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Oncology Section EDGE Task Force on Breast Cancer Outcomes: A Systematic Review of Outcome Measures for Functional Mobility

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ABSTRACT

Background: Breast cancer treatments in women with breast cancer often result in physical impairments that lead to activity limitations and participation restrictions. These limitations and restrictions manifest in impaired functional mobility skills that may impact survivorship. Thus, evaluation of functional mobility is an important part of survivorship care. **Purpose:** To identify functional mobility outcome measures that possess strong psychometric properties and are clinically useful for examination of women treated for breast cancer. **Methods:** Multiple electronic databases were searched for articles published after 1995. Studies were included if they reported psychometric properties, used clinically feasible methods, were performed on adults, and published in the English language. Each outcome measure was independently evaluated and rated by two reviewers. A single Cancer EDGE Task Force Outcome Measure Rating Form was completed for each category of functional mobility, and a recommendation was made using the 4-point Cancer EDGE Task Force Rating Scale. **Results:** Of the original 819 articles found, 211 were included in this review. A total of 11 measures are recommended for clinical use: the Timed Up and Go; the 2-Minute, 6-Minute, and 12-Minute Walk Tests; 10-Meter Walk; 5 Times Sit to Stand; Short Performance Physical Battery; Physical Battery for Patients with Cancer; Functional Independence Measure (FIM); Assessment of Life Habits; and Activity Measure for Post-acute Care. **Conclusions:** Many tools are available to assess upper extremity and overall functional mobility skills in women treated for breast cancer. There are currently no tools recommended that assess community participation.

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Key Words: breast neoplasms, outcome assessment, patient-reported outcomes, psychometrics

INTRODUCTION

Breast cancer is the most common form of cancer in women in the United States with approximately 12% developing breast cancer in their lifetime.[1] In 2015, an estimated 231,840 new cases of invasive breast cancer in women will be diagnosed, and in 2011 an estimated 2,889,726 women were living with breast cancer.[1] There are approximately 3 million women diagnosed with breast cancer surviving today.[1] For all stages of breast cancer combined, the 5-, 10-, and 15-year relative survival rates are 89%, 83%, and 78%, respectively.[1] As the number of breast cancer survivors (BCS) continues to grow, many women will develop significant impairments of multiple body systems and functions.[2]

Functional mobility is an essential physical ability categorized within the activities and participation domains of the International Classification of Functioning, Disability, and Health (ICF).[3] Abilities related to changing and maintaining body position including carrying, moving, and handling objects, and walking and moving, fall under the Mobility domain.[3] The Self-Care domain contains abilities related to washing oneself, toileting, dressing, eating, and drinking, while the Domestic Life domain includes acquisition of necessities, household tasks, and caring for and assisting others.[3] The categories of functional measures evaluated in this review fall under these specific subdomains of the ICF. Whether a BCS can safely move about, complete self-care activities, and partake in domestic life must be assessed as part of the rehabilitation evaluation. Other measures used to detect and quantify impairments in functional mobility include additional upper extremity functional tests, tests for activities of

daily living, walk tests, and self-report questionnaires identifying impairments with community participation. Determining which measures of functional abilities are reliable and valid in this population provides a means for accurate and thorough assessment of function.

Treatment for breast cancer is generally comprised of surgery and adjuvant strategies. Surgical interventions include removal of the tumor and surrounding tissue or mastectomy, which is the surgical removal of the breast. Treatments may also involve radiation therapy, chemotherapy that can be administered before or after surgery, targeted therapy, and/or hormone therapy such as selective estrogen receptor modifiers, aromatase inhibitors, and ovarian ablation.[1] The impact of cancer treatments on overall function has been explored in the literature, and findings suggest that the cancer experience has a long-term negative influence on activity and participation abilities of survivors. Complications from cancer and its treatments may affect some patients' functional mobility such as their ability to lift and carry objects, handle objects, complete self-care activities, and even walk and move about to carry out these daily activities.[4-8] Nearly 25% of cancer survivors report difficulty walking,[9] reported more functional limitations than women without cancer,[10] and generally scored lower on the Short Form-36 (SF-36), a patient-reported measure that assesses health-related quality of life.[11] In a study of cancer survivors post-treatment, the majority of whom were BCS, 22% had difficulty walking and 30% had participation restrictions.[12] The Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH), a 30-item patient outcomes assessment designed to evaluate disorders of the upper limbs and monitor change or function over time, has been used to capture upper extremity dysfunction in women with or post breast cancer.[13] In survivors 6 months after diagnosis and treatment, 25.6% had a score greater than 20, where a higher score denotes greater disability. Scores greater than 20 indicate an impairment of motor function.[13] At a 6-year follow-up, 21.1% had continued dysfunction with scores above 20.[14] Certainly, researchers have established that women with limitations in upper extremity range of motion and strength also report greater difficulties with activities of daily living (ADLs) and lower overall arm function on self-reported questionnaires.[14-16] Declines in activities and participation seen in this population often translate to changes in overall quality of life.

In 1991, the Task Force on Standards for Measurement in Physical Therapy (a committee of the American Physical Therapy Association [APTA]) established the criteria for valid, reliable, objective, and standardized tests and measures to assist clinicians in providing the highest quality of care.[17] The criteria for appropriate outcome measures needs to consider the following elements: (1) measurement of a domain within the ICF; (2) purpose of the measure relevant to obtaining discriminative, predictive, or evaluative information; (3) disease specific vs. general measure; self-report vs. performance-based measure; (4) patient's ability and goals; (5) psychometric properties, particularly reliability, validity, diagnostic accuracy, minimal detectable change (MDC), and minimal clinical important difference (MCID); and (6) feasibility, including the time, equipment, cost, space, and training required to administer and score the test results, overall burden on the patient to complete the test, and consideration of cultural and language barriers.[18] The use of standardized outcome measures is an essential component of evidence-based practice and enhances the communication with patients and payers.[19] The main barriers to a standardization of physical therapy outcome measures include both the length of time and difficulty for patients to complete the test, as well as the time necessary for clinicians to administer the test and interpret the results.[19]

In 2010, the Oncology Section of the APTA created the Evaluation Database to Guide Effectiveness (EDGE) Task Force to critically review and recommend outcome measures to be used when assessing the status of cancer survivors.[20] The Breast Cancer EDGE Task Force subcommittees have provided recommendations for outcome measures in the areas of shoulder and upper quarter function,[21,22] scapular assessment,[23] strength and muscular endurance,[24] pain,[25] fatigue,[26] balance and peripheral neuropathy,[27] health-related quality of life,[28] and cardiovascular fitness.[29]

This systematic review continues the ongoing efforts of the EDGE Task Force and evaluates the ways in which functional mobility is measured clinically in individuals with breast cancer. These tools provide important information about the patient, focus intervention strategies, and measure treatment effectiveness, addressing the survivorship needs of women treated for breast cancer. The reliability, validity, MDC, and/or MCID are important psychometric properties that need to be established and assessed to justify the use of the selected outcome measures in the clinic.[18] In addition, tools used to track and measure patient outcomes should be validated in the population in which they are used to be most beneficial for the patient. Lastly, these tools need to be considered in light of clinical utility, including the availability of resources, cost, ease of use, and availability of normative data. The purpose of this systematic review is to make recommendations of the best methods to evaluate functional mobility in BCS based on psychometric properties and clinical utility.

METHODS

Search Strategy

The authors systematically investigated the literature for outcome measures that directly measured functional mobility to evaluate the psychometric properties and clinical utility for use assessing BCS. The primary literature search took place during February and March of 2014 using 8 electronic databases: Google Scholar, Ovid, PubMed/Medline, CINAHL, Sports Discus, Web of Science, Cochrane Review, and PEDro. Search terms that were used included breast cancer or neoplasm in addition to multiple terms describing functional mobility including function, mobility, and limb use. The name of established functional tests were also specifically searched (refer to Appendix 1 for full list of search terms). Note that this list exceeds the number of functional tests investigated in this review. The final list includes only those

measures that were deemed to assess functional mobility skills, and that had published reports available for analysis. It is possible that outcome measures were omitted if the search did not reveal published information on the test.

Study Selection

To be included in this review, studies (1) were published in English; (2) performed tests of functional mobility; (3) reported psychometric properties; (4) presented clinically feasible methods; and (5) included adults (≥ 18 years), preferably women. Included articles were considered if published from 1/1/1995-present. The breast cancer population took first priority within the search, however, if no studies included this population, women with other cancers, geriatric patients, and the general population were considered for review.

Data Extraction

Teams of two reviewers independently performed data extraction using the Cancer EDGE Task Force Rating Form.[20] Tests of functional mobility were categorized into one of 4 groupings: (1) upper extremity functional tests, (2) ADL functional tests, (3) walk tests, and (4) self-report community participation tests. The categories for functional mobility were selected based on the qualities and foci of the functional outcome measures. Each functional category included a series of tests and assessments. Refer to Appendix 2 for tests listed under each category. Following data extraction, reviewers independently appraised each outcome measure using all articles covering the outcome measure of interest. Outcome measures were rated 1-4 using the Cancer EDGE Task Force Rating Scale (Figure 1), taking into consideration both psychometric properties and clinical utility. Outcome measures rated differently by each reviewer were discussed with 4 primary reviewers until consensus was obtained.

RESULTS

The initial literature search for functional mobility testing in survivors of breast cancer resulted in 819 articles. The assessors reviewed all the titles and any duplicates were removed. A total of 297 articles were retrieved and assessed for eligibility. Abstract and article titles were then examined to identify studies that addressed the specific purpose of the research. After exclusions were applied, 211 articles were reviewed. See Figure 2 for flow diagram of literature search.

The number of articles reviewed for each category of tests were: (1) upper extremity functional tests—37, (2) ADL functional tests—23, (3) walk tests—101, and (4) self-report community participation tests—53. Some research studies evaluated multiple tools; therefore, the number of articles for each category is not mutually exclusive. Table 1 delineates the clinical usefulness of the recommended tests.

Eleven measures are recommended by the Breast Cancer EDGE Task Force members for use to measure the functional mobility skills of BCS in the clinic. These 11 measures are rated 3 or 4 on the Task Force rating scale. Two measures are highly recommended (4) having been used in research with breast cancer: the 6-Minute Walk Test (6MWT) and the Timed Up and Go (TUG). Nine are recommended (3): 2-Minute and 12-Minute Walk, 10-Meter Walk, 5 Times Sit to Stand, Short Performance Physical Battery, Physical Battery for Patients with Cancer, Functional Independence Measure (FIM), Assessment of Life Habits, and Activity Measure for Post-acute Care. The Task Force is unable to recommend 10 measures due to lack of psychometric support or poor clinical utility. Two measures scored a 2A: Barthel Index and Reintegration in to Normal Living; 8 scored a 2B: Canadian Occupational Performance Measure, Impact on Participation and Autonomy Questionnaire, Life Satisfaction Questionnaire, Modified Rankin Scale, Timed 25 Foot Walk, Arm Mobility Ability Test, Wolf Motor Function Test, Action Research Arm Test. Finally, 4 measures are not recommended (1): Functional Status Examination, Participation Objective Participation Subjective, Participation Survey of Mobility Limited People, and 6-Minute Arm Test. See Tables 2 (recommended outcome measures) and 3 (not recommended outcome measures) with Task Force ratings and clinical utility comments. Detailed psychometric properties of the recommended clinical measures of functional mobility testing in BCS can be found in Table 4 (supplemental online table provides detail for all reviewed outcome measures).

Discussion

The purpose of this review was to systematically identify and review methods of evaluating functional mobility in BCS and to make recommendations about these outcome measures based on psychometric properties and clinical utility. Since functional mobility comprises activities that enable an individual

4	Highly Recommend	Highly recommended; the outcome has good psychometric properties and good clinical utility. The measure has been used in research on individuals with or post breast cancer.
3	Recommend	Recommended; the outcome measure has good psychometric properties and good clinical utility. No published evidence that the measure has been applied to research on individuals with or post breast cancer.
2A	Unable to Recommend at this time	Unable to recommend at this time; there is insufficient information to support a recommendation of this outcome measure. The measure has been used in research on individuals with or post breast cancer.
2B	Unable to Recommend at this time	Unable to recommend at this time; there is insufficient information to support a recommendation of this outcome measure. No published evidence that the measure has been applied to research on individuals with or post breast cancer.
1	Do Not Recommend	Do not recommend; poor psychometrics &/or poor clinical utility (time, equipment, cost, etc.)

Figure 1. Breast Cancer EDGE Task Force rating scale.

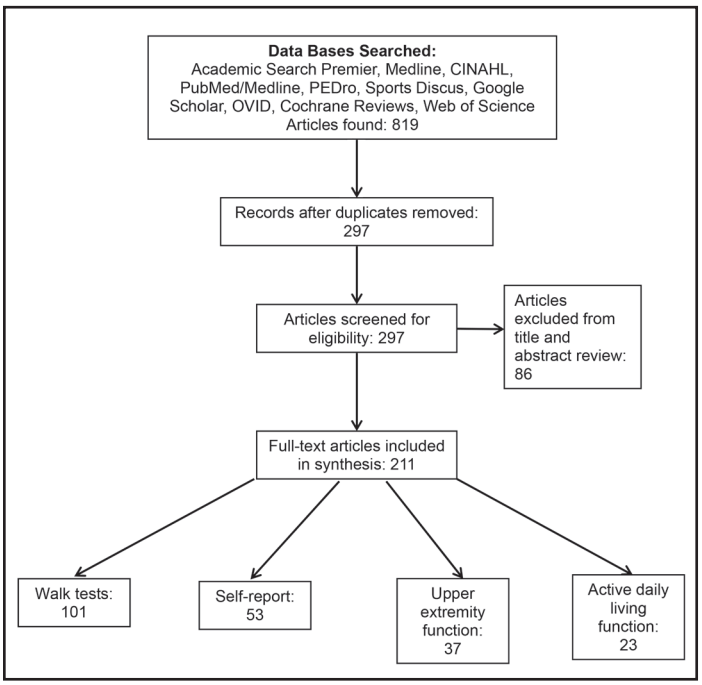

Figure 2. Flow of literature search.

to move about in their environment in order to perform ADLs and participate in life situations,[30] the measures reviewed by the Breast Cancer EDGE Task Force members span upper extremity functional tests, ADL tests, walk tests, and self-report community participation questionnaires. Eleven measures are rated 3 (recommend) or 4 (highly recommend).

The ability to complete functional mobility tasks is a necessary part of the rehabilitation experience. Although the upper limb is the most obvious body part on which to focus, overall functional mobility of BCS should be included in assessment. It is for this reason that all levels of functional mobility were evaluated in this review.

Upper Extremity Functional Tests

Of the upper extremity functional tests included in this review, only one, the Activity Measure for Post-Acute Care (AM-PAC), was recommended (rated 3). The AM-PAC assesses activity limitations based on the ICF model for patients across the post-acute care setting with varying diagnoses.[31] The AM-PAC measures activity limitations in 3 distinct domains: basic mobility, daily activities, and applied cognitive; and it is available in two formats: a computer-based version and a short form version.[32] The number of items varies depending on the format, as well as the setting (eg, in-patient vs. out-patient). The measure is very thorough and comprehensive, and has undergone substantial psychometric testing and validation, but because the instrument is meant to apply across many settings to as wide a patient population as possible, the specificity and sensitivity might be decreased. The AM-PAC was used in studies with other cancer diagnoses, but not specifically for BCS. There is a fee associated with use of the instrument and scoring is not intuitive.

Activities of Daily Living Functional Tests

Two measures, the FIM and the Assessment of Life Habits (LIFE-H), were rated 3 (recommended). The FIM is a widely used uniform measurement system for evaluating basic quality of daily living activities in persons with a disability.[33] The FIM is comprised of 18 items (13 motor tasks and 5 cognitive tasks) and assesses the amount of assistance an individual requires to complete the activities safely and effectively. Items include skills

Table 1. Clinical Usefulness of Recommended Measures

Measure	Equipment Needed	Cost	Ease of Use	Scoring/ Interpretation	Normative Data
6-Minute Walk	Yes – Stopwatch	Free	High	Easy	Yes
Timed Up & Go	Yes – Stopwatch, chair, measuring tape	Free	High	Easy	Yes
5 Times Sit to Stand	Yes – Stopwatch, standard chair	Free	High	Easy	Yes*
2-Minute Walk	Yes – Stopwatch	Free	High	Easy	Yes*
12-Minute Walk	Yes – Stopwatch	Free	High – patient may be limited by condition	Easy	Yes*
10-Meter Walk	Yes - Stopwatch	Free	Medium – varied procedures	Easy	Yes*
Short Performance Physical Batter	Yes – Stopwatch, chair, measuring tape, cones	Free	High	Easy	Yes*
Physical Battery for Patients with Cancer	No	Free	High - poor reliability for balance	Difficult	Yes*
Functional Independence Measure	Yes – varies based on category	Moderate	Low – training required	Moderate	Yes
Assessment of Life Habits	No	Minimal	High	Difficult	Yes*
Activity Measure for Post-acute Care	No	Minimal	Medium	Moderate	Yes*

*Not validated in breast cancer populations

Table 2. Recommended Outcome Measures

Measure	Breast Cancer EDGE Task Force Rating	Clinical Utility
6-Minute Walk	4	Good clinical utility, free and easy to administer. Evidence with BCS.
Timed Up and Go	4	Good clinical utility, free and easy to administer. Evidence with BCS.
5 times sit to stand	3	Good clinical utility, free and easy to administer, not used in BCS.
2-Minute Walk	3	Good clinical utility, free and easy to administer, not used in BCS.
12-Minute Walk	3	Free to administer but limited clinically with lower functioning individuals.
10-Meter Walk	3	Free and easy to administer, not used in BCS.
Short Performance Physical Battery	3	Free to administer. Not established in BCS.
Physical Battery for Patients with Cancer	3	Specific to the cancer population. May not have time to use in the clinic.
Functional Independence Measure	3	Cost to purchase. 30-40 minutes to complete. Not valid in cancer population.
Assessment of Life Habits	3	Takes time to complete with challenging scoring. Lower clinical utility.
Activity Measure for Post-Acute Care	3	CAT version available. Based on WHO ICF. Not used in BCS.

Abbreviations: BCS, breast cancer survivors; WHO, World Health Organization; ICF, International Classification of Functioning; CAT, computer assisted testing

Table 3. Outcomes Measures Not Recommended

Measure	Breast Cancer EDGE Task Force Rating	Clinical Utility
Barthel Index	2A	Not used in the cancer population.
Reintegration into Normal Living/Life Index	2A	10 minutes to complete, insufficient information to recommend at this time.
Canadian Occupational Performance Measure	2B	Fee to use. No evidence in use in BCS.
Impact on Participation and Autonomy Questionnaire	2B	30 minutes to complete, not used in cancer population.
Life Satisfaction Questionnaire	2B	10-30 minutes to complete, free, not used in cancer populations.
Modified Rankin Scale	2B	6-30 minutes to complete. Free to complete. Experience raters needed to decrease bias.
Timed 25 Foot Walk	2B	Easy to administer. Not validated in cancer population.
Arm Mobility Ability Test	2B	Lengthy time to complete and scoring is difficult. No evidence in BCS.
Wolf Motor Function Test	2B	Used in the neurological population but not used in BCS.
Action Research Arm Test	2B	Uses multiple pieces of equipment. Used in the neurological population but not used in BCS.
Functional Status Exam	1	6-30 minutes to complete. Used in the neurological population.
Participation Objective, Participation Subjective	1	6-30 minutes to complete. Not recommended, no evidence in cancer populations.
Participation Survey of Mobility Limited People	1	20-40 minutes to complete online or 60-90 minutes hard copy – lack of clinical feasibility.
6-Minute Arm Test	1	Used to assess cardiovascular fitness. No psychometric data and difficulty obtaining the equipment.
Hi-Level Mobility Assessment Tool	1	Developed specifically for high level traumatic brain injury.

Abbreviation: BCS, breast cancer survivor

related to self-care, sphincter control, transfers, locomotion, communication, and social cognition. The FIM was validated on a number of populations across a variety of settings with good psychometric properties.[34-36] The FIM is a measure that physical therapists are familiar with, and the tool has been used in studies with a BCS cohort. However, there is a cost associated with use of the FIM, training/certification is required prior to using the FIM, and it ideally is scored by consensus with a multi-disci-

Table 4. Psychometric Properties of Recommended Outcome Measures

Measure	Intra-rater Reliability	Inter-rater Reliability	Test/Re-test Reliability	Responsiveness to Change	Validity
Upper Extremity Functional Tests					
Activity Measure for Post-acute Care (not tested in cancer population)		Daily Activity: ICC = 0.90[63] Mobility: ICC = 0.86[63] Applied cognition: ICC = 0.68[63]	Daily Activity: ICC = 0.96[63] Mobility: ICC = 0.97[63] Applied cognition: ICC = 0.91[63]	MDC AMPAC Computer version[64] basic mobility =4.28 points Daily activity = 3.7 points Applied cognitive = 5.55 MDC AMPAC CAT = 2 points [65]	With SF-36: r = .84[66] With Gait speed: r = 65[66] With 6MWT: r = 0.67[66] Internal consistency Cronbach alpha Total: 0.92-0.94[67] Specific dx groups: 0.90-0.95[67]
Activities of Daily Living Functional Tests					
Functional Independence Measure (FIM) (not tested in cancer population)		ICC = 0.95[68]	ICC = 0.80 - 0.90[69,70]		With Barthel Index r = 0.92-0.94[71]
Assessment of Life Habits (LIFE-H) (not tested in cancer population)		ICC = 0.89[72]	ICC = 0.74 - 0.89[37,73,74]		With Craig Handicap Assessment and Reporting Technique: r = 0.14 - 0.76[75] With Community Integration Questionnaire: r = 0.54 - 0.75[75] Internal Consistency: Cronbach alpha = 0.82 - 0.90[75]
Walk Tests					
2-minute walk test (not tested in cancer populations)	ICC = 0.83 – 0.980[76-80] Coefficient of variation: r = .049[81]	ICC = 0.85 - 0.97[78,79,82]	ICC = 0.94 - 0.95[82]	SEM estimated ≤ 6.3m[83] MDC (older adults): 13.4 - 14 m[79,82]	With TUG: r = -0.68 - 0.87[82,83] With BBS: r = 0.88[82] With 6MWT: r = 0.93 – 0.96[82,84] With EDSS: r = -0.61[84] With MSWS-12: r = -0.72[84] With MFIS physical sub-index: r = 0.31[84]
6-minute walk test	Other populations ICC = 0.74 - 0.99[41,85]	Other populations: ICC = 0.78 - 0.99[41,85]	Cancer population: ICC: 0.93 (0.86-0.97)[40] Other populations: ICC = 0.94-0.99[44,86-92] R = 0.95[3]	Cancer population: Coefficient of repeatability: 60m[40] Small meaningful change: 20m[93] Substantial meaningful change: 50m[93]	Cancer population: With:[40] exercise capacity r = 0.67 maximum workload r = 0.70, perceived physical function r = 0.55 age r = -0.52 Other populations: With 10MWT: r = -.95[92,94] With TUG: r = -0.88[90,94,95] With Walking Index for SCI: r = 0.60[94] With 2MWT: r = 0.997[85] 12MWT: r = 0.994[85] 10m fast gait: r = 0.94[90] 10m comfortable gait: r = 0.84[90]
12-minute walk test (not tested in cancer populations)	ICC= 0.71[87]	ICC = 0.68[87]		Standardized response mean (SRM) score = 1.90[87]	
10-meter walk (not tested in cancer populations)	ICC = 0.98[41,95]	ICC = 0.97 - 0.99[41,95,96]	*R* = 0.75-0.90[97] ICC = 0.82 - 0.93[56,66,90,98-100]	MDC .013 - 0.25m/s[89,95,101,102]	With dependence in self-care: r = 0.60 - .087[102] With dependence in mobility: r = 0.34- .074[102] With dependence in domestic life: r = 0.34 - 0.74[102] With instrumental activities of daily living: *r* = 0.76[103] With Barthel Index: *r* = 0.78[103] With TUG: ICC = -0.84 to -0.91[90] With 6MWT: ICC = 0.89 – 0.95[90]

Table 4 Continued.

Measure	Intra-rater Reliability	Inter-rater Reliability	Test/Re-test Reliability	Responsiveness to Change	Validity
Walk Tests – continued					
Timed Up & Go (Cognitive & Manual)			r = 0.90[104]	MCID = 1 sec[105]	Cancer population: With falls within 1 year: r = 0.85[106] With falls within 3 months: r = 0.85[106] With falls since cancer diagnosis: r = 0.74[106] With Simmonds Performance Status Battery: r = 0.85[106] Other populations: With 5 times sit to stand: r = 0.60[104] With standing balance: r = -0.31[104] With Rapid Disability Rating Scale: r = 0.42[104] With S-36 physical function: r = -0.50[104] With 2MWT: r = 0.68 - 0.81[107]
5 Times Sit to Stand (not tested in cancer populations)		ICC=0.99[99-101]	r= 0.82 – 0.99[99-105]	MDC 2.5 – 4.2sec[101,102,106] MCID ≥ 2.3 sec[107]	With PASE: r = -0.38[99] With PDQ-mobility: r = 0.58[99] With ABC: r = 0.54 – 0.68[99,107] With Mini-BEST: r = 0.71[99] With quads MVIC: r = -0.33 – 0.65[99,108] With 6MWT: r = 0.60 – 0.75[99,108] With 5MWT: r = -0.78[100] 50 foot walk: r = 0.87[100] Repeated trunk flexion: r = 0.64[100] With DGI: r = -0.58[107]
Short Performance Physical Battery (SPPB) (not tested in cancer populations)	ICC >0.90[118]	ICC >0.90[118]	ICC = 0.82 – 0.92[118-121]	MDC 1.42 – 2.9 points (elderly)[66,93] 3.42 points (s/p hip fracture)[122]	With self-reported mobility = 89%[59] With ADL associated disability = 96%[59]
Physical Performance Battery for Patients with Cancer		r = 0.98 and 0.99[106]	r = 0.69-0.99[106]		Cancer pop: Portions correlated with TUG:[106] Walk test: r = 0.85 Sit to stand: r = 0.74 Sock test: r = 0.55 6MWT: r = -0.62 Portions correlated with functional status:[88] ADLs: r = 0.39 – 0.43 Forward reach: r = 0.25 Sit to stand: r = 0.44 6MWT: r = -0.49

Abbreviations: ICC, intraclass correlation coefficient; r, Pearson's Coefficient Correlation; SEM, standard error of measurement; MDC, minimal detectable change; MCID, minimal clinical important difference; BCS, breast cancer survivors; QOL, quality of life; 2MWT, 2-minute walk test; 6MWT, 6-minute walk test; BBS, Berg Balance Scale; EDSS, Expanded Disability Status Scale; MSWS, Multiple Sclerosis Walking Scale; TUG, Timed Up and Go; MFIS, Modified Fatigue Impact Scale; AM-PAC, Activity Measure for Post-acute Care; CAT, Computer Adaptive Testing; SF-36, Short Form-36

plinary team. The test may take up to 45 minutes to administer/complete, which can affect its clinical utility.

The LIFE-H assesses the quality of an individual's social participation based on one's perception of difficulty experienced and how much assistance is required to complete a task.[37] The long and short form of the instrument (ver. 3.0) has 240 and 69 items, respectively, covering 12 domains including nutrition, personal care, mobility, interpersonal relationships, community life, and recreation. The LIFE-H is comprehensive and has good psychometric properties, however, Magasi and colleagues[38] point out that the LIFE-H was not widely used outside of the group that developed the instrument, and the conceptual foundation on which the instrument was grounded was not widely known, limiting its adoption by the clinicians and researchers. The LIFE-H was not validated in the cancer population. Moreover, scoring of the instrument is difficult, and it may take an hour or more to complete the instrument (up to 60 minutes for the short form, up to 120 minutes for the long form).

Walk Tests

Walk tests fall under the ICF Mobility Domain. The ability to safely and efficiently walk and move about is considered an

essential life skill. The following tests were rated a 3 (recommended) or 4 (highly recommended) by the EDGE Task Force.

The 6MWT and the TUG were rated 4 (highly recommended). Both of these tests exhibit good psychometric properties, and were tested and used extensively with BCS. In the 6MWT, the individual is asked to walk as far as possible for a total of 6 minutes on a hard, flat surface; the patient is allowed to self-pace or rest as needed during the test.[39] This test was originally developed as a measure of exercise tolerance in patients with chronic respiratory disease and heart failure, but has since been used as a performance-based measure of functional capacity in many other populations.[40-44] Among patients with cancer, the 6MWT exhibited good reliability, and the distance walked correlates well to exercise capacity and workload.[40] The 6MWT has been used to assess physical impairments following breast cancer treatment,[45] as well as functional improvements after exercise programs for BCS.[46-48]

The second highly recommended test, the TUG, measures the time in seconds for a person to rise from sitting in a standard chair with arms, walk 3 meters, turn, walk back to the chair, and sit down.[49] Thus, this test provides an overall assessment of elements that are important for independent mobility including sit to stand to sit transfers, ambulation, and turning about in space. The TUG has good inter/intrarater reliability and is highly correlated with gait speed,[50] which in turn, is a significant predictor of functional dependency and disability.[51,52] Among patients with cancer, the TUG was used as a measure of performance status, mobility, and postural control.[51,53] Both the 6MWT and the TUG are free and easy to administer, requiring little to no equipment. The instructions for both tests are also available in many languages.

Six measures in the Walk Test category are rated recommended (rated 3). These tests include the 2-minute and 12-minute walk, 10-meter walk, as well as physical performance batteries that incorporated walk tests: Short Performance Physical Battery (SPPB), and the Physical Performance Battery for Patients with Cancer. The 5 times sit-to-stand test (FTSST or 5xSST) was also included in this category. The 2- and 12-minute walk tests (2MWT, 12MWT) are both variants of the 6MWT. The individuals walk as far as they can in 2 or 12 minutes, respectively. Like the 6MWT, individuals can rest or stop as needed, and use their customary walking aid. The 2MWT was proposed as an alternative to the 6MWT as being more clinically feasible for a patient with significant muscle weakness, gait inefficiency, or fatigue.[54] On the other hand, the 12MWT was proposed in response to the observation that patients tend to walk at a faster pace initially before settling to a more constant speed, thus a longer walk test would be a more accurate measure of functional capacity and exercise tolerance.[55] While both of these measures were tested in other populations and exhibit good clinical utility, the 2MWT has not been used, to our knowledge, on BCS. The 12MWT may have limited utility with BCS as the patients who have significant sequelae from breast cancer treatment (eg, peripheral neuropathy, cancer-related fatigue, etc) might have difficulty completing the test due to the longer time frame. The 10-meter walk (10MWT) assesses the time it takes an individual to walk 10 meters. The distance is then divided by the time to complete that distance in order to derive gait speed. There are variations of this measure in which the individual walks at his/her preferred or fastest speed possible.[56] While this test is easy to administer, there are different reported methods for how to conduct the 10MWT, such as the use of extra distances to allow the individual to accelerate or decelerate.[57] Moreover, there is limited information on its use with BCS.

The SPPB and Physical Performance Battery for Patients with Cancer are both physical performance batteries. Each of these batteries attempts to capture a hierarchy of function for a variety of physical tasks that mimic daily activities. The SPPB captures mainly lower extremity function, while the Physical Performance Battery for Patients with Cancer also includes upper extremity tasks. The SPPB is composed of a balance task, a short walk at the usual speed, and 5 repetitive chair stands.[58] This test was designed such that it could be performed in almost all clinical and research settings, and to quantify physical performance changes over time.[59] The SPPB captures domains of strength, endurance, and balance, is relatively easy to administer, and was used extensively in studies in the older population. However, its use with BCS is limited, perhaps because lower extremity function is not perceived as an area of immediate concern compared to upper extremity function. Of note, Curb and colleagues[60] report that the balance subscale of the SPPB has poor reliability, and suggests using the summary SPPB score or a difference balance assessment tool if balance is the construct of interest.

The Physical Performance Battery for Patients with Cancer was devised specifically for the oncology population.[61] This test battery has 9 separate individual tests. While the individual tests are relatively easy to administer/perform, the total time to complete the test battery may be up to 40 minutes. The Physical Performance Battery for Patients with Cancer was used in studies including BCS, however, the time it takes to complete the test battery as well as putting the results into context (ie, results of the battery vs. individual tests) may diminish its clinical usefulness.

The 5xSST assesses lower extremity strength and ability to perform transitional movements. Individuals are asked to stand up from a standard chair and sit down 5 times, as quickly as possible, while keeping arms folded across the chest.[62] The 5xSST is quick and easy to administer and is a test within the SPPB. The 2 Times Sit to Stand is a test within the Physical Performance Battery for Patients with Cancer. There are other versions that were reported, such as a 30-second sit to stand, a 10 times sit to stand, and a single leg sit to stand. However, the 5xSST and other versions were not specifically tested in the cancer population.

Self-report Questionnaires/Community Participation

None of the reviewed scales for self-report and community participation are recommended by this Task Force. They either lacked psychometric testing or clinical utility presenting issues for the clinician as the dearth of quality scales leaves a void in accurate assessment. One might argue that some assessment is better than no assessment; however, should the assessment

be unreliable or lack validity, then it may not assess the given construct accurately. Because the Task Force cannot recommend any of the measures for self-report and community participation, using traditional descriptive techniques to define performance is recommended.

CONCLUSION

Assessing functional mobility is an important part of breast cancer survivorship. Many tools exist that accurately and reliably assess upper extremity functional mobility, activities of daily living, walking, and community participation. Eleven measures are recommended for use by the Oncology EDGE Task Force. Tools that assess community functional mobility currently lack either psychometric validation or clinical utility, or both. Further research exploring community functional mobility for this population is necessary either to develop further existing tools or design new tools that possess both sound psychometric properties and good clinical utility. Survivorship care for women treated for breast cancer is enhanced by using the recommended measures.

Appendix 1. Search Terms

Primary search terms: breast cancer, neoplasm, function, functional mobility, limb use

Secondary search terms:

- 5 Times Sit to Stand
- 10 Meter Walk Test
- 2 Minute Walk Test
- 6 Minute Walk Test
- 12 Minute Walk Test
- Action Research Arm Test
- Activity Measure for Post-acute Care
- Arm Motor Ability Test
- Assessment of Life Habits
- Barthel Index
- Canadian Occupational Performance Measure
- Clinical Test of Sensory Interaction and Balance
- Community Balance and Mobility Scale
- Functional Independence Measure
- Functional Reach Test/Modified Functional Reach Test
- Functional Self-assessment
- Functional Status Examination
- Goal Attainment Scale,
- Hauser Ambulation Index
- High-level Mobility Assessment Tool (HiMAT)
- Impact of Participation and Autonomy Questionnaire (IPAQ)
- Jebsen Taylor Arm Function Test
- Life Satisfaction Questionnaire (LISAT-9)
- Modified Rankin Scale
- Motor Activity Log
- Motricity Index
- Participation Measure for Post-acute Care
- Participation Objective, Participation Subjective
- Participation Survey of Mobility Limited People
- Physical Performance Battery for Patients with Cancer
- Reintegration to Normal Living/Life Index
- Six Minute Arm Test (6-MAT)
- Short Performance Physical Battery
- Timed 25 Foot Walk
- Timed Up & Go (Cognitive and Manual)
- Wolf Motor Function Scale

Appendix 2. Categories of Functional Mobility Testing and Respective Tests

Upper Extremity Functional Movement Tests	ADL Functional Tests Category (Physical and Self-report)	Walk Tests	Self-report Community Participation
• Action Research Arm Test • Activity Measure for Post-acute Care • Arm Motor Ability Test • Six Minute Arm Test (6-MAT) • Wolf Motor Function Scale	• Assessment of Life Habits • Action Research Arm Test • Activity Measure for Post-acute Care • Arm Motor Ability Test • Canadian Occupational Performance Measure • Barthel Index • Functional Independence Measure/Functional Self-assessment	• 2 Minute Walk Test • 6 Minute Walk Test • 12 Minute Walk Test • 10 Meter Walk Test • 5 Times Sit to Stand • Timed 25 Foot Walk • Timed Up & Go (Cognitive and Manual) • High-Level Mobility Assessment Tool (HiMAT) • Short Performance Physical Battery • Physical Performance Battery for Patients with Cancer	• Impact on Participation and Autonomy Questionnaire (IPAQ) • Life Satisfaction Questionnaire (LSAT-9) • Functional Status Examination • Modified Rankin Scale • Participation Measure for Post-acute Care • Participation Objective • Participation Subjective (POPS) • Participation Survey of Mobility Limited People (PSM) • Reintegration to Normal Living/Life Index

Abbreviation: ADL, activities of daily living

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