The Five Times Sit to Stand Test in Senior Athletes

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ABSTRACT

Background and Purpose: The Five Times Sit to Stand Test (FTSST) has been established as a valid and reliable functional measure for older adults. Norms have been clearly defined for community-dwelling older adults and can be useful in the identification of mobility decline and prediction of future disability. However, because of the high rates of inactivity in the population of community-dwelling older adults, it seems inappropriate to compare high-functioning older adults, for example, senior athletes, to these norms. With trends showing increased senior athlete participation, new norms may be necessary to appropriately evaluate this population of older adults. The purpose of this study was to (1) compare results of the FTSST in senior athletes older than 60 years to norms for community-dwelling adults of the same age (2) determine the effects of age, gender, and sport intensity on FTSST performance in senior athletes, and (3) establish norms appropriate for this population of interest.

Methods: The FTSST was performed on 276 (104 men, 172 women) senior athletes age 50 to 91 years (mean age = 64.9, SD = 15) reporting an average of 4 hours of cardiovascular training and 1 hour of strength training each week. All were actively engaged in national or state senior game competitions.

Results: All participants were able to complete the test. One hundred ninety-four participants between 60 and 89 years of age showed significantly faster times than currently reported norms. Performance was negatively associated with age, but did not differ significantly between genders. Participants in more physically demanding sports did show the best FTSST times, although athletes engaged in more leisure sports still outperformed norms for community-dwelling seniors.

Conclusion: Senior athletes show significantly greater FTSST speed than norms derived from community-dwelling older adults. New normative guidelines are presented to assist the screening of these athletes on this functional performance measure.

Key Words: chair stand, normative data, older adults, senior games, senior olympics.

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INTRODUCTION

There is growing literature supporting the use of functional performance measures for assessment of geriatric patients and clients and to predict future functional loss.[1,2] The Five Times Sit to Stand Test (FTSST) is a simple, quick measure of function often used for this purpose. This measure has significant correlations not only with lower extremity strength,[3-6] but with balance,[7-10] step execution time,[4,9] cognitive status,[11] and vestibular function.[7,12] It also predicts disability[13] and falls.[8,14,15] Wang and colleagues[1] found that the FTSST outperformed 6 other functional measures in predicting mobility decline among community-dwelling seniors. Intrarater,[3] interrater,[3,8] and test-retest reliability[3,8,15-17] estimates have consistently been good to excellent and are reliable even among amateur raters.[3]

Normative data for the FTSST have been reported in several studies.[10,17,18] A recent, thorough meta-analysis by Bohannon[19] yielded mean scores by age decade for community-dwelling seniors. However, community-dwelling seniors, as a group, have demonstrated very low physical activity levels.[20-22] While the general population of aging adults is showing high rates of inactivity, several authors have noted a trend toward increased participation in competitive events for senior athletes.[23-25] For the purpose of this article, we will define a senior athlete as an individual older than 50 years who participates in sport competition. Numbers reported by the National Senior Games Association show that while the first National Summer Senior Games event in 1987 hosted 2500 athletes,

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that number has grown steadily and stayed consistently over 10 000 since 2003.[26] With these trends, we expect increasing demands for measures and norms that are more applicable to senior athletes. Accurate normative data for this population may provide more opportunities to identify a relative mobility decline, prevent injury or disability, and ultimately promote continued physical fitness for these active senior athletes.

The objective of this study was to (1) compare results of the FTSST in senior athletes older than 60 years to norms for community-dwelling adults of the same age, (2) determine the effect of age, gender, and sport intensity on FTSST performance in senior athletes, and (3) establish norms appropriate for this population of interest.

METHODS

All participants were athletes, older than 50 years, registered in either the 2011 National Senior Summer Games or the 2011 South Dakota Senior Games. Each participant volunteered to be tested as a part of a larger 15-minute fitness screen. Testing was based on participant availability and therefore occurred before or after their sport competition or on a rest day between competitions. Participants were tested individually in a secluded area reserved for screening and were not tested at the same time, thus avoiding the possibility of competition between participants. This study was approved by the University of South Dakota Institutional Review Board, and all participants signed an informed consent to participate.

The FTSST was administered as described by Duncan and colleagues[8] with participants seated in a chair 43 cm from the ground. Participants were instructed to stand and sit 5 times as quickly as possible with their arms crossed over their chests. The test was demonstrated, but no practice session was allowed. Timing began when the tester said "go" and was stopped when the participant resumed contact with the chair after the fifth stand. Time was recorded to the nearest hundredth of a second.

As a part of the larger screen subjects also self-reported their registered events and estimated time spent each week on cardiovascular and strength training activities.

Data Analysis

The mean time to complete the FTSST and SD were calculated for age groups 50 to 59, 60 to 69, 70 to 79, 80 to 89, and 90 to 99 years. To improve the accuracy of data reports, participants were grouped into 2 categories of sport intensity based on their registered events: (1) active sports (AS) and (2) leisure sports (LS) (Table 1). AS were defined as those sports activities that provide the opportunity for strength or cardiovascular challenges such as the triathlon or basketball events. LS were those activities determined to have limited opportunity for strength or cardiovascular challenges such as shuffleboard or horseshoes. Participants grouped as LS did not report participation in any AS. The mean for decades 60+ was compared with available normative data[19] using Type III sum of squares due to differences in the group size. An omnibus ANOVA was used to simultaneously test for differences by age, gender, and sport intensity (AS or LS).

RESULTS

All 276 participants were able to complete the FTSST. The average age was 64.9 years (SD = 15). There were 104 men and 172 women. One hundred ninety-four were between the ages of 60 and 89. The mean FTSST time and standard deviation for each age-decade are reported in Table 2. Across each age category, all FTSST mean times were significantly faster than current reported norms[19] for community-dwelling adults over age 60. We also computed effect sizes (Cohen's *d*) for each of the tests between previously published norms and the athlete's means. Effect sizes are important for assessing *clinical*, as opposed to *statistical* significance. Generally, *d*s greater than 0.80 are considered large.[27] All effects reported here were large, ranging from 1.00 to 2.36. This implies that senior athletes perform significantly and *substantially* better than their community-dwelling counterparts. We have included descriptive statistics for the 50 to 59 and 90 to 99 years age groups for clinical use, although we did not have published norms for comparative analyses.

The significant omnibus ANOVA predicting FTSST time by age group, gender, AS versus LS, and all interactions

Table 1. Sport Intensity and Self-reported Training

Sport Intensity	Events Included	Cardiovascular Training, min/wk		Strength Training, min/wk	
		Mean	SD	Mean	SD
Active sport[a] (N = 262)	Badminton, basketball, cycling, pickle ball, race-walking, racquetball, road races (5K, 10K), softball, swimming, table tennis, tennis, triathlon, track & field, volleyball	253	221.7	68	77
Leisure sport[b] (N = 14)	Archery, bowling, golf (with cart), horseshoes, shuffleboard	131	208	45	62
Difference between groups		*P* = .07		*P* = .29	

[a]Activities that provide the opportunity for strength or cardiovascular challenge.
[b]Activities with limited strength or cardiovascular challenge.

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Table 2. Differences Between Community Norm FTSST Times (in seconds) and Senior Athletes

	Community-Dwelling Norm[19]	Senior Athletes			Difference	
Age Group (Average Age), y	Mean	N	Mean	SD	*P*	Cohen's *d*
50-59 (50.46)	NA	78	6.73	1.86		
60-69 (64.83)	11.4	106	7.26	4.13	<.0001	1.00
70-79 (74.42)	12.6	68	8.11	1.90	<.0001	2.36
80-89 (83.54)	12.7	21	9.18	2.87	<.0001	1.22
90-99 (91.05)	NA	3	10.39	2.10		

Abbreviation: NA, not applicable.

was significant and thus controls for experiment-wise error ($F = 2.60$, $P = .0012$). Experiment-wise error refers to the compounding chance for incorrectly rejecting a null hypothesis with each successive hypothesis test on a given study data set. Using an omnibus test reduced the chance that any of the analyses successively reported here were the result of alpha inflation due to multiple independent hypothesis tests.

Among the significant effects, FTSST times increased significantly for each older decade ($F = 3.69$, $P = .0061$; see Table 2). There was no difference between genders ($F = 1.73$, $P = .19$). However, there was a significant difference between the AS (mean = 7.39) and LS (mean = 9.51) groups ($F = 5.88$, $P = .02$). Not surprisingly, the difference in reported cardiovascular training times between these groups (see Table 1) did approach significance with a moderate effect size ($P = .07$, $d = 0.49$, statistical power = 0.45). Despite these differences, the LS group still performed the FTSST significantly faster than current norms, that is by 3.08 seconds on average, than previously published norms ($t = 4.45$, $P < .001$).[19]

There was also a significant interaction between age group and whether the subject participated in an AS or LS ($F = 2.70$, $P = .046$). Simple effects analyses revealed a significant difference in the 80 to 89 year age group between AS and LS. Specifically, subjects aged 80 to 89 years who participated in LS took significantly longer (mean = 13.71) to complete the FTSST than the AS participants in the same age group (mean = 8.70) ($F = 7.22$, $P = .01$). No other main or interaction effects were significant.

DISCUSSION

Currently available normative data for the FTSST suggest that times greater than 12 seconds[19] to 15 seconds[14] indicate poor performance for community-dwelling seniors. Our results suggest that the population of senior athletes is indeed in need of its own normative guidelines. On the basis of our findings, we propose that a senior athlete who performs the FTSST test with a time greater than 9 seconds, is performing more slowly than their athletically active peers. However, future studies will be necessary to empirically and more reliably make this estimate. It is also of value to note that women in this athletic population, unlike their community-dwelling counterparts,[10,17] show less decline in test performance than men over time, particularly after age 80.

These findings and associated normative values should assist clinicians in more accurate assessment of senior athletes. This may include those competing in senior games events, masters-level competition, or older adults consistently involved in fitness training. Furthermore, physical therapists should take note of the very obvious impact of training and sport participation on the physical function of these seniors. As we strive to promote increased physical activity across the lifespan, the performance of these active seniors should provide clear motivation. Future research is encouraged to determine the best functional measures for use in this population as well as the appropriate interpretation of these measures.

Limitations

The participants of this study were engaged in senior game competitive events near the time of testing. Thus, this environment may have fostered a more competitive attitude and motivated these participants to perform better than those who provided previous normative data. Our classification of participants into the AS and LS groups was based solely on sport registration information and may have erroneously categorized some participants. In addition, our convenience sample did not include many LS participants or participants in the oldest age categories. Ultimately, in the clinic, the decision to use these new norms on a given patient will require clinical expertise.

CONCLUSION

Senior athletes should have the opportunity to perform a physical performance measure that challenges their physical function and compares their results to other senior athletes, rather than to norms for more sedentary community-dwelling older adults. In the present article, we have tried to estimate age and activity-relevant normative statistics for such comparison and for better detection of functional decline in senior athletes.

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