2):119-26.
- Abellan van Kan G, Rolland Y, Andrieu S, Bauer J, Beuchet O, Bonnefoy M, et al. Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people: an International Academy on Nutrition and Aging (IANA) Task Force. *J Nutr Health Aging*. 2009;**13**(10):881-9.
- Sartor-Glittenberg C, Lehmann S, Okada M, Rosen D, Brewer K, Bay RC. Variables explaining health-related quality of life in community-dwelling older adults. *J Geriatr Phys Ther*. 2014;**37**(2):83-91.
- Bjerk M, Brovold T, Skelton DA, Bergland A. Associations between health-related quality of life, physical function and fear of falling in older fallers receiving home care. *BMC Geriatr*. 2018;**18**(1):253.
- Biderman A, Cwikel J, Fried AV, Galinsky D. Depression and falls among community dwelling elderly people: a search for common risk factors. *J Epidemiol Community Health*. 2002 Aug;**56**(8):631-6.
- Sivertsen H, Bjorklof GH, Engedal K, Selbaek G, Helvik AS. Depression and Quality of Life in Older Persons: A Review. *Dement Geriatr Cogn Disord*. 2015;**40**(5-6):311-39.
- Kong D, Solomon P, Dong X. Depressive Symptoms and Onset of Functional Disability Over 2 Years: A Prospective Cohort Study. *J Am Geriatr Soc*. 2019;**67**(S3):S538-44.
- White J, Zaninotto P, Walters K, Kivimaki M, Demakakos P, Biddulph J, et al. Duration of depressive symptoms and mortality risk: the English Longitudinal Study of Ageing (ELSA). *Br J Psychiatry*. 2016;**208**(4):337-42.
- Fukuhara S, Suzukamo Y. Manual of the SF-8 Japanese Version. Kyoto: Institute for Health Outcomes and Process Evaluation Research. 2004.
- Chen LK, Liu LK, Woo J, Assantachai P, Auyeung TW, Bahyah KS, et al. Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. *J Am Med Dir Assoc*. 2014;**15**(2):95-101.
- Hoyle MT, Alessi CA, Harker JO, Josephson KR, Pietruszka FM, Koelfgen M, et al. Development and testing of a five-item version of the Geriatric Depression Scale. *J Am Geriatr Soc*. 1999;**47**(7):873-8.
- Di Bari M, Virgilio A, Matteuzzi D, Inzitari M, Mazzaglia G, Pozzi C, et al. Predictive validity of measures of comorbidity in older

- community dwellers: the Insufficienza Cardiaca negli Anziani Residenti a Dicomano Study. *J Am Geriatr Soc.* 2006;**54**(2):210-6.
14. Engedal K, Gjora L, Bredholt T, Thingstad P, Tangen GG, Ernstsén L, et al. Sex Differences on Montreal Cognitive Assessment and Mini-Mental State Examination Scores and the Value of Self-Report of Memory Problems among Community Dwelling People 70 Years and above: The HUNT Study. *Dement Geriatr Cogn Disord.* 2021;**50**(1):74-84.
15. Shimada H, Lee S, Doi T, Bae S, Tsutsumimoto K, Arai H. Prevalence of Psychological Frailty in Japan: NCGG-SGS as a Japanese National Cohort Study. *J Clin Med.* 2019; **8**(10):1554.