Slow gait speed could be a signal for common geriatric syndromes besides sarcopenia

Xu He
Kunming University of Science and Technology

Yan Li (liyanken@126.com)
The Affiliated Hospital of Kunming University of Science and Technology

Jun Chen
The First People's Hospital of Yunnan Province

Li Zhang
The First People's Hospital of Yunnan Province

Jing Quan
The First People's Hospital of Yunnan Province

Sunnui Lu
The Pu'er People's Hospital of Yunnan Province

Zhou Ying
The Affiliated Hospital of Kunming University of Science and Technology

Yan Huang
The Affiliated Hospital of Kunming University of Science and Technology

Kehua Wang
The First People's Hospital of Yunnan Province

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Abstract

Background

In China geriatricians is inadequate for the growing elderly. We need more doctors to recognize geriatric syndromes with a simple examination, which could help more elderly have better care.

Aims

Clarified that slow gait speed could be a signal to identify common geriatric syndromes besides sarcopenia in elderly outpatients.

Methods

According to the gait speed cut-off (< 1.0m/s), we classified 985 elderly outpatients (457 men and 528 women) into two groups. The groups were defined as the normal speed group (NSG, gait speed ≥ 1.0m/s), and the slow speed group (SSG, gait speed < 1.0m/s). We used the CGA management system Simply Edition (CGA-SE) software to collect data and compared demographic variations and the prevalence of functional decline in the two groups.

Results

Participants in SSG were significantly older, shorter in height, lighter in weight, used more drugs, and had a higher score in Edmonton, SDS, SAS, and MNA, and a lower score in BADL, and MMSE than in NSG. And they had significantly higher prevalence percentages in frailty, disability, depression, and dementia than in NSG. In addition, gait speed was an independent protective factor associated with frailty, disability, dementia, and swallowing dysfunction. And slow gait speed was an independent risk factor associated with frailty, depression, and dementia. Furthermore, participants with comorbidity, better function in daily life, and good cognition usually had faster gait speeds. However, participants with polypharmacy, low education, malnutrition risk, and frailty usually had slow gait speed (p < 0.05).

Discuss

Clinical physicians should give more attention to those with slow gait speed elderly outpatients, and be alert to their geriatric syndromes.

Conclusions

Slow gait speed could be a signal for several common geriatric syndromes in elderly outpatients. We recommended 6 meters gait speed test as a routine examination for the elderly, not only in the geriatric department but also others serving the elderly.

Introduction
Geriatric syndromes often cause a longer length of stay and poorer outcomes in the elderly rather than the disease itself[1]. Geriatricians have commonly acknowledged that increased awareness is needed among older people with geriatric syndromes[2]. However, the mostly elderly or non-geriatricians haven’t recognized the importance of it or been trained to evaluate it. Some people even never heard about geriatrics in China country areas or less developed cities. According to China, the aging population dramatically increased and would reach its peak of approximately 385 million by 2058[3], and the challenge becomes more and more severe. Therefore, the “Healthy China” program demanded over half of the secondary hospitals around China should build up a geriatric department by 2022. Many experienced pioneering geriatric departments have trained professional geriatricians since 2018, but specialists are still rare. As a result, the gap between inadequate geriatricians and the aging healthy desire becomes huger. Acquaint all physicians with geriatric syndromes and essential measurements may solve this problem. Especially necessary for the clinician of primary care, and hospital-based community health services, who will be on the front line in the care of the growing population of the elderly[4].

The essential evaluation of geriatric syndromes is comprehension geriatric assessment (CGA). Geriatric syndromes are the manifestations of complicated symptoms and signs related to daily life functions and are hard to check out by routine examination. Only CGA could identify and quantify the geriatric syndromes. We use examining functional scales to find risky domains and body disorders[5]. Many studies have clarified that the use of CGA in geriatric therapy has multiple benefits[1, 6], including improvement in functional status, cognition, and independence on discharge; increased likelihood of discharge home, and satisfaction among patients, families, medical and nursing staff; reduced mortality, re-hospitalization, and shorter hospital stays; delayed the development of chronic health conditions[2]. Although the superiority of CGA is obvious, obstructions can’t be ignored either. Firstly, it is difficult for those old people with impairment in hearing or sight and poor understanding or movement to answer abundant questions or perform specific motions. Therefore CGA is often hard to complete. Secondly, CGA is a process of communication and interaction, but functional evaluation mostly depended on the physician’s subject judgment. If the physician lacks training about those functional scales, the diagnosis of geriatric syndromes might be unreliable. In addition, even an experienced geriatrician completing the whole CGA usually costs lots of time. For every physician, it is hard to identify geriatric syndrome from lots of unfamiliar scales besides the diagnosis of systematic diseases in a limited time. But the prevalence of common geriatric syndromes was very impressive in the elderly. Former studies had shown that the prevalence of sarcopenia was 13.1-14.9% in elderly men and 11.4% in elderly women in Korea[7]; frailty was 18% on an overall estimated in Europe[8]; mild cognitive impairment among Chinese elderly was 15.4%[9]; ADL impairment was greater in old-old participants (12.7%) than in young-old ones (3.0%) in Korea[10] and much higher in Palestinian (31.2%)[11]. Tragedy ends in unawareness of sarcopenia or other geriatric syndromes usually leads to falls, lower quality of life, and a higher financial burden to health and social systems, so far as to a greater morbidity and mortality risk in hospital[12]. To avoid such bad outcomes and help the elderly healthy aging, the most important part is to use CGA sufficiently and promote awareness of geriatric syndromes in non-geriatricians. So we wondered to find a method to
help physicians recognize geriatric syndromes fast, objectively, and efficiently. Then we focused on the sarcopenia diagnosis process. Sarcopenia is defined as age-related skeletal muscle atrophy and low muscle strength and/or low physical performance[13] and has certain relationships with frailty[14], cognitive impairment[15], disability[16], and so on. According to AWGS 2019 consensus[17], the diagnosis of sarcopenia needs to evaluate skeletal muscle mass, grip strength, and balance ability with some objective assessments. Just as using BIA or DXA to evaluate skeletal muscle mass, pinch meter equipment evaluates grip strength, and 6 meters course evaluates walk performance. But most hospitals in China have insufficient BIA, DXA, and pinch meter equipment for routine examinations. Furthermore those poor elderly from suburbs have obvious difficulties in economy and time. Fortunately, the usual gait speed test (over a 6-m course) is good for both doctors and patients, without special equipment and expensive cost. As the EWGSOP 2010[18] recommendation, the gait speed test was used as an evaluation of sarcopenia performance. Although it had been replaced by the 5-times chair stand test or SPPB in the recent AWGS consensus 2019[17]. But as a matter of our observation, few elderly could complete them smoothly, especially those over 80 years old. So gait speed finally becomes what we want.

The largest advantage of the gait speed test is fast confirmation. It helps every doctor check out the gait speed change in seconds. Regarded sarcopenia having a relationship with other geriatric syndromes, gait speed may also have equal. So we hypothesized that a slower gait speed implies a higher risk of geriatric syndromes. If we can testify to our hypothesis, the gait speed test should be recommended as a routine clinical examination for every elderly to warn of geriatric syndromes. Furthermore, gait speed test should be checked for every elderly patient, no matter what department they need in hospitals, communities, and long-term care.

**Methods**

**Study design and participants**

This study was a retrospective study of a remote province in China southwest. Our database was established on an independent invention of CGA software, named “CGA management system”, which was used for 3 years in several regions of this province for free. The CGA management system contains three versions: Simply Edition is suitable for outpatients (CGA-SE), Hospital Edition for inpatients (CGA-HE), and Geracomium Edition for long-term care patients (CGA-GE).

We chose cases from the CGA-SE from December 2019 to December 2021. Different city participants were involved, like Kunming, Qujing, Kaiyuan, Chuxiong, Wenshan, and other cities. The inclusion criteria were as follows:(1) geriatric outpatient aged $\geq 60$ years; (2) completed entire assessments of CGA-SE; (3) with the ability to walk independently or with the help of assistive devices or a companion at least 6 meters. The exclusion criteria were as follows: (1) incomplete assessment owing to physical dysfunction such as severe cardiac insufficiency, respiratory failure, acute cerebrovascular diseases, severe cognitive
impairment, and disability; (2) communication problems owing to loss of hearing or sight, furthermore lack of companion; (3) disagree with anticipating this study.

Between 2019 to 2021, there were 2359 cases in the CGA-SE database. After the data cleaning step, we eliminated the reassessment, disability, age < 60 years, mistake or failure to complete, and finally 985 cases were enrolled (Fig. 1). Every case contained information such as height, weight, age, gender, BMI, gait speed, chronic pain, comorbidity, polypharmacy, fall, frail, mood, cognition, nutrition, and dysphagia.

This study protocol was approved by the Research Ethics Committee of the First People's Hospital of Yunnan province (Ethics number: KHLL2021-KY038). The content of the study was explained to the participants and obtained written informed consent from them.

**CGA management system Simple edition (CGA-SE)**

CGA-SE was invented by the geriatric department of the First People's Hospital of Yunnan Province in China southwest. It contained generally used assessment scales for frailty (EFS \[19\]), ADL (ADL \[20\]), mood (SDS \[21\], SAS \[22\]), cognition (MMSE \[23\]), nutrition (MNA \[24\]), swallow function (water swallow test, WST \[25\]) and health questionnaire. The database stored information about healthy like age, gender, height, weight, BMI, gait speed, chronic pain, polypharmacy, comorbidity, and falls history in recent one year. More importantly stored every assessment scale score, diagnosis of dysfunction, and severity. To protect results standardization, all the assessors from different participant units of this study were trained in uniformity. With the advantage of our database, we can assemble all kinds of data easily and analyze them in different dimensions.

**Frailty Evaluation**

For recognition of frailty, CGAMS-SE designed Edmonton Frail Scale (EFS \[19\]) to evaluate the severity of frailty in enrolled outpatients. It was a comprehensive assessment of cognition, general health status, functional independence, social support, medication use, nutrition, mood, continence, and functional performance. According to scores, enrolled cases were classified as no frailty (score ≤ 5), performance of frailty (6 ≤ score ≤ 7), mild frailty (8 ≤ score ≤ 9), moderate frailty (10 ≤ score ≤ 11) and serious frailty (12 ≤ score ≤ 18).

**Disability Evaluation**

For recognition of Disability, CGAMS-SE used the Barthel index of ADL \[20\] to assess. It was defined as having any difficulty in feeding, bathing, grooming, dressing, continence of bowels and bladder, toilet use, transferring, mobility, and stairs. Enrolled cases were classified as independence (91 ≤ score ≤ 100), mild dependence (61 ≤ score ≤ 90), moderate dependence (41 ≤ score ≤ 60), serious dependence (21 ≤ score ≤ 40), disability (score ≤ 20).
Mood Evaluation

For recognition of depression and anxiety, the simple edition used SDS[21] and SAS[22] scales as the assessment. The SDS was convenient for identifying clinically meaningful depression symptoms in the elderly[26]. Enrolled cases considered in recent two weeks condition, classified as depression when T score over 50. The SAS was designed to assess anxiety in this software. Enrolled cases were classified as normal when the T score was less than 50, mild anxiety(50 ≤ score ≤ 59), moderate anxiety(60 ≤ score ≤ 69), and serious anxiety(over 69).

Cognition Evaluation

For recognition of cognition, the simple edition used a mini-mental state examination(MMSE[23]) as the assessment, which is feasible, reliable, and valid for the assessment of cognitive function in the elderly[27]. According to different level of education, cut-off of 17(uneducated), 20(educated < 6 years), 24( educated > 6 years) as normal. To those educated over 6 years enrolled cases were classified as mild dementia (13 ≤ score ≤ 23), moderate dementia (5 ≤ score ≤ 12), and serious dementia(score < 5).

Nutrition And Swallow Function Evaluation

For recognition of nutrition, the simple edition used the mini nutritional assessment (MNA)[24] to evaluate, which is predictive of malnutrition, mortality, and hospital cost[28]. According to scoring, enrolled cases were classified as malnutrition (< 17.0), potential malnutrition (17.0 ≤ score ≤ 23.5), and well nutrition(score ≥ 24.0). According to the water swallow test(WST)[25], enrolled cases were classified as swallow function normal (if the participant could pass the test well), fail( if failed to complete the test or had contraindication of the test), swallow dysfunction (if a participant needs more than twice or whether cough or not, swallow 5ml water), dysphagia ( even worse).

Other Geriatric Syndromes

For physical performance measurement, a 6 meters gait speed was tested, and participants should complete 6 meters straight walking test by themselves or with help of a companion or facilities for safety, speed over 1.0m/s[17] was classified as good performance of movement, otherwise classified as the performance of sarcopenia. Participants with chronic pain which badly affect daily life, are classified as having chronic pain; with more than two chronic diseases requiring long-term treatment[29], classified as comorbidity; with more than four kinds of medicines requiring everyday use, classified as polypharmacy.

Statistical Analyses

To compare the height, weight, age, BMI, and scores of EFS, BADL, SDS, SAS, MMSE, and MNA, we performed an analysis using a two-tailed unpaired Student’s t-test, and values were presented as mean ±
standard deviation. With categorical variables like sex, age group, BMI degree, chronic pain, comorbidity, polypharmacy, fall, frailty degree, disability degree, depression, anxiety degree, education, malnutrition degree, and dysphagia degree, we performed an analysis using a chi-square test. The main effect was detected, and between-group comparisons were performed using Bonferroni’s multiple comparisons.

All statistical analyses were performed using GraphPad Prism, version 9.4. P values < 0.05 were considered statistically significant.

**Results**

According to the AWGS 2019 recommendation, in Asian gait speed cut-off < 1.0 m/s[17] could indicate physical function decline. We classified participants into two groups, the normal speed group (NSG, gait speed ≥ 1.0 m/s) comprised 11.88% (men, 52.14%; women, 47.86%), the slow speed group (SSG, gait speed < 1.0 m/s) comprised 88.12% (men 45.62%, women 54.38%) (shown in Table 1.). There was no sex-related difference in the proportions between these two groups ($X^2 = 1.759, p = 0.200$).

<table>
<thead>
<tr>
<th></th>
<th>NSG (gait speed ≥ 1.0m/s)</th>
<th>SSG (gait speed &lt; 1.0m/s)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man</td>
<td>61(6.19)</td>
<td>396(40.2)</td>
<td>457(46.4)</td>
</tr>
<tr>
<td>Woman</td>
<td>56(5.69)</td>
<td>472(47.92)</td>
<td>528(53.6)</td>
</tr>
<tr>
<td>Total</td>
<td>117(11.88)</td>
<td>868(88.12)</td>
<td>985(100)</td>
</tr>
</tbody>
</table>

**Characteristics Of Participants**

The result of the non-parametric test for continuous variables was expressed by median and quartile. Compared to NSG, SSG had significant differences in several characteristics ($p < 0.05$). In SSG participants were much older in age (age: 77 vs. 72 years, respectively), shorter in height (height: 159 vs. 162 cm), lighter in weight (weight: 55 vs. 59 kg), used more kinds of drugs (number: 4 vs 3), had a higher score in Edmonton (score: 8 vs. 4), SDS(T score: 52.5 vs. 42.5), SAS (T score: 37.5 vs. 31.25) and MNA (score: 16 vs. 14), lower score in BADL (score: 95 vs. 100), MMSE (score: 22 vs. 28). Although participants in SSG tend to shorter and lighter than NSG, BMI between two groups had no significant difference ($p = 0.325$); SSG used more kinds of drugs, but the numbers of diagnosis were almost the same to NSG ($p = 0.752$). We showed the detail in Table 2 and Fig. 2–1, Fig. 2–2.
### Table 2
characteristic of participants in two groups

<table>
<thead>
<tr>
<th></th>
<th>NSG(n = 868)</th>
<th>SSG(n = 117)</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(year)</td>
<td>72(68.5 ~ 79)</td>
<td>77(71 ~ 84)</td>
<td>-3.912</td>
<td>0.000</td>
</tr>
<tr>
<td>Height(cm)</td>
<td>162(155 ~ 168)</td>
<td>159(153 ~ 165)</td>
<td>-3.549</td>
<td>0.000</td>
</tr>
<tr>
<td>Weight(kg)</td>
<td>59(49 ~ 70)</td>
<td>55(48 ~ 65)</td>
<td>-2.081</td>
<td>0.037</td>
</tr>
<tr>
<td>BMI(kg/m2)</td>
<td>22.59(20 ~ 24.85)</td>
<td>22.17(19.91 ~ 24.61)</td>
<td>-0.983</td>
<td>0.325</td>
</tr>
<tr>
<td>Diagnosis(num)</td>
<td>3(1.5 ~ 5)</td>
<td>3(1 ~ 5)</td>
<td>-0.316</td>
<td>0.752</td>
</tr>
<tr>
<td>Drug(num)</td>
<td>3(2 ~ 8)</td>
<td>4(2 ~ 7)</td>
<td>-1.996</td>
<td>0.046</td>
</tr>
<tr>
<td>Edmonton(score)</td>
<td>4(2 ~ 6)</td>
<td>8(5 ~ 11)</td>
<td>-8.981</td>
<td>0.000</td>
</tr>
<tr>
<td>BADL(score)</td>
<td>100(95 ~ 100)</td>
<td>95(80 ~ 100)</td>
<td>-7.441</td>
<td>0.000</td>
</tr>
<tr>
<td>SDS T (score)</td>
<td>42.5(36.25 ~ 51.87)</td>
<td>52.5(43.75 ~ 61.25)</td>
<td>-6.579</td>
<td>0.000</td>
</tr>
<tr>
<td>SAS T(score)</td>
<td>31.25(26.25 ~ 37.5)</td>
<td>37.5(31.25 ~ 45)</td>
<td>-5.327</td>
<td>0.000</td>
</tr>
<tr>
<td>MMSE(score)</td>
<td>28(25 ~ 29)</td>
<td>22(16 ~ 26)</td>
<td>-9.386</td>
<td>0.000</td>
</tr>
<tr>
<td>MNA(score)</td>
<td>14(13 ~ 17.5)</td>
<td>16(13 ~ 20)</td>
<td>-2.698</td>
<td>0.007</td>
</tr>
</tbody>
</table>

### Prevalence Of Geriatric Syndrome

Comparing the prevalence of geriatric syndromes in two groups, we found most results were concordant with the characteristics above. Participants in SSG had a higher prevalence percentage in frailty (68.7 vs. 29.91%), disability (48.6 vs. 15.4%), depression (60.0 vs. 30.8%), and dementia (38.7 vs. 11.1%) than NSG. Due to using MMSE estimated dementia depended on education level, we also put illiterate into the analysis. The result showed that illiterate SSG participants were much more than in NSG (14.45 vs. 3.4%), (p < 0.001). But analysis of chronic pain (49.55 vs 48.7%), comorbidity (59.9 vs. 60.7%), polypharmacy (47.7 vs. 41.0%), fall (13.65 vs. 9.4%), anxiety (16.1 vs. 9.4%), malnutrition (96.9 vs. 96.6%) and dysphagia (6.6 vs. 5.1%) between SSG and NSG had no significant difference (p > 0.05). Although SSG participants used more kinds of drugs and had higher SAS T scores than NSG, the prevalence of polypharmacy and anxiety were almost the same (p = 0.175, 0.068). According to our study, participants with low gait speed (< 1.0m/s) had a higher risk to suffer from frailty, disability, depression, and dementia than those with normal gait speed.
Table 3
prevalence of geriatric syndromes in two groups

<table>
<thead>
<tr>
<th>geriatric syndromes</th>
<th>NSG(n = 117)</th>
<th>SSG(n = 868)</th>
<th>Z</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>chronic pain</td>
<td>57(48.7%)</td>
<td>430(49.55%)</td>
<td>-0.167</td>
<td>0.868</td>
</tr>
<tr>
<td>comorbidity</td>
<td>71(60.7%)</td>
<td>520(59.9%)</td>
<td>-0.161</td>
<td>0.872</td>
</tr>
<tr>
<td>polypharmacy</td>
<td>48(41.0%)</td>
<td>414(47.7%)</td>
<td>-1.356</td>
<td>0.175</td>
</tr>
<tr>
<td>fall</td>
<td>11(9.4%)</td>
<td>118(13.65%)</td>
<td>-1.261</td>
<td>0.207</td>
</tr>
<tr>
<td>frailty</td>
<td>35(29.9%)</td>
<td>596(68.7%)</td>
<td>-8.38</td>
<td>0.000</td>
</tr>
<tr>
<td>disability</td>
<td>18(15.4%)</td>
<td>422(48.6%)</td>
<td>-6.755</td>
<td>0.000</td>
</tr>
<tr>
<td>depression</td>
<td>36(30.8%)</td>
<td>521(60.0%)</td>
<td>-5.989</td>
<td>0.000</td>
</tr>
<tr>
<td>anxiety</td>
<td>11(9.4%)</td>
<td>140(16.1%)</td>
<td>-1.825</td>
<td>0.068</td>
</tr>
<tr>
<td>dementia</td>
<td>13(11.1%)</td>
<td>336(38.7%)</td>
<td>-5.838</td>
<td>0.000</td>
</tr>
<tr>
<td>malnutrition</td>
<td>113(96.6%)</td>
<td>841(96.9%)</td>
<td>-0.179</td>
<td>0.858</td>
</tr>
<tr>
<td>dysphgia</td>
<td>6(5.1%)</td>
<td>57(6.6%)</td>
<td>-0.584</td>
<td>0.559</td>
</tr>
<tr>
<td>illiterate</td>
<td>4(3.4%)</td>
<td>125(14.45%)</td>
<td>-3.749</td>
<td>0.000</td>
</tr>
</tbody>
</table>

The Affection Of Gait Speed

Our study aimed to clarify that slow gait speed was a signal of geriatric syndrome risk. So we put generally healthy information like height, weight, sex, age, BMI, gait speed, slow gait speed(< 1.0m/s), chronic pain, numbers of diagnoses and drugs, comorbidity, polypharmacy, and fall history in one year into building the geriatric syndrome model we focused. The results of binary logistic regression showed that gait speed was independently a protective factor associated with frailty, disability, dementia, and swallow dysfunction, and slow gait speed was independently a risk factor associated with frailty, depression, and dementia. But in swallow dysfunction analysis, low gait speed was a protective factor, which astonished us. In anxiety analysis, gait speed had no obvious association with it. While age was an independent risk factor in frailty, disability, and dementia, but a protective factor in anxiety. Comorbidity was an independent risk factor in disability, depression, anxiety, dementia, and the number of diagnoses was a risk factor in frailty and swallowing dysfunction. The history of falls in the recent one year was an independent risk factor in frailty, depression, and anxiety. When we analyzed malnutrition with the above factors, the result showed that no one was associated factor(p > 0.5). Except for other affect factors, the participant with higher gait speed had a lower risk of frailty, disability, dementia, and swallowing dysfunction. Contrarily, the participant with a slow gait speed(< 1.0m/s) had a higher risk of frailty, depression, dementia, and swallowing dysfunction. All the statistic detail about OR(95%CI) and p < 0.05
showed in Fig. 4,5. It suggested that gait speed was a consistent predictive factor associated with frailty, disability, depression, dementia, and swallowing dysfunction.

Alternatively, to find influencing factors of gait speed among our collected information, we put covariates into an analysis consisting of basic characteristics and results of CGA. Through continuity variables and categorical variables, the score of BADL, MMSE, MNA, Edmonton, whether polypharmacy and comorbidity and education level, were the factors influencing gait speed. It seemed that participants with better daily life function, cognition, and comorbidity had faster gait speed, but with polypharmacy, low educated, a higher score of MNA, and Edmonton would decline the gait speed. According to multiple linear regression of gait speed, we got the model below with standardized coefficients (p < 0.05):

\[
y = 0.218*x_1 + 0.159*x_2 + 0.146*x_3 - 0.136*x_4 - 0.091*x_5 - 0.087*x_6 - 0.085*x_7 + 0.272
\]

(y: gait speed; x_1: BADL; x_2: MMSE; x_3: comorbidity; x_4: polypharmacy; x_5: education level; x_6: Edmonton; x_7: MNA)

**Discussion**

We tried to testify gait speed test was a fast and sensitive measurement, not only for sarcopenia but also for other common geriatric syndromes, like frailty, disability, depression, dementia, and swallowing dysfunction. For elderly outpatients, the clinical physician should give more attention to those with the slow gait speed one, care about their function condition. Potential geriatric syndromes maybe cause several adverse health outcomes, longer hospitalization, and more expensive spending in the hospital.

**Basic Characteristics Associated With Gait Speed**

Former studies were accustomed to regarding gait speed as an objective result of one specific disease or geriatric syndrome. Actually, comorbidity was widespread in the elderly. Those elderly had only one illness or one function decline usually lacking examination regularly. In our study, the prevalence of comorbidity between NSG and SSG was about 60%.

From the multiple linear regression of gait speed, age (over the 60s), sex, BMI or bodily form, chronic pain, and fall, the scores of SDS, SAS, and swallow function did not affect gait speed. Such results were partly opposite to common sense. Additionally, those we often ignored elements like comorbidity, polypharmacy, and education level, had more obvious influence than frailty and malnutrition. But similar reach was rare, further study needed to be completed continually.

**The Correlativity Of Gait Speed And Geriatric Syndromes**

Many previous studies reported that gait speed could be used as an identified characteristic of frailty, daily life function, dementia or cognition impairment, malnutrition, depression, and
chronic pain[31]. Most of them considered the gait speed as a performance of function decline but did not clarify which gait speed as cut-off had more risk. Our study showed that slow gait speed (< 1.0m/s) was an independent risk factor for frailty, depression, dementia, and swallowing dysfunction. Contrarily participants with faster gait speed, gained better conditions in frailty, daily life function, cognition, and swallow function.

Meanwhile, gait speed had no relativity with malnutrition and chronic pain from our regression analysis. Different from the general inpatients with certain diseases, the participants we collected were all old outpatients, excluded adults, and inpatients. Without consideration of the exact diseases, our result showed that in both groups, the percentage of well nutritional status was less than 4%, but of chronic pain was almost reached half. It was following reality. The elderly patients suffer from aging, appetite declining, losing teeth, weak digestive function, comorbidity, drug adverse reactions of polypharmacy, and even insufficiency of care, had bad nutrition more easily than normal adults. Because of the high prevalence of malnutrition in old outpatients, there was no statistical significance between the two gait speed groups. As to chronic pain, most of our participants had comorbidity or mood disorders, which could bring chronic pain to a certain part or the whole body. And such diseases and functional disorders usually caused difficulties in analysis. It also reminded us the elderly had complicated physical and functional situations. Diagnosis and therapy should be considered comprehensively.

The Application Of Gait Speed Test In The Outpatient Clinic

Gait speed test used to be a key examination for sarcopenia, and nervous system diseases. From this study, we found slow gait speed had close relativity with several geriatric syndromes. Of course, a gait speed test can't instead of CGA, but could be a primary preparation for it.

We all realized the importance of assessment of functional decline in the elderly. But accomplishing the CGA program cost lots of time, and even geriatric doctors hardly did the whole CGA in a few minutes, let alone other department doctors. Oppositely completing the gait speed test just needs seconds. Follow up geriatrics concept is accepted widely. Awareness of the potential geriatric syndrome was the most important part of diagnosis and treatment for old people.

Limitation

The participants in this study were all collected from outpatients in the geriatric department. The characteristics of outpatients in other departments or inpatient and long-term care may differ. Meanwhile, race, economic condition, smoking or drinking, sports habit, pain intensity, risk of falls, and sleeping quality were not considered, which maybe influence the result we had. Furthermore, after intervention with strength training, whether the gait speed test was still a good biomarker was not sure. So much more clinical studies and follow-up visits needed to be accomplished continually.

Conclusion
We collected characteristics and geriatric syndromes in elderly outpatients and compared the difference between the normal gait speed to the slow gait speed (cutoff < 1.0m/s). It showed that slow gait speed could be a signal for some geriatric syndromes in elderly outpatients. When the elderly had a gait speed of less than 1.0m/s, they had a higher risk of frailty, disability, depression, and dementia than the gait speed normal. In addition, outpatients with higher scores in BADL, MMSE, lower scores in Edmonton, and MNA, meanwhile had comorbidity, no polypharmacy, and were not illiterate would have better gait speed. Therefore we recommend 6 meters gait speed test as a routine examination for the elderly. Not only in the geriatric department but also in others serving the elderly.

**Declarations**

**Author contributions** Conceptualization: [Xu, He],[Yan, Li]; Methodology: [Xu, He], [Yan, Li],[Jun, Chen]; Formal analysis and investigation: [li, Zhang], [Jin, Quan], [Ying, Zhou]; Writing - original draft preparation: [Xu, He]; Writing - review and editing: [Yan, Li]; Funding acquisition: [Xu, He], [Yan, Li]; Resources: [Kehua, Wang], [Yan, Huang], [Sunrui, Lu]; Supervision: [Yan, Li]

**Availability of data and material** Not applicable.

**Code availability** Not applicable.

**Consent for publication** Not applicable.

**Compliance with Ethical Standards** This study was a retrospective research and did not use intervention therapy among the participants.

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**Conflict of interest** The authors declare that they have no competing interests.

**Ethics approval** This study protocol was approved by the Research Ethics Committee of the First People's Hospital of Yunnan province (Ethics number: KHLL2021- KY038).

**Informed consent** The content of the study was explained to the participants, and written informed consent was obtained from them.

**References**


**Figures**
Figure 1

See image above for figure legend.
Figure 2

See image above for figure legend.

**Figure 3**

The prevalence of GS between NSG and SSG. According to Mann-Whitney U test, SSG had higher prevalence in frailty, disibility, depress, dementia ($p<0.05$, expressed as *). Because of MMSE classified cognition depends on education, we also analysed illiterate in both group.
See image above for figure legend.

**Figure 4**

See image above for figure legend.
Figure 5

See image above for figure legend.

**Table:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>2.51 (1.385–4.553)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Fall</td>
<td>2.21 (1.388–3.54)</td>
<td>&lt;0.01</td>
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<tr>
<td>Chronic pain</td>
<td>2.63 (1.766–3.92)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td>0.97 (0.952–1.00)</td>
<td>&lt;0.05</td>
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<table>
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<tr>
<th>Variable</th>
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<th>P</th>
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<tbody>
<tr>
<td>Dementia</td>
<td>1.57 (1.002–2.471)</td>
<td>&lt;0.05</td>
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<tr>
<td>Comorbidity</td>
<td>2.81 (1.317–6.017)</td>
<td>&lt;0.01</td>
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<tr>
<td>Gait speed</td>
<td>0.37 (0.173–0.817)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Age</td>
<td>1.05 (1.029–1.068)</td>
<td>&lt;0.001</td>
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<tr>
<th>Variable</th>
<th>OR (95% CI)</th>
<th>P</th>
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<tbody>
<tr>
<td>Swallow dysfunction</td>
<td>1.20 (1.045–1.387)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>0.20 (0.054–0.748)</td>
<td>&lt;0.05</td>
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<tr>
<td>Gait speed</td>
<td>0.04 (0.009–0.207)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Fig5. Independently factor associated with anxiety, dementia and swallow dysfunction.