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Factors Associated with Performance-based Physical Function of Older Veterans of the PLAAF: A Pilot Study

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Abstract. [Purpose] This study investigated the factors associated with performance-based physical function of older veterans of the People's Liberation Army Air Force of China (PLAAF). [Subjects and Methods] A cross-sectional survey of 146 older veterans of the PLAAF was carried out. Their physical function was measured using the Chinese Mini-Physical Performance Testing (CM-PPT). The demographics and health status (including physical measures, blood chemical tests, chronic diseases, and number of morbidities) were collected from health examination reports and computer records of case history. Cognition was measured using the Mini-Mental Status Examination (MMSE). [Results] In multiple linear regressions, age, MMSE, Parkinsonism, and chronic obstructive pulmonary disease were independently associated with CM-PPT, while previous stroke and albumin level reached borderline statistical significance. The association between the number of morbidities and CM-PPT was significant after adjustment for MMSE and demographics. The CM-PPT of low (0 or 1), medium (2 to 4) and high count (5 or more) morbidities were 11.3±3.9, 10.2±4.1, 6.1±3.8 respectively, and the difference among these three groups was significant. [Conclusion] Some modified conditions and the number of chronic diseases might be associated with the physical function of older veterans of the PLAAF.
Key words: Physical function, Physical performance test, Aging

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INTRODUCTION

The quality of life of older persons is more determined by their level of physical function and ability to maintain independence than by the specific diseases diagnosed by their physicians[1)]. When physical function declines to the point where older persons cannot fully care for themselves, the burden on their families and the medical care system becomes substantial. With increasing age, there is a noticeable rise in the proportion of the population residing in nursing homes or living at home and needing the help of other people[2)]. In addition, it has been consistently demonstrated that measures of physical function of the elderly can predict major health-related events, such as falls, disability, hospitalization, institutionalization, and mortality[3–6)]. Therefore, it is imperative to understand and realize the determinants of physical functional decline. These determinants can not only be used as an early warning system for identifying persons at great risk of subsequent decline of physical function, but also to suggest therapy strategies to delay or even ameliorate physical function impairment, in order to prevent and postpone adverse health-related events.

A series of studies have reported that the age, cognitive function, life-style, psychosocial factors, and chronic medical conditions, are associated with the physical function of older persons. However, these studies have inconsistent results which may be related to differences in race and geography, in addition to different designs and methods[1, 2, 7–11)]. As such, it is necessary to investigate these associations in populations of different races and countries, but this has not been carried out in China.

Physical function can be assessed by self-report or performance-based measures. Different from the self-report measures, physical performance tests (PPT) provide a multidimensional, objective and standardized assessment of elderly persons, and are less confounded by culture, language, or educational level[1, 7, 12)]. In addition, PPT have been proved to be able to identify more limitations in physical function than self-report measures, and consequently they are more sensitive to changes leading to disability[13–15)]. PPT have more recently been considered as the 'gold standard' for the measurement and follow-up of physical function.

Recently, we modified the Mini-Physical Performance Test of Wilkins et al.[16)] by replacing the 50-ft timed walk with a 20-ft timed walk, and adding one-leg standing to construct the Chinese version of the Mini-PPT (CM-PPT)[17)]. CM-PPT has an unchanged score for the timed walk with the shortened distance, and has a more sensitive assessment of balance. Fitzpatrick et al. found that the tasks

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requiring greater functional reserve appear to be more sensitive at assessing the physical function than the usual tasks, and CM-PPT is required to be completed as quickly as possible[18]. A pilot study showed that CM-PPT is reliabe, and is more sensitive than the Barthel index (BI) at evaluating and monitoring the physical function of elderly Chinese[17].

In the present cross-sectional study, we investigated the association of CM-PPT with demographics, cognition and health status in older veterans of The People's Liberation Army Air Force of China (PLAAF). We found that aging, cognition, some chronic conditions, and a number of morbidities were associated with the physical function of older veterans of the PLAAF.

SUBJECTS AND METHODS

The data used in this study were collected in our previous study, in which 170 Veterans taking part in the 2010 health examination at the General Hospital of Air Force PLA were recruited for a study of the reliability and validity of CM-PPT[17]. Eligibility criteria were an age of 60 years or older, and the ability to follow a one-step command. Participants were excluded if they were enrolled in a hospice program with anticipated survival of less than 6 months, enrolled in a sub-acute or acute care program, or were unable to follow directions due to severe visual and hearing impairment, or profound dementia. In the present study, we selected only those persons with complete health examination and computer records of case history. Subjects with dementia were also excluded in order to make sure that the participants had completely comprehended their instructions. A cross-sectional survey was carried out of the remaining 146 persons. Information about their demographics, health status, cognitive and physical functions was collected. All procedures were approved by the Institutional Ethical Review Committee, and all participants provided their written informed consent to participation in this study.

The CM-PPT contains 4 physical performance tests: standing static balance, 20-ft timed walk (time of 10-ft forward and back), chair-stand time (time to sit in and rise from a chair with arms folded across the chest 5 times) and picking up a penny from the floor (a penny was placed approximately 12 inches from the subject's foot on the dominant side, and the time taken to pick up the penny from the floor and stand up). Standing static balance also contains 4 items: feet together (standing still with the feet together), semi-tandem (standing with the heel of one foot placed to the side of the first toe of the opposite foot), tandem (standing with the heel of one foot directly in front of the other foot), and one-leg standing (standing unassisted on one leg with eyes open). Each test is scored from 0 to 4 points and the sum of the scores from the 4 physical tests ranges from 0 to 16, with higher scores indicating better physical performance. Standing static balance is scored by the ability to maintain the following positions: feet together for 10 seconds, semi-tandem for 10 seconds, tandem for 10 seconds, and one-leg for 5 seconds. Each position is scored. The 20-ft timed walk was scored as follows: a score of 1 for >11 seconds; a score of 2 for >9 and ≤11 seconds; a score of 3 for >7 and ≤9 seconds; a score of 4 for ≤7 seconds. The chair-stand time was scored as follows: a score of 1 for >15 seconds; a score of 2 for >12 and ≤15 seconds; a score of 3 for >9 and ≤12 seconds; a score of 4 for ≤9 seconds. Picking up a penny was scored as follows: a score of 1 for >4 seconds; a score of 2 for >3 and ≤4 seconds; a score of 3 for >2 and ≤3 seconds; a score of 4 for ≤2 seconds. A score of 0 indicates the subject is unable to do the test.

Demographics measures included age, sex, marital status, and years of formal education. Health status included physical measures, blood chemical levels, and chronic diseases. The conditions selected to be investigated in this study were based on the fact that they are common or have been reported in the literature as related to the physical function of older persons. Physical measures included systolic and diastolic blood pressures, body mass index (BMI), self-rated visual and hearing scales. BMI is weight (kg)/height (m^2), and underweight was defined as BMI<18.5 and overweight as BMI>25. Visual assessment was divided into normal reading and poor reading (only large fonts), while the hearing assessment was divided into normal hearing and poor hearing (only loud talking). Blood measures included fasting blood sugar, total cholesterol, triglyceride, low and high density lipoproteins, blood creatine and urea nitrogen, blood uric acid, blood haematin, total protein, albumin. Chronic diseases included coronary disease, chronic heart failure (CHF), hypertension, hyperlipidemia, diabetes, sleep apnea syndrome (SAS), chronic obstructive pulmonary disease (COPD), neoplasm, arthritis, chronic renal failure, anemia, previous stroke, and parkinsonism. The number of chronic diseases was counted and categorized as low (0 or 1), medium (2 to 4) and high (5 or more). Cognitive function was measured using the Mini-Mental State Examination (MMSE)[19].

Chronic diseases were collected from computer records of case history. The MMSE and self-rated visual and hearing assessment were completed by trained nurses. Other information was obtained from health examination reports.

The data of continuous variables is presented as mean values±SD, and the data of categorical variables as percentage. The associations of CM-PPT with demographics measures, all data of health status, and MMSE were examined using multiple linear regression. In Model 1, only demographic measures were included. In Model 2, all covariates of health status and MMSE were examined in separate demographics-adjusted regression models. In Model 3, the significant variables of Model 2 were simultaneously entered into a summary demographics-adjusted regression model. In Model 4, the number of morbidities was examined in the regression model after adjustment for MMSE and demographics. The correlation between CM-PPT and the number of morbidities is expressed by Pearson's correlation coefficient. The difference of CM-PPT scores among the low, medium and high counts of morbidities was examined by analysis of variance. Statistical significance was accepted for values of $p \leq 0.05$, and all statistical analyses were performed using SPSS version 16.0.

RESULTS

The main characteristics of CM-PPT, demographics measures, health status and MMSE of 146 subjects are shown in Table 1. Except for BMI, there were complete clinical data for all subjects. Most of the participants were male in this study because our sample was comprised of PLAAF veterans. In Model 1, age was significantly associated with CM-PPT (Table 2): CM-PPT declined with age. In separate demographic-adjusted linear regression models, MMSE, albumin level, SAS, COPD, previous stroke, and parkinsonism were significantly associated with CM-PPT, in addition to age (Table 2). In the summary demographics-adjusted linear regression model, age, MMSE, COPD and parkinsonism were significantly associated with CM-PPT, and previous stroke and albumin level reached borderline statistical significance (Table 2). The number of morbidities was negatively associated with CM-PPT ($r=0.337$, $p<0.001$). This association still existed after adjusted for MMSE and demographics ($p=0.007$, Table 2). The CM-PPT of the low, medium and high count morbidities were 11.3 ± 3.9, 10.2 ± 4.1, and 6.1 ± 3.8 respectively, and the difference among the three groups was significant ($p=0.002$).

DISCUSSION

In the present study, we explored the association of a performance-based physical function assessment with demographics, cognition, and health status in a sample of non-demented and non-institutionalized veterans of the PLAAF who were older than 60 years. Our results show that age, cognitive function, and some medical conditions (such as parkinsonism and COPD) might independently affect physical function, and that previous stroke and low albumin level showed associations that were close to statistical significance. In addition, the number of morbidities was also associated with physical function, and persons with more diseases had poorer physical performance.

Our cross-sectional study show that age was negatively associated with physical function, which is consistent with the results of other studies[7, 9]. The longitudinal studies of Miller et al.[6] and Ishizaki et al.[20] also showed that age is associated with physical function decline. In addition, Ostir et al. found that 65–74-year-olds had the highest initial PPT scores and the most moderate slope of decline, followed by 75–84-year-olds, and ≥85 year-olds[7]. Therefore, age is the main risk factor of physical function decline. The mechanism of decline may be that muscle loss due to aging results in declines in motor ability and physical function[21, 22].

Our results also showed that the cognitive function was associated with physical performance, similar to many other studies[18, 23], even though we had excluded dementia patients in order to eliminate the confounder of instructions of CM-PPT being not comprehended well. This suggests that cognition is another factor of physical function decline, as well as age. Physical frailty and cognitive impairment may share a common underlying etiopathogenesis (e.g., vascular pathology, inflammation, stress)[24]; However, the accumulation of Alzherimer's disease pathology in brain regions that subserve cognition may affect components of frailty through the impairment of neural systems involved in the planning and monitoring of simple movement[24].

In our study, some medical conditions affected physical performance, a result which is consistent with those of previous studies[1, 2, 7–11]. Neurological diseases (such as parkinsonism and previous stroke) have an negative effect on physical function[1, 2, 7, 8] since these diseases can cause muscle weakness, abnormal gait, balance impairment, and other movement disorders[25, 26]. A recent study showed that sustained or unsustained decline in physical performance is also common after an ischemic stroke or transient ischemic attack, even in the absence of a recurrent neurological event[27]. Some systemic conditions (such as COPD and low albumin level) can also contribute to poor physical function[28–31]. COPD is being increasingly viewed as a multiple-system disease associated with depleted lean mass that results in muscle weakness and physical fraityl[28]. Besides a sedentary lifestyle, the factors that lead to skeletal muscle atrophy include systemic or muscular hypoxia, systemic inflammation, and oxidative stress[32, 33]. A albumin is a negative acute phase protein that decreases with systemic inflammation and is conventionally viewed as a marker of chronic inflammation[30, 31]. Since pro-inflammatory cytokines may cause muscle atrophy and are associated with physical frailty, it is very interesting that the common mechanism for the observed association of these two medical conditions with physical function may be chronic inflammantion[33].

Some other chronic medical conditions (e.g., chronic heart failure, obesity, diabetes, coronary vascular disease, impaired vision, hypertension, cancer, arthritis, depression) have also been reported in other studies to affect physical function[1, 2, 7–11], but these were not verified in our study. The reason for this inconsistency may be that different chronic diseases play a role in the decline of physical function in different populations. Some studies have shown that chronic heart failure (CHF), but not COPD, influences physical function in American and European populations[1, 6–8]. In the past decade, it has become clear that both COPD and CHF have important systemic consequences. Cachexia and muscle weakness are two clearly visible expressions of the systemic consequences associated with both diseases[33]. Therefore, COPD and CHF may affect the physical function of Chinese and Western populations, respectively. Miller and Troosters found that obesity (BMI≥30 kg/m^2), another condition associated with inflammation, is strongly associated with disability in Western populations[1, 6], but this was not demonstrated in our study. Since the prevalence of obesity (only 4.4% in our study) is lower in China than in Western countries[34], it's no surprise that a low albumin level, but not obesity, may be a biomarker for the decline of physical function in the Chinese population. Finally, many studies have shown that diabetes is associated with physical function[1, 6–8], but the reason for the lack of this relationship in our population is not clear.

The inconsistencies between our study results and those of other studies may also arise from chronic conditions exerting an effect on physical function proportionate to their severity[11]. Therefore, it is understandable that the mere presence or absence of most chronic conditions is not related

Table 1. Demographic measures, health status, MMSE and CM-PPT of the 146 particpants

Characteristics	Mean±SD	Range	Number (%)
Demographic measures			
Age (year)	80.8±6.8	60–94	
Sex (male)			136 (93.2)
Marital Status (married)			129 (88.4)
Educational levels			
Illiteracy			1 (0.7)
≤6 years			10 (6.8)
≤12 years			63 (43.2)
>12 years			72 (49.3)
Physical measures			
Systolic BP (mmHg)	130.1±15.4	90–180	
Diastolic BP (mmHg)	73.3±9.3	58–110	
BMI (kg/m^2)			
<18.5			3 (2.1)
18.5–25			70 (47.9)
>25			60 (41.1)
Unknown			13 (8.9)
Hearing (normal)			127 (87.0)
Vision (normal)			81 (55.5)
Blood chemistry			
Fasting blood sugar (mmol/L)	5.5±1.3	3.6–11.9	
Total cholesterol (mmol/L)	4.0±0.8	2.0–8.1	
Triglyceride (mmol/L)	1.4±0.8	0.5–6.8	
LDL (mmol/L)	2.6±0.7	0.4–6.2	
HDL (mmol/L)	1.1±0.3	0.6–1.9	
Creatine (umol/L)	108.2±102.2	48.0–795.0	
Urea nitrogen (mmol/L)	6.6±3.2	2.0–23.4	
Uric acid (umol/L)	344.6±95.1	129.0–667.0	
Haematin (g/L)	124.0±19.0	69.0–163.0	
Albumin (g/L)	40.5±3.2	33.0–49.0	
Chronic diseases			
Coronary disease			22 (15.1)
Chronic heart failure			13 (8.9)
Hypertension			92 (63.0)
Hyperlipidemia			20 (13.7)
Diabetes			44 (30 .1)
SAS			3 (2.1)
COPD			9 (6.2)
Neoplasm			33 (22.6)
Arthritis			7 (4.8)
Chronic renal failure			15 (10.3)
Anemia			61 (41.8)
Previous stroke			21 (14.4)
Parkinsonism			10 (6.8)
Number of morbidities			
≤1			38 (26.0)
2–4			98 (67.2)
≥5			10 (6.8)
MMSE	27.0±2.6	20–30	
CMPPT	10.2±4.2	0–16	

SD = standard deviation; BP = blood pressure; BMI = body mass index; LDL = low density lipoproteins; HDL = high density lipoproteins; SAS = sleep apnea syndrome; COPD = chronic obstructive pulmonary disease; MMSE = Mini-Mental State Examination;CM-PPT = Chinese version Mini-Physical Performance Test

Table 2. Associations of CM-PPT with demographics, physical health state, and MMSE by multiple linear regressions

	Model 1			Model 2			Model 3			Model 4		
	B	β	P	B	β	P	B	β	P	B	β	P
Age	***−0.352***	***−0.576***	***<0.001***				***−0.283***	***−0.463***	***<0.001***	***−0.281***	***−0.460***	***<0.001***
Sex	0.055	0.003	0.963				0.300	0.018	0.777	0.301	0.018	0.786
Marital Status	−0.282	−0.044	0.547				−0.320	−0.050	0.450	−0.143	−0.022	0.745
Educational levels	−0.343	−0.054	0.484				−0.575	−0.090	0.194	−0.552	−0.086	0.231
SBP (mmHg)				0.010	0.036	0.614						
DBP (mmHg)				0.010	0.023	0.748						
BMI (kg/m^2)												
<18.5 vs 18.5~25.0				−0.053	−0.002	0.979						
>25.0 vs 18.5~25.0				−0.080	−0.010	0.891						
Hearing				−0.561	−0.046	0.543						
Vision				−0.821	−0.099	0.162						
Fasting blood sugar (mmol/L)				−0.325	−0.098	0.166						
Total cholesterol (mmol/L)				0.243	0.048	0.497						
Triglyceride (mmol/L)				−0.545	−0.099	0.157						
LDL (mmol/L)				0.243	0.040	0.568						
HDL (mmol/L)				0.634	0.041	0.562						
Creatine (umol/L)				−0.003	−0.068	0.339						
Urea nitrogen (mmol/L)				−0.059	−0.045	0.539						
Uric acid (umol/L)				−0.002	−0.044	0.531						
Haematin (g/L)				0.022	0.102	0.166						
Albumin (g/L)				***0.263***	***0.204***	***0.004***	0.162	0.125	0.062*			
Previous stroke				***−1.743***	***−0.148***	***0.036***	−1.353	−0.115	0.077*			
Coronary disease				−0.959	−0.083	0.237						
Chronic heart failure				−1.033	−0.071	0.321						
Hypertension				−0.597	−0.070	0.326						
Hyperlipidemia				−0.134	−0.011	0.875						
Diabetes				−0.930	−0.103	0.149						
SAS				***−4.067***	***−0.139***	***0.045***	−3.073	−0.105	0.098			
COPD				***−3.129***	***−0.182***	***0.010***	***−3.121***	***−0.181***	***0.005***			
Neoplasm				−0.010	−0.001	0.988						
Arthritis				−1.039	−0.054	0.449						
Parkinsonism				***−3.634***	***−0.222***	***0.001***	***−3.004***	***−0.183***	***0.005***			
Chronic renal failure				−1.307	−0.096	0.183						
Anemia				−0.277	−0.033	0.662						
MMSE				***0.437***	***0.273***	***<0.001***	***0.293***	***0.183***	***0.010***	***0.387***	***0.242***	***<0.001***
Number of morbidities										***−0.568***	***−0.188***	***0.007***

SBP = systolic blood pressure; DBP = diastolic blood pressure; BMI = body mass index; LDL = low density lipoproteins; HDL = high density lipoproteins; SAS = sleep apnea syndrome; COPD = chronic obstructive pulmonary disease; MMSE = Mini-Mental State Examination; CM-PPT = Chinese version Mini-Physical Performance Test.
Model 1: analysis of demographics; Model 2: analysis of physical health state and MMSE after adjustment for demographics; Model 3: analysis using the significant variables of Model 2 after adjustment for demographics; Model 4: analysis of the number of morbidities after adjustment for both MMSE and demographics. Bold and italic p <0.05; *p close to 0.05.

to physical performance measures in our population. Moreover, lifestyle can influence the effect of chronic diseases on physical performance and function, but such associations were not confirmed in our sample due to the absence of information on physical activity and training programs[33, 35, 36]. In addition, the limited data of some conditions in our study (such as arthritis) reduced its power to confirm their association with physical function. Lastly, the single effect of these medical conditions on physical function was low, but the combined effect may be significant, since our results show that multi-morbidity (two or more morbidities in one individual) rather than single or zero morbidity, was associated with lower physical function. This association between the number of morbidities (multi-morbidity) and physical function has also been demonstrated in other studies[1, 11].

Our study had several important strengths. First, chronic diseases were collected from computer records of case history, not self-report by the participants, so the accuracy of the information is higher. Second, CM-PPT has the characteristics of being brief and easy to implement and is well-suited to the clinical environment, so the results can be used to guide clinical practice[17].

This study also had a few limitations. The sample size was not large enough, and the study design was cross-sectional, which reduces its statistical power. However, this study was a pilot one. The good reliability and validity of CM-PPT as well as its ease of implementation will ensure a wide range of surveys evaluating and monitorinf the physical function of elderly Chinese will be undertaken. A further limitation is that most participants were male, because our sample was of retired veterans, which limits the generalization of our results. However, our results still provide some important information about male subjects.

In summary, our study showed that the age, cognitive impairment, parkinsonism, COPD, and the number of morbidities might be independently associated with the physical function of elderly Chinese and that previous stroke and low albumin level also showed association that were close to statistical significance. In addition, the number of chronic diseases was also associated with the physical function. In the future, we need to study the relationship between these conditions and physical function in large samples or in a longitudinal study. Our findings also suggest that the prevention and intervention of some specific conditions or the comprehensive management of multi-morbidity might retard the decline of physical function.

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REFERENCES

1) Cesari M, Onder G, Russo A, et al.: Comorbidity and physical function: results from the aging and longevity study in the Sirente geographic area (ilSIRENTE study). Gerontology, 2006, 52: 24–32. [Medline] [CrossRef]
2) Wang L, van Belle G, Kukull WB, et al.: Predictors of functional change: a longitudinal study of nondemented people aged 65 and older. J Am Geriatr Soc, 2002, 50: 1525–1534. [Medline] [CrossRef]
3) Cesari M, Kritchevsky SB, Newman AB, et al.: Added value of physical performance measures in predicting adverse health-related events: results from the health, aging and body composition study. J Am Geriatr Soc, 2009, 57: 251–259. [Medline] [CrossRef]
4) Delbaere K, Van den Noortgate N, Bourgois J, et al.: The physical performance test as a predictor of frequent fallers: a prospective community-based cohort study. Clin Rehabil, 2006, 20: 83–90. [Medline] [CrossRef]
5) Volpato S, Cavalieri M, Sioulis F, et al.: Predictive value of the short physical performance battery following hospitalization in older patients. J Gerontol A Biol Sci Med Sci, 2011, 66: 89–96. [Medline] [CrossRef]
6) Miller DK, Wolinsky FD, Andresen EM, et al.: Adverse outcomes and correlates of change in the short physical performance battery over 36 months in the African American health project. J Gerontol A Biol Sci Med Sci, 2008, 63: 487–494. [Medline] [CrossRef]
7) Ostir GV, Volpato S, Fried LP, et al.: Reliability and sensitivity to change assessed for a summary measure of lower body function: results from the Women's Health and Aging Study. J Clin Epidemiol, 2002, 55: 916–921. [Medline] [CrossRef]
8) Rozzini R, Frisoni GB, Ferrucci L, et al.: The effect of chronic diseases on physical function. Comparison between activities of daily living scales and the physical performance test. Age Ageing, 1997, 26: 281–287. [Medline] [CrossRef]
9) Morala DT, Shiomi T, Maruyama H: Factors associated with the functional status of community-dwelling elderly. J Geriatr Phys Ther, 2006, 29: 101–106. [Medline] [CrossRef]
10) Arias-Merino ED, Mendoza-Ruvalcaba NM, Ortiz GG, et al.: Physical function and associated factors in community-dwelling elderly people in Jalisco, Mexico. Arch Gerontol Geriatr, 2012, 54: e271–e278. [Medline] [CrossRef]
11) Kadam UT, Croft PR: Clinical multimorbidity and physical function in older adults: a record and health status linkage study in general practice. Fam Pract, 2007, 24: 412–419. [Medline] [CrossRef]
12) Morala D, Shiomi T: Assessing reliability and validity of physical performance test for the Japanese elderly. J Phys Ther Sci, 2004, 16: 15–20. [CrossRef]
13) Louie GH, Ward MM: Association of measured physical performance and demographic and health characteristics with self-reported physical function: implications for the interpretation of self-reported limitations. Health Qual Life Outcomes, 2010, 8: 84. [Medline] [CrossRef]
14) Bean JF, Olveczky DD, Kiely DK, et al.: Performance-based versus patient-reported physical function: what are the underlying predictors? Phys Ther, 2011, 91: 1804–1811. [Medline] [CrossRef]
15) van Weely SF, van Denderen JC, Steultjens MP, et al.: Moving instead of asking? Performance-based tests and BASFI-questionnaire measure different aspects of physical function in ankylosing spondylitis. Arthritis Res Ther, 2012, 14: R52. [Medline] [CrossRef]
16) Wilkins CH, Roe CM, Morris JC: A brief clinical tool to assess physical function: the mini-physical performance test. Arch Gerontol Geriatr, 2010, 50: 96–100. [Medline] [CrossRef]
17) Chen DW, Chen JW, Xu W, et al.: A pilot study for reliability and validity of mini-physical performance test for Chinese male elders. Int J Gerontol, 2012, 6: 16–19. [CrossRef]
18) Fitzpatrick AL, Buchanan CK, Nahin RL, et al.: Associations of gait speed and other measures of physical function with cognition in a healthy cohort of elderly persons. J Gerontol A Biol Sci Med Sci, 2007, 62: 1244–1251. [Medline] [CrossRef]
19) Folstein MF, Folstein SE, McHugh PR: "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res, 1975, 12: 189–198. [Medline] [CrossRef]
20) Ishizaki T, Furuna T, Yoshida Y, et al.: Declines in physical performance by sex and age among nondisabled community-dwelling older Japanese during a 6-year period. J Epidemiol, 2011, 21: 176–183. [Medline] [CrossRef]
21) Nikolić M, Bajek S, Bobinac D, et al.: Aging of human skeletal muscles. Coll Antropol, 2005, 29: 67–70. [Medline]
22) Buford TW, Lott DJ, Marzetti E, et al.: Age-related differences in lower extremity tissue compartments and associations with physical function in older adults. Exp Gerontol, 2012, 47: 38–44. [Medline] [CrossRef]
23) Eggermont LH, Gavett BE, Volkers KM, et al.: Lower-extremity function in cognitively healthy aging, mild cognitive impairment, and Alzheimer's disease. Arch Phys Med Rehabil, 2010, 91: 584–588. [Medline] [CrossRef]
24) Buchman AS, Schneider JA, Leurgans S, et al.: Physical frailty in older persons is associated with Alzheimer disease pathology. Neurology, 2008, 71: 499–504. [Medline] [CrossRef]
25) Brusse KJ, Zimdars S, Zalewski KR, et al.: Testing functional performance in people with Parkinson disease. Phys Ther, 2005, 85: 134–141. [Medline]
26) Young JA, Tolentino M: Stroke evaluation and treatment. Top Stroke Rehabil, 2009, 16: 389–410. [Medline] [CrossRef]
27) Kernan WN, Viscoli CM, Brass LM, et al.: Decline in physical performance among women with a recent transient ischemic attack or ischemic stroke: opportunities for functional preservation a report of the women's estrogen stroke trial. Stroke, 2005, 36: 630–634. [Medline] [CrossRef]
28) Eisner MD, Blanc PD, Yelin EH, et al.: COPD as a systemic disease: impact on physical functional limitations. Am J Med, 2008, 121: 789–796. [Medline] [CrossRef]
29) Taspinar B, Gursoy S, Baser S, et al.: Comparison of pulmonary function, physical function, quality of life, depressive symptoms and cognitive abilities between patients with chronic obstructive pulmonary disease and healthy subjects. J Med Sci, 2010, 10: 71–79. [CrossRef]

30) Visser M, Kritchevsky SB, Newman AB, et al.: Lower serum albumin concetration and change in muscle mass: the health, aging and body composition study. Am J Clin Nutr, 2005, 82: 531–537. [Medline]
31) Aung KC, Feng L, Yap KB, et al.: Serum albumin and hemoglobin are associated with physical function in community-living older persons in Singapore. J Nutr Health Aging, 2011, 15: 877–882. [Medline] [CrossRef]
32) Cesari M, Pedone C, Chiurco D, et al.: Physical performance, sarcopenia and respiratory function in older patients with chronic obstructive pulmonary disease. Age Ageing, 2012, 41: 237–241. [Medline] [CrossRef]
33) Troosters T, Gosselink R, Decramer M: Chronic obstructive pulmonary disease and chronic heart failure: two muscle diseases? J Cardiopulm Rehabil, 2004, 24: 137–145. [Medline] [CrossRef]
34) Wu Y: Overweight and obesity in China. BMJ, 2006, 333: 362–363. [Medline] [CrossRef]
35) Toto PE, Raina KD, Holm MB, et al.: Outcomes of a multicomponent physical activity program for sedentary, community-dwelling older adults. J Aging Phys Act, 2012, 20: 363–378. [Medline]
36) Gennuso KP, Gangnon RE, Matthews CE, et al.: Sedentary behavior, physical activity, and markers of health in older adults. Med Sci Sports Exerc, 2013, 45: 1493–1500. [Medline] [CrossRef]