

**ORIGINAL RESEARCH**

# Developing and Validating a Novel Tool to Enhance Functional Status Assessment: The Tennessee Functional Status Questionnaire (TFSQ)

Stephanie G. Vanterpool, MD, MBA, FASA, Robert E. Heidel, PhD, Kyle Snyder, MD, Tara Keil, MD, Cecilia Contreras, BS, Alexa Hartman, MS, Rebecca Higdon, MPH, and Julie Jeter, MD

**Purpose:** Functional status is a major contributor to overall health and reflects both daily activity level (performance) and maximum attainable activity level (capacity). Existing assessment tools evaluate only 1 domain of function and do not provide insight into contributors to functional decline. We addressed these deficiencies by developing the Tennessee Functional Status Questionnaire (TFSQ), which reports activity levels in metabolic equivalents (METs) and evaluates 5 key areas: performance, capacity, activity, pain, and acute care. We validated the activity levels reported by the TFSQ against the Duke Activity Status Index (DASI).

**Methods:** In this prospective, observational study, 120 patients completed both the TFSQ and the DASI. TFSQ-reported functional performance and capacity was correlated with DASI-calculated METs.

**Results:** Pearson correlation between TFSQ-reported capacity and DASI-calculated METs was  $r = 0.69$ ,  $P < .001$ . TFSQ capacity was significantly lower in patients who reported recently decreased activity, pain affecting function, or recent acute care exposure.

**Conclusions:** The TFSQ is a brief and efficient assessment of patient function, standardized to METs and validated against the DASI. Our study suggests that many patients may have the functional reserve to increase daily physical activity and that factors such as changes in activity, pain, and recent acute care interaction may lower functional capacity. (J Am Board Fam Med 2023;00:000–000.)

**Keywords:** Chronic Disease, Exercise, Functional Performance, Functional Status, Geriatrics, Health Promotion, Metabolic Equivalent, Surveys and Questionnaires, Tennessee

## Introduction

In today's fast-paced, outcomes-focused health care environment, it is important to have brief and

efficient tools that enhance holistic clinical assessment. Patient physical activity and function is one area that is often inconsistently assessed. Patient physical activity level is a major predictor of overall health and mortality<sup>1</sup> and is dependent on a patient's functional status. A patient's *functional status* reflects the person's "ability to perform daily activities required to meet basic self-care needs and maintain health and wellbeing"<sup>2</sup> and is composed of both the patient's *functional performance* (usual daily physical activity) and the person's *functional capacity* (maximal attainable physical activity). Functional capacity may or may not exceed functional performance, depending on the amount of functional reserve a patient possesses (Figure 1). Functional status can be affected by the presence of pain<sup>3</sup> or by recent acute care episodes (emergency department

This article was externally peer reviewed.

Submitted 29 July 2022; revised 7 October 2022; accepted 11 October 2022.

This is the Ahead of Print version of the article.

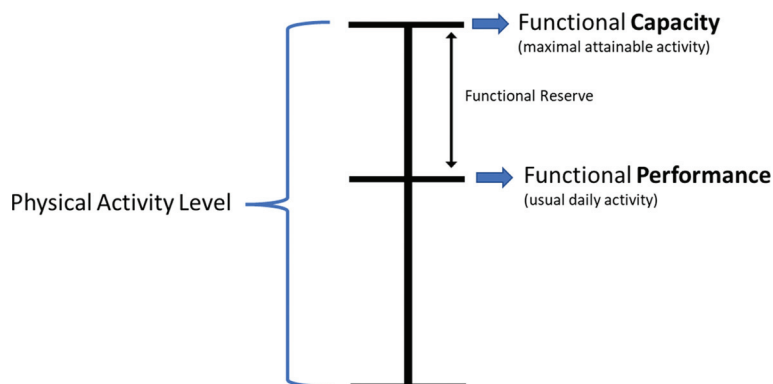
From the Department of Anesthesiology, University of Tennessee Graduate School of Medicine, Knoxville, TN (SGV, KS, TK, CC); Department of Surgery, University of Tennessee Graduate School of Medicine, Knoxville, TN (REH); Department of Family Medicine, University of Tennessee Graduate School of Medicine, Knoxville, TN (AH, RH, JJ).

**Funding:** none.

**Conflict of interest:** The authors have no conflicting or competing interests to disclose.

**Corresponding author:** Stephanie G. Vanterpool, MD, MBA, FASA, 1934 Alcoa Hwy, Bldg D-474, Knoxville, TN, 37920 (E-mail: Svanterpool@utmck.edu).

**Figure 1. Graphical depiction of the components of functional status. Functional status is composed of both functional performance and functional capacity. Functional performance reflects usual physical activity level. Functional capacity is the maximal attainable physical activity level. Functional reserve is the difference between functional performance and functional capacity.**



[ED] visit, hospitalization, or surgery).<sup>4</sup> Proactively identifying a patient’s functional status can guide a clinician to facilitate and evaluate treatment, set treatment goals, and help prevent a patient’s further functional decline.<sup>5–7</sup>

Objective reporting of physical activity can be challenging due to the variability of physical activity intensity. One method of standardizing function is to convert reported physical activity levels into corresponding metabolic equivalents (METs), with 1 MET being the patient’s energy expenditure at rest, or the amount of oxygen consumed while at rest.<sup>8</sup> Functional capacity is therefore often reported in METs.<sup>9</sup> Functional capacity in METs can be objectively assessed by using direct measurement (exercise stress testing)<sup>9</sup> or validated activity questionnaires such as the 12-question Duke Activity Status Index (DASI).<sup>10</sup> These existing methods are limited in that they require complex equipment or only assess maximal attainable physical activity, which is just 1 component of functional status. In addition, none of these assessment methods directly report on functional performance, functional trajectory, or factors known to affect functional capacity. There currently is no time-efficient tool that can be used by clinicians at point-of-care to establish a patient’s functional status at baseline, reassess following a health event, and establish a trajectory of functional recovery.

We sought to address these deficiencies in functional status assessment by developing and validating a patient-reported survey instrument that

would be brief, be easy to score, and indicate specific areas for attention and potential intervention. These efforts led to the development of the novel 5-question survey instrument the Tennessee Functional Status Questionnaire (TFSQ), which allows patients to report both their functional performance and functional capacity in METs along with identifying any activity changes, pain affecting function, or recent acute care interactions.

In this prospective observational study, we present the development of the TFSQ and the initial validation data comparing the TFSQ-reported functional capacity in METs to the functional capacity calculated from the 12-question DASI. We hypothesized that there would be at least a moderate correlation between both MET values. Further, we used the TFSQ to better understand the relationship between the 2 components of functional status and compared those responses to recent changes in physical activity and factors known to be associated with functional decline. We hypothesized that recently decreased activity level, pain affecting activity, and acute care exposure (ED visit, hospitalization, or surgery) are each independently associated with reduced functional capacity and functional performance.

## Methods

### *TFSQ Design and Development*

The TFSQ (Appendix) was developed to address the aforementioned deficiencies in functional status

assessment. We identified 2 components that would be necessary to accomplish this goal. The first was a simple table of activities from which patients could select their respective activity levels (functional performance or functional capacity) and identify their level of energy expenditure in METs (Table 1). The activities were chosen to represent a broad range of familiar self-care, caregiver, indoor, outdoor, and sporting activities. The associated energy expenditure in METs for each activity was determined from the Compendium of Physical Activities,<sup>8</sup> a listing of more than 800 specific activities with associated measured or calculated MET values. The activities were then grouped according to similar levels of energy expenditure into 5 ordinal columns of activities (A–E) representing MET values of <3METs to >6METs (Table 1).

The second component of the TFSQ was the specific questions that were asked to generate a more robust functional assessment picture (Table 2). Each question (TFSQ 1 to 5) was chosen and carefully worded to assess a separate component of function. *Performance* (TFSQ 1) assesses functional performance, asking patients to rate their *usual* level of activity by selecting the appropriate column (A–E) from the activity table. *Capacity* (TFSQ 2) assesses functional capacity by asking patients to rate their *best* level of activity using the same columns of activities

(A–E). *Activity* (TFSQ 3) assesses for recent (within the past 60 days) changes in physical activity level. *Pain* (TFSQ 4) assesses if the respondent has pain that limits physical activity. *Acute care* (TFSQ 5) evaluates if the respondent had acute care exposure through an ED visit, hospitalization, or surgery in the past 60 days. The entire TFSQ was then assessed for readability using SMOG<sup>11</sup> and Flesch-Reading Ease<sup>12</sup> to ensure it was between 3rd-grade and 6th-grade reading level.

### Participants and Setting

This internal review board–approved prospective observational study compared patient responses on the TFSQ with responses to the DASI across 2 sites: the Family Medicine Clinic (UFP) and the Chronic Pain Clinic (Pain Clinic). Our inclusion criteria consisted of patients over age 18 presenting for well visits (UFP) or new patient consults (Pain Clinic) who were willing and able to independently complete both questionnaires. Exclusion criteria consisted of patients under age 18 or those who were unwilling or unable to independently complete both questionnaires. All participants completed both the DASI and the TFSQ during the same visit. To account for potential respondent biases, the order of the DASI and TFSQ were counterbalanced randomly as to which survey

**Table 1. Columns of Activities, Grouped by Metabolic Equivalents (METs), for Tennessee Functional Status Questionnaire (TFSQ) Questions 1 and 2**

Columns for TFSQ 1 and 2				
A (<3 METs)	B (3 to <4 METs)	C (4 to <5 METs)	D (5 to <6 METs)	E (≥ 6 METs)
<ul style="list-style-type: none"> <li>• Self-care—shower/wash, dress, use bathroom, eat</li> <li>• Shop at store, make food</li> <li>• Walk around house</li> <li>• Sit at computer</li> <li>• Ride mower, water grass</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column A, and at least 1 activity below:</li> <li>• Child care—lift a child</li> <li>• Sweep/vacuum/clean inside house</li> <li>• Walk the dog/walk on flat firm surface</li> <li>• Trim shrubs or trees, use leaf blower</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column B, and at least 1 activity below:</li> <li>• Elder care, care for disabled adult</li> <li>• Sweep outside house, sidewalk, or garage</li> <li>• Push a wheelchair/walk fast while holding less than 25 pounds</li> <li>• Push a power mower, rake lawn, play golf (walk and pull clubs)</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column C and at least one activity below:1</li> <li>• Walk/run—play with children—vigorous only active periods</li> <li>• Carry 1-pound to 15-pound load upstairs</li> <li>• Walk fast on a flat surface (4 mph) (walk a mile in 15 minutes)</li> <li>• Softball or baseball; tennis, doubles; health club/gym workout</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column D and at least 1 activity below:</li> <li>• Move furniture, household items, carry boxes</li> <li>• Walk 3.5 mph (very fast) up hill</li> <li>• Jog, singles tennis, basketball game, hard workout (high-impact aerobics)</li> </ul>

Activities in each column are grouped by intensity level, reported as multiples of the patient’s baseline metabolic rate. 1 MET = a patient’s baseline metabolic rate (amount of oxygen consumed at rest). For example: 3 METs = physical activity intensity equal to approximately 3 times the patient’s baseline metabolic rate. Abbreviation: METs, metabolic equivalents.

**Table 2. Tennessee Functional Status Questionnaire (TFSQ): TFSQ Questions 1–5 Ask Details about Functional Performance, Capacity, Activity, and Acute Care. Questions 1 and 2 Refer to Columns A–E Listed in Table 1. (See Appendix for the Complete Instrument)**

Item	Category	Question
TFSQ 1	Performance	1) Choose the column that best matches what you <i>usually</i> do in a day (your usual activity level) (circle one) Column: A B C D E
TFSQ 2	Capacity	2) Choose the column that best matches what you <i>can</i> do on your <i>best</i> day (circle one) Column: A B C D E
TFSQ 3	Activity level	3) In the past 60 days has your <i>usual</i> activity level <i>changed</i> ? a. I am now <i>more</i> active than I was 60 days ago. b. I am now <i>less</i> active than I was 60 days ago. c. My activity level is the <i>same</i> as it was 60 days ago.
TFSQ 4	Pain	4) In the past 60 days have you had <i>pain</i> that affects your activity level? a. Yes b. No
TFSQ 5	Acute care	5) In the past 60 days have you gone to the <i>ER/hospital</i> or had a <i>surgery</i> ? a. Yes b. No

Note: Columns of activities for TFSQ 1 and 2 are shown in Table 1.

instrument was completed first. The data were collated using Research Electronic Data Capture (REDCap) software (Vanderbilt University, Nashville, TN).

### **TFSQ Validation and Analysis**

Our primary objective was to validate the functional *capacity* (TFSQ 2) MET values reported by the TFSQ to the MET values calculated from the DASI. The DASI is a validated 12-question patient-reported measure of functional capacity<sup>10</sup> that asks participants what they “can” do, with the sum of each weighted answer calculating an index value. A published and validated formula is then used to convert this to METs.<sup>10</sup> The American College of Cardiology/American Heart Association recommends using the DASI in preoperative risk assessment to determine functional capacity.<sup>9</sup> Our secondary analysis evaluated the relationship between functional performance and functional capacity as they related to each other and then further associated each component with recent change in physical activity level, presence of pain affecting activity, and recent acute care exposure (ER/hospitalization/surgery).

### **Statistical Power**

An a priori sample size calculation was performed with the following parameters: 2-tailed hypothesis,

$\alpha$  value of 0.05,  $\beta$  value of 0.20, null hypothesis of  $r=0.00$ , moderate correlation of 0.40 between the TFSQ and DASI, and an attrition rate of 30%. The sample size calculation yielded a needed sample size of  $n = 66$  based on the stated parameters.

### **Statistical Methods**

Frequency and descriptive statistics were used to describe the demographic characteristics of the sample. The MET values from the DASI instrument were calculated using the associated scoring rubric.<sup>10</sup> The METs reported from TFSQ 2 (functional capacity) were validated against the METs calculated from the DASI. Frequency statistics were used to calculate the number of missing observations. Missing data were assessed for randomness using MCAR (missing completely at random) analysis. Pearson’s  $r$  correlation was employed to test for significant associations between the MET values from TFSQ question 2 and the MET values derived from the DASI to generate convergent validity evidence. The statistical assumption of homogeneity of variance for the ordinal columns of responses (A–E) to TFSQ questions 1 and 2 and the categorical responses to questions 3, 4, and 5 was assessed using Levene’s test of equality of variances.

Cross-tabulation tables were used to assess the level of concordance between functional *performance* (TFSQ 1) and *capacity* (TFSQ 2). An independent



samples *t*-test was performed to compare the respondents' answers to *performance* and *capacity* (TFSQ questions 1 and 2) across *activity* (TFSQ 3) responses. Independent sample *t*-tests were also used to compare the respondents that responded yes or no on *pain* (TFSQ 4) on their respective average answers to *performance* and *capacity* (TFSQ 1 and 2). The same analysis was used to compare those who responded yes or no to recent exposure to *acute care* (TFSQ 5). Means and SDs for the TFSQ question comparisons were reported and interpreted using numeric values 1 to 5 to associate with the TFSQ ordinal columns A through E.

The statistical analyses were performed using SPSS Version 28 (IBM, Armonk, NY), and statistical significance was assumed at an  $\alpha$  value of 0.05.

## Results

A total of  $n = 120$  patients participated in this study. The sample was primarily female ( $n = 77, 65.3\%$ ), white ( $n = 106, 92.2\%$ ), and non-Hispanic ( $n = 102, 97.1\%$ ). The frequency and descriptive statistics of the patient sample and their responses to the TFSQ questions are presented in Table 3. Missing data for each of the TFSQ questions are also reported in Table 3. MCAR analysis showed that the missingness in the data set was random, therefore we continued with the statistical analysis. We decided not to impute any values at this juncture as we sought to generate validity evidence for the TFSQ.

### Correlation of TFSQ with DASI

Pearson's *r* correlations yielded evidence of convergent validity with statistically significant positive correlations between the TFSQ-reported functional capacity in METs (TFSQ 2) and the DASI-calculated METs,  $r = 0.690, P < .001$  (Figure 2). There was also a positive correlation between TFSQ-reported performance (TFSQ 1) and the MET values generated by the DASI,  $r = 0.565, P < .001$ . Both correlations are considered strong effects as defined by Cohen.<sup>13</sup>

### Functional Performance (TFSQ 1) and Capacity (TFSQ 2)

The difference in frequency distribution between functional *performance* (TFSQ 1) and functional *capacity* (TFSQ 2) is shown in Figures 3a and 3b. The cross-tabulation analysis showed that there

was concordance between the responses to TFSQ 1 and TFSQ 2 46.1% of the time ( $n = 47$  respondents out of a total of 102). The cross-tabulation tables also showed that the discordance between the responses to TFSQ question 1 and TFSQ question 2 was greater than 2 (2) column deviations 20.6% of the time (21/102 respondents).

### Activity (TFSQ 3)

There was a statistically significant difference in both performance (TFSQ 1) and capacity (TFSQ 2) for persons reporting less *activity* (TFSQ 3) in the past 60 days, compared with those who reported no change or being more active. Those reporting being less active in the past 60 days had significantly lower reported performance,  $P = .048$ , and functional capacity (TFSQ 2),  $P = .047$ . This also held true for the calculated DASI MET values, with patients reporting that they were less active reporting significantly fewer METs than more active ( $P = .002$ ) and no change ( $P < .001$ ). See Table 4 for the relevant means and SDs.

### Pain (TFSQ 4)

Patients reporting yes to *pain* (TFSQ 4) had significantly lower functional performance (TFSQ 1),  $P = .009$  ( $n = 70$ ), and functional capacity (TFSQ 2),  $P < .001$  ( $n = 66$ ) than those who reported no pain. See Table 4 for the relevant means and SDs. The mean DASI-reported MET value was also significantly lower for those respondents reporting pain versus no pain,  $P < .001$  (Table 4).

### Acute Care (TFSQ 5)

Patients reporting yes to *acute care* (TFSQ 5, ED/hospitalization or surgery in the past 60 days) had significantly lower functional capacity (TFSQ 2) than those who reported no,  $P = .017$  ( $n = 20$ ; see Table 4). The mean DASI-reported METs were also significantly lower for patients answering yes to acute care (TFSQ 5) versus those who answered no ( $P = .003$ ) (Table 4).

## Discussion

We developed the TFSQ to enhance functional status assessment by evaluating both functional performance and functional capacity in METs and provide actionable information on activity, pain, and acute care effects on function. We validated the

**Table 3. Characteristics of Sample and Responses to Tennessee Functional Status Questionnaire (TFSQ) Questions (Study Participants, Demographics, and Descriptive Statistics)**

Variable	Response	M (SD) or Frequency (%)
Age (n = 120)	-	58.52 (14.93)
Height (n = 115)	-	65.93 (4.11)
Weight (n = 117)	-	189.49 (53.29)
Site (n = 120)	Pain clinic	56 (46.7%)
	University Family Physicians (UFP)	63 (52.5%)
	Missing	1 (0.8%)
Gender	Man	41 (34.25%)
	Woman	77 (64.2%)
	Missing	2 (1.7%)
Race	Caucasian	106 (92.2%)
	African American	6 (5.0%)
	Asian	2 (1.75)
	Other	1 (0.8%)
	Missing	5 (4.2%)
Ethnicity	Non-Hispanic	102 (85.0%)
	Hispanic	3 (2.5%)
	Missing	15 (12.5%)
Performance (TFSQ 1)	A (<3 METs)	48 (40.0%)
	B (3 to <4 METs)	18 (15.0%)
	C (4 to <5 METs)	12 (10.0%)
	D 5 to < 6 METs)	22 (18.3%)
	E (>= 6 METs)	6 (5.0%)
	Missing	14 (11.7%)
Capacity (TFSQ 2)	A (<3 METs)	30 (25.0%)
	B (3 to <4 METs)	14 (11.7%)
	C (4 to <5 METs)	12 (10.0%)
	D 5 to < 6 METs)	21 (17.5%)
	E (>= 6 METs)	27 (22.5%)
	Missing	16 (13.3%)
Activity (TFSQ 3)	More active	14 (11.7%)
	Less active	41 (34.7%)
	No change	63 (52.5%)
	Missing	2 (1.7%)
Pain (TFSQ 4)	No	39 (32.5%)
	Yes	78 (65.0%)
	Missing	3 (2.5%)

*Continued*

**Table 3. Continued**

Variable	Response	M (SD) or Frequency (%)
Acute care (TFSQ 5)	No	95 (79.2%)
	Yes	23 (19.2%)
	Missing	2 (1.6%)

Abbreviations: METs, metabolic equivalents; SD, standard deviation.

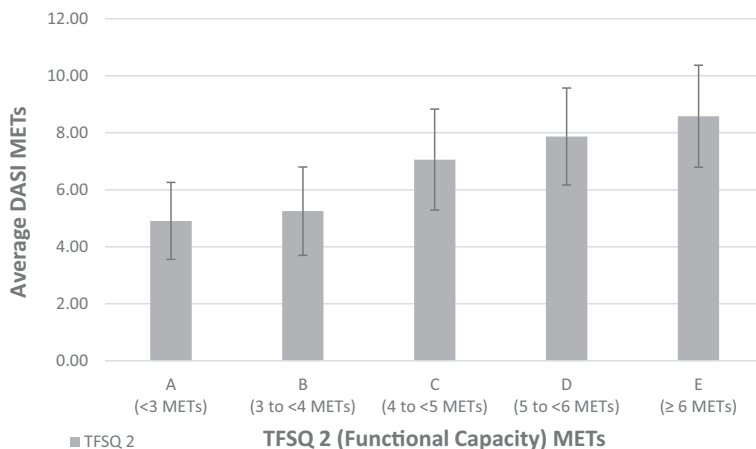
METs reported by the TFSQ by correlating them with the MET values calculated from the DASI. We further used the TFSQ to assess how both components of functional status relate to change in activity, presence of pain affecting activity, and recent ED visits, hospitalization, or surgery. In doing so we were able to capture a quantifiable functional status snapshot of the participating subjects while also gaining insight into factors that may affect their functional status.

Our data showed a strong correlation between functional capacity (TFSQ 2) and DASI METs ( $r=0.69, P<.001$ ). This provides robust psychometric evidence that the self-selection of best activity level from 1 of the 5 TFSQ activity columns (Table 1) provides an adequate estimation of patient functional status compared with the 12-question DASI. There was also a statistically significant correlation between functional performance (TFSQ 1) and

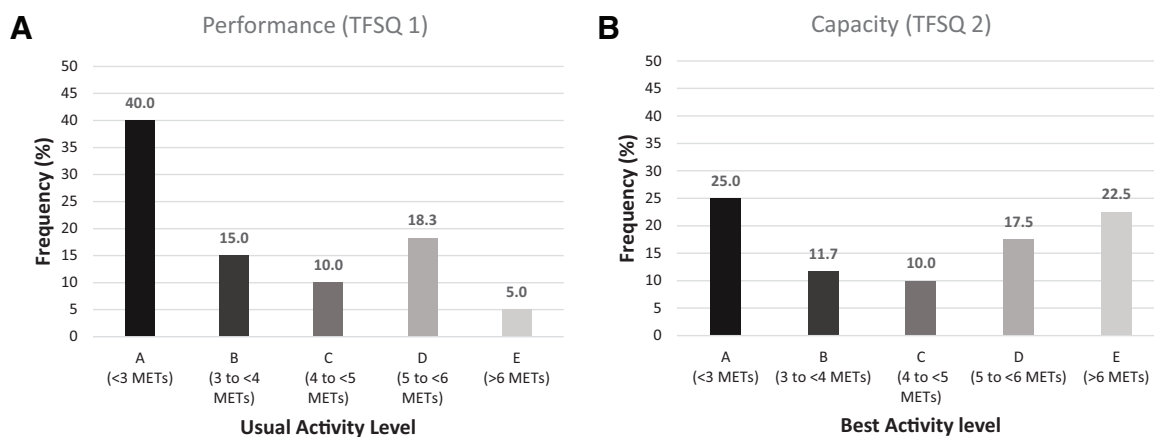
DASI METs ( $r=0.565, P<.001$ ), although this correlation was expected not to be as strong as the correlation between functional capacity (TFSQ 2) and DASI because functional performance is often not as intense as functional capacity.

Indeed, one key finding in our study was the difference in distribution between functional *performance* (TFSQ 1) and functional *capacity* (TFSQ 2) in the sample (Figure 3). We found that TFSQ-reported functional performance was skewed to lower MET values, with 40% of respondents selecting column A (<3 METs), and only 5% of patients selecting column E (>6 METs). However, when the same patients were asked to report their functional capacity, only 25% of patients selected column A, with 22.5% of patients indicating they could perform activities of >6 METs. These findings suggest there is an opportunity to encourage additional physical activity in our patients, as many

**Figure 2. Distribution of mean Duke Activity Status Index (DASI) metabolic equivalents (METs) per corresponding Tennessee Functional Status Questionnaire (TFSQ) response. TFSQ 2 assesses functional capacity; that is, a patient’s maximal attainable level of physical activity. Standard deviation (SD) represented by error bars. Statistically significant positive correlations between the TFSQ 2-reported METs (functional capacity) and DASI-calculated METs. Pearson’s  $r$  correlation  $r = 0.690, P < .001$ .**



**Figure 3 A: Frequency distributions for Tennessee Functional Status Questionnaire (TFSQ) 1—functional performance. Patients selected their usual activity level from 1 of 5 columns of activities (A–E) grouped according to Metabolic Equivalents (METs) (<3 METs to >6 METs). B: Frequency distributions for TFSQ 2—functional capacity. Patients selected their best activity level from 1 of 5 columns of activities (A–E) grouped according to METs (<3 METs to >6 METs).**



patients have the capacity and functional reserve (Figure 1) to be more active in their daily lives. Another finding of interest was the discordance between TFSQ 1 and 2 (53.9%), with there being a minimum of 2-column difference in functional performance and functional capacity 20.6% of the time. Although some of the discordances may be explained by the physiologic barriers to function assessed in this tool (pain, acute care, and so forth), behavioral science suggests that there are also psychological barriers to physical activity that may need to be addressed.<sup>14</sup>

We also investigated the link between recent changes in *activity* (TFSQ 3) and functional capacity (TFSQ 2). We found that those participants who reported being less active in the previous 60 days had significantly lower functional capacity and functional performance than those who reported no change or increased activity. This reported decrease in physical activity may serve as an early warning sign of a negative functional trajectory. Awareness of this trajectory may in turn lead to opportunities for the

**Table 4. Tennessee Functional Status Questionnaire (TFSQ) Internal Consistency: Functional Performance (TFSQ 1) and Capacity (TFSQ 2), Associations with Activity (TFSQ 3), Pain (TFSQ 4), and Acute Care (TFSQ 5) (and Corresponding Duke Activity Status Index [DASI] Metabolic Equivalents [METs] for Pain and Acute Care).**

TFSQ Question	Response	Performance (TFSQ 1) M (SD)	P Value	Capacity (TFSQ 2) M (SD)	P Value	DASI METs M (SD)	P Value
Activity (TFSQ 3)	No change or more active	2.44 (1.44)		3.24 (1.59)			
	Less active	1.89 (1.16)	0.048	2.58 (1.54)	0.047		
Pain (TFSQ 4)	No	2.74 (1.34)		3.73 (1.39)		8.25 (1.57)	
	Yes	2.01 (1.32)	0.00	2.62 (1.59)	<0.001	5.74 (2.10)	<0.001
Acute care (TFSQ 5)	No	2.34 (1.34)		3.19 (1.60)		6.86 (2.24)	
	Yes	1.86 (1.42)	0.15	2.25 (1.37)	0.017	5.31 (1.92)	0.003

Abbreviations: METs, Metabolic Equivalents; SD, Standard deviation.

Means and standard deviations for the TFSQ question comparisons were reported and interpreted using numerical values 1–5 to associate with the TFSQ ordinal activity columns A through E. Participants who answered “less active” to Activity (TFSQ 3) reported significantly lower functional Performance (TFSQ 1) and Capacity (TFSQ 2) than those who answered “no change” or “more active”. Similarly, participants who reported “yes” to Pain (TFSQ 4) also reported significantly lower functional performance and capacity and significantly lower mean DASI METs. Patients reporting “Yes” to Acute Care (TFSQ 5) reported lower performance and significantly lower capacity on the TFSQ as well as significantly lower DASI METs.



clinician to intervene to prevent further functional decline.

Analysis of responses to *pain* (TFSQ 4), showed that patients who had pain that affected their daily physical activity reported significantly lower functional performance (TFSQ 1) and functional capacity (TFSQ 2) than those who did not report pain ( $P < .001$ ). TFSQ 4 prompts the clinician to assess whether the decreased physical activity is due to an inability to perform at a higher level because of limitations from pain versus being due to a possible lack of effort (see the difference between MET frequencies in TFSQ 1 and 2 [Figure 2]). Studies show that pain frequency and intensity are negatively associated with disability, and early intervention of pain is known to result in better functional outcomes.<sup>15</sup>

*Acute care* (TFSQ 5) asks about recent ED visits, hospitalization, or surgery. Affirmative answers to this question were also associated with lower functional capacity than those who answered no ( $P = .017$ ). This is consistent with the findings of Brown et al,<sup>4</sup> who noted that participants more than 75 years old with either ED visits or hospitalization had a decrease in function that did not return to baseline even after 1 year. This finding highlights the importance of clinicians proactively identifying such patients and initiating functional restoration measures such as posthospitalization rehabilitation and active physical therapy to prevent further functional decline.

This study has important limitations. One limitation of this study is the relatively homogeneous patient sample in which it was initially validated (Table 3). Further validation efforts would ideally include more diverse patient samples, along with translation to other languages. Additional versions of the table of activities (Table 1) could also be created to reflect appropriate activities for different populations or geographical regions. In addition, 47.1% of respondents were patients at a chronic pain clinic (Table 3), which may have magnified the effect of chronic pain on function, as these patients were seeking specialist treatment for their chronic pain. Another limitation of this study is the effect that recall bias and subjectivity play on patient-reported outcomes.<sup>9</sup> Other studies have shown that patient-reported outcomes often slightly underestimate the actual functional capacity.<sup>16</sup> Conversely, using that same rationale, if a patient reports a functional capacity of  $>4$  METs on the TFSQ (column

C or higher), we can more readily conclude that they are at lower risk of perioperative complications.<sup>6</sup> In the same vein, a TFSQ functional capacity of  $>5$  METs (column D or E) aligns with a lower risk of all-cause and cardiovascular-related death.<sup>5</sup> A third limitation is that this study only assessed patients' functional status at 1 point in time. Repeated assessments in the same patients may provide more robust and reliable data. This is 1 reason why trending TFSQ results over time may provide more valuable insight into the patient's functional status, such as in situations where aberrances in life circumstances may have an undue effect on overall activity.

In summary, the 5-question TFSQ is a novel tool that enhances functional status assessment by establishing a robust yet efficient functional snapshot that is relevant across multiple settings in health care. With this tool, clinicians can quickly assess whether patients have potential to increase their usual physical activity, and potentially their overall health and well-being,<sup>2</sup> by addressing any difference observed between functional performance (TFSQ 1) and capacity (TFSQ 2). In addition, by assessing both components of functional status regularly in preventive care, chronic care, and acute visits, clinicians can monitor for subtle signs of decline and establish the urgency of a referral for rehabilitation, intervention, or specialty referral to avoid permanent disability. The TFSQ may be used with various patient populations across different medical settings. For example, a family medicine physician could use the questionnaire as a tool to track patient functional status longitudinally, and an anesthesiologist might use it as a snapshot of functional status in evaluating a patient's risk level for surgery.

The TFSQ provides insight into potential reasons for functional decline, such as pain affecting activity (TFSQ 4) or recent acute care (TFSQ 5). It also allows for functional reassessment after an acute event such as hospitalization, trauma, or surgery. It is important to note that the TFSQ is not a substitute for a detailed history and physical examination. However, it may facilitate focusing those efforts on factors that may be limiting a patient's function and quality of life. To date, we know of no other validated instrument that succinctly measures all of the components assessed on the TFSQ.

Future research and clinical applications for the TFSQ may include preoperative assessment,

cardiac rehab, pain management outcomes, and palliative care interventions, where objective documentation of functional status can be beneficial for both care planning and tracking outcomes. It could also be used as a measure of the effectiveness of pain management treatments or other therapies designed to improve overall function. This tool could be used to follow patients throughout their lives, helping to establish goals of care, assess the efficacy of treatments, and engage patients in their care. It may also provide patients with insight into how change in activity, pain, or recent acute care exposure can impact their functional status and prompt educational interventions and motivation for patients to restore their function appropriately. Together, these insights can help patients and clinicians “Focus on Function” when addressing the health needs and goals of individual patients.

---

The authors would like to acknowledge Paul D. Allen, MD, PhD for his contributions to the study design and crafting of the manuscript.

To see this article online, please go to: <http://jabfm.org/content/36/1/000.full>.

## References

1. Stenholm S, Koster A, Valkeinen H, et al. Association of physical activity history with physical function and mortality in old age. *J Gerontol A Biol Sci Med Sci* 2016;71:496–501.
2. Chang T, Tamura M [Internet]. Chapter 35: Methods to assess quality of life and functional status and their applications in clinical care in elderly patients with CKD; 2009. Available from: <https://www.semanticscholar.org/paper/Chapter-35-%3A-Methods-to-Assess-Quality-of-Life-and-Chang-Tamura/d5370d5dd77d5d26bf01912ba78cdccbcc0fb6c3>.
3. Chapman JR, Norvell DC, Hermsmeyer JT, et al. Evaluating common outcomes for measuring treatment success for chronic low back pain. *Spine* 2011;36:S54–68.
4. Brown CJ, Kennedy RE, Lo AX, Williams CP, Sawyer P. Impact of emergency department visits and hospitalization on mobility among community-dwelling older adults. *Am J Med* 2016;129:1124.e9–15.
5. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *CMAJ* 2006;174:801–9.
6. Smilowitz NR, Berger JS. Perioperative cardiovascular risk assessment and management for noncardiac surgery. *JAMA* 2020;324:279–90.
7. Feinglass J, Thompson JA, He XZ, Witt W, Chang RW, Baker DW. Effect of physical activity on functional status among older middle-age adults with arthritis. *Arthritis Rheum* 2005;53:879–85.
8. Ainsworth BE, Haskell WL, Herrmann SD, et al. 2011 Compendium of Physical Activities. *Med Sci Sports Exerc* 2011;43:1575–81.
9. Strath SJ, Kaminsky LA, Ainsworth BE, American Heart Association Physical Activity Committee of the Council on Lifestyle and Cardiometabolic Health and Cardiovascular, Exercise, Cardiac Rehabilitation and Prevention Committee of the Council on Clinical Cardiology, and Council, et al. Guide to the assessment of physical activity: clinical and research applications. *Circulation* 2013;128:2259–79.
10. Hlatky MA, Boineau RE, Higginbotham MB, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). *Am J Cardiol* 1989;64:651–4.
11. McLaughlin G. SMOG grading: a new readability formula. *J Reading* 1969;12:639–46.
12. Flesch R. A new readability yardstick. *J Appl Psychol* 1948;32:221–33.
13. Cohen J. *Statistical power analysis for the behavioral sciences*. 2nd ed. Lawrence Erlbaum Associates; 1988.
14. André N, Agbangla NF. Are barriers the same whether i want to start or maintain exercise? A narrative review on healthy older adults. *IJERPH* 2020;17:6247.
15. Olsson IT, Alberts NM, Li C, et al. Pain and functional outcomes in adult survivors of childhood cancer: a report from the St. Jude Lifetime Cohort study. *Cancer* 2021;127:1679–89.
16. Weinstein AS, Sigurdsson MI, Bader AM. Comparison of preoperative assessment of patient’s metabolic equivalents (METs) estimated from history versus measured by exercise cardiac stress testing. *Anesthesiol Res Pract* 2018;2018:5912726.

## Appendix. Tennessee Functional Status Questionnaire Instrument

Tennessee Functional Status Questionnaire (TFSQ) -Version 9 (9/19/2020)      DATE \_\_\_\_\_

Please use the table below to answer Questions 1 and 2:

A	B	C	D	E
<ul style="list-style-type: none"> <li>• Self-Care – shower/wash, dress, use bathroom, Eat</li> <li>• Shop at store, make food</li> <li>• Walk around house</li> <li>• Sit at computer</li> <li>• Ride mower, water grass</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in Column A, <b>and</b> at least one activity below:</li> <li>• Child care – lift a child</li> <li>• Sweep/Vacuum/Clean inside house</li> <li>• Walk the Dog/ Walk on flat firm surface</li> <li>• Trim shrubs or trees, use leaf blower</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in Column B, <b>and</b> at least one activity below:</li> <li>• Elder care, care for disabled adult</li> <li>• Sweep outside house, sidewalk, or garage.</li> <li>• Push a wheelchair/ Walk fast while holding less than 25 lbs</li> <li>• Push a power mower, Rake lawn, Play Golf (walk and pull clubs)</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column C <b>and</b> at least one activity below:</li> <li>• Walk/run - play with children - vigorous only active periods</li> <li>• Carry 1-15lb load upstairs;</li> <li>• Walk fast on a flat surface (4mph) (walk a mile in 15 minutes)</li> <li>• Softball or baseball; Tennis, doubles; Health club/gym work out</li> </ul>	<ul style="list-style-type: none"> <li>• Activities in column D <b>and</b> at least one activity below:</li> <li>• Move Furniture, household items, carry boxes</li> <li>• Walk 3.5mph (very fast) up hill</li> <li>• Jog, singles tennis, basketball game, hard work out (high impact aerobics)</li> </ul>

1. Choose the column that best matches what you **usually** do in a day (your usual activity level) (circle one)

Column:      A                      B                      C                      D                      E

2. Choose the column that best matches what you **can** do on your **best** day (circle one)

Column:      A                      B                      C                      D                      E

3. In the last 60 days, has your **usual** activity level **changed**? (circle one)

- I am now **more** active than I was 60 days ago.
- I am now **less** active than I was 60 days ago.
- My activity level is the **same** as it was 60 days ago.

4. In the last 60 days, have you had **pain** that affects your activity level?

- Yes
- No

5. In the last 60 days, have you gone to the **emergency room** (ER)/**hospital** or had a **surgery**?

- Yes
- No