

Functional status measures for the COPD patient: A practical categorization

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Abstract

The objective of this study is to review available functional status measures (FSMs) validated for use in the chronic obstructive pulmonary disease (COPD) population and categorizing the measures by their commonalities to formulate a framework that supports clinicians in the selection and application of FSMs. A literature review identifying valid and reliable measures of functional status for people with COPD was undertaken. Measures were thematically analyzed and categorized to develop a framework for clinical application. A variety of measures of activity levels exist, with 35 included in this review. Thematic categorization identified five categories of measures: *daily activity*, *impact*, *surrogate*, *performance-based*, and *disability-based* measures. The vast variety of FSMs available for clinicians to apply with people who have COPD may be overwhelming, and selection must be thoughtfully based on the nature of the population being studied/evaluated, and aims of evaluation being conducted, not simply as a standard measure used at the institution. Psychometric testing is a critical feature to a strong instrument and issues of reliability, validity, and responsiveness need to be understood prior to measurement use. Contextual nature of measures such as language used and activities measured is also important. A categorical framework to support clinicians in the selection and application of FSMs has been presented in this article.

Keywords

Functional status measures, COPD, practical categories, psychometric properties

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Introduction

Functional status measures (FSMs) are instruments generally used to evaluate the impact of a person's health condition on their ability to perform activities. These measures have also been referred to as activity (or functional status) measures, questionnaires, instruments, or tools. FSMs were initially developed to describe an individual's participation in activities of daily living; however, functional status is sometimes more broadly used as a term for the evaluation of other types of function such as social, psychological, physiologic, and emotional. This article will use the term FSM as it relates to the direct or indirect measurement of activity by patients with chronic obstructive pulmonary disease (COPD).

Why measure activities? FSMs can provide detailed information on what individuals do, providing a window into the daily life of patients. The development of FSMs in the 1950s and 1960s focused on grading disability or the degree to which patients

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required assistance in the long-term residential care setting. However, since this time, expansion of the application of FSMs, such as for patients with chronic disease, has allowed clinicians to use FSMs to describe progress secondary to the disease, or in response to therapy.

In the past 30 years, there has been a great deal of interest in quantifying the degree of activity limitation for patients with COPD. During this time, activity monitors were introduced to measure activity levels as purportedly, a more reliable method due to their objective nature, as opposed to the subjective nature of FSMs. However, activity monitors have limitations in measuring small changes in daily life and patterns of activities in patients.¹ Compared to FSMs, activity monitors have the disadvantages of expense, limitation in detecting steps in those with slow walking speed, evaluation of predominantly lower extremity movement, and failure in some instances to provide information specific to what activity is being performed,² for example, making a bed versus washing the dishes. More recently, attempts have been made to evaluate patients with both types of measures, resulting in complimentary information being gathered.¹

Numerous FSMs exist, most developed for purposes of measuring activities in patients other than COPD. Many have the potential to be applied in the COPD population after the measure has undergone appropriate psychometric testing. For example, the Nottingham Extended Activities of Daily Living Scale³ was developed in the 1980s for use with stroke patients, and has now been validated for use in the COPD population.⁴ This transferability of FSMs between patient population groups has led to a vast array of measures being available to clinicians, with a potential for confusion over which measure is the most appropriate for specific scenario use. Observing patterns of uniqueness of measures led the authors of this article to consider categorizing FSMs to support clinicians in decision-making. Providing a categorical framework of FSMs for the pulmonary community would be beneficial for greater clarity in the selection and informed application of these measures.

The purpose of this article is to review available FSMs that have been validated for use in the COPD population and categorizing the measures by their commonalities. Characteristics and unique qualities of the instruments will be highlighted, and a framework for selection of a measure will be presented to support the appropriate application of the measures for both clinicians and researchers. The features

presented will include ease of use (reflected in time to administer, scoring, etc.), time frame, psychometric properties (e.g. validity, reliability, responsiveness), and minimal clinically important difference (MCID).

Methods

Establishing the FSM categories was completed in three phases. First, FSMs were identified that were commonly used in COPD patients through a literature search of PubMed and Google Scholar. Three recent systematic reviews of FSMs were identified, published in 2014 and 2016⁵⁻⁷ and FSMs presented in these systematic reviews obtained. A reference list check of all papers included in the review was also completed to source all FSMs for use with COPD patients. Measures that were included in the synthesis had to meet the following criteria:

1. Validated for use with the COPD population.
2. Documented beginning psychometric properties of the measure, reporting on validity and reliability.
3. Published in English.
4. Full-text articles published in peer review publications.
5. Tools publicly available to review.

Instruments were excluded if they were not found to have been used in COPD patients, were never tested or used beyond the initial development after 5 years or more, have not been used for measurement with the COPD population for a decade or more, or where the scoring system changed too frequently to reliably report the psychometric properties. Papers considered for inclusion were reviewed by the two authors, and consensus reached on inclusion by discussion.

The second phase was to complete a subsequent search of PubMed and Google Scholar to obtain copies of the measures and the literature reporting on the psychometric properties of all FSMs identified for inclusion. The psychometric properties of the FSMs were then extracted from the papers by one author. While psychometric properties often receive less attention, inadequate testing of measures may result in failure to obtain the desired information about the patient/study, or provide false or misleading conclusions. Responsiveness of the instrument measuring the activity for impact of COPD or following treatment (e.g. pulmonary rehabilitation) was also recorded. The MCID of the measure was noted;

however, as this information was not always available, papers were not excluded if MCID had not been determined.

Descriptive analysis of the components of the measures was then undertaken by one of the authors, grouping papers based on the purpose of the FSM, number of activities evaluated, how the activities were evaluated, how the FSM was administered, and whether it was tested and used in COPD patients. Finally, the instruments were thematically organized according to concepts. Initially, information on the types of activities measured, the number of activities evaluated, time taken to complete the entire measure, total number of items (questions) in the measure, time frame for administering, psychometric measurement properties (as previously described), and process of completing the measure, including scoring and whether nominal, ordinal, or interval scores, were extracted from the papers. The purpose of the FSM was the primary driver in developing the themes.

Results

A total of 61 FSMs were identified, with 35 included in this review and thematic analysis. A list of all FSMs reported for use with COPD patients are provided in Table 1, noting rationale for those excluded. The main reasons for exclusion were, they had either not been tested in the COPD population or testing was limited to the initial instrument development.

Categories of measures

Five themes of measures were identified: *daily activities*, *impact*, *surrogate*, *indirect performance-based*, and *disability-based measures*. These themes formed five categories of measures.

1. Measures that looked at participation in a variety of activities were labeled *Activity Measures*. These measures evaluated the ability of the patient to engage in numerous activities often assessing domains of self-care, home management, ambulation, and participation in social and recreational activities.
2. Activities that were associated with symptoms were labeled *Impact Measures*. These measures evaluated how symptoms (primarily dyspnea and/or fatigue) affected the person's ability to participate in activities. A measure that is classically used to measure dyspnea is

the Medical Research Council (MRC) Scale^{46,47}; however, because this scale focuses on the effect of dyspnea on walking limitations, it could also be considered an *Activity Measure*. Additionally, one could argue that the MRC reflects disability because like the *Disability Measures*, the MRC categorizes patients as ambulatory or housebound.

3. Where activities were subscales or domains of health status questionnaires, such as the physical function subscale of the Medical Outcomes Study/SF-36,⁶⁹ these measures were labeled *Surrogate Measures* of activities. These subscales are often used as substitutes to establish concurrent validity of *Activity Measures*; however, the activities in these *Surrogate Measures* sometimes included evaluation of emotional function making them not purely FSMs. The domains of these health status measures comprise part of a total score that reflects overall health status or health-related quality of life. Where feasible, the psychometric properties of the individual domains/subscales were reported.
4. *Indirect Performance-Based Measures* as a category describes measures used to evaluate the individual's potential to engage in activities by observation of typical body motions. There are limited numbers of these measures but their contribution to understanding patients' limitations in activities made them candidates as FSMs.
5. *Disability-Based Measures* either observe and rate an activity or have the individual self-report their level of independence with activities. These instruments were initially designed for patients in long-term care settings such as nursing homes or those limited in activity due to stroke or orthopedic surgery.

Figure 1 provides a pictorial illustration of how these categories address functional status. For example, the Activity Category measures "do you do it (the activity listed)?" In relation to activities, the Disability Category asks, "can you do it?" and so on.

Of the measures identified, 17 instruments were deemed to fit in the category of *Activity*, 5 *Impact*, 5 *Surrogate*, 3 *Performance-based*, and 5 *Disability-based* measures. It was noted that some measures could be considered overlapping with other

Table 1. List of FSMs considered for inclusion with reasons for exclusion.

Measure	Included/ excluded	Reason for exclusion
Activities Checklist ⁸	Excluded	No known use in COPD patients
Activities of Daily Living Index (AKA Frenchay Activities Index) ⁹	Excluded	No known use in COPD patients
Activities of Daily Living Inventory (ADLI) ¹⁰	Excluded	No known in COPD use since original development, and limited testing
Activities of Daily Living Questionnaire (ADLQ) ¹¹	Excluded	Last known use in COPD patients >10 years.
Activities of Daily Living Test ¹²	Excluded	No known use in COPD patients
Activities of Daily Living Simulation Test ¹³	Excluded	Limited psychometric testing. Performance and types of activities altered in studies of COPD patients.
Adelaide Activities Profile (AAP) ¹⁴	Excluded	No known use in COPD patients
Baecke Physical Activity Questionnaire ¹⁵	Excluded	Types of activities designed for healthy, active elderly
Barthel Index (BI) ¹⁶	Included	
Barthel Index Modified (BIM) ¹⁷	Included	
Baseline Dyspnea/Transitional Dyspnea Index ¹⁸	Included	
Canadian Occupational Performance Measure (COPM) ¹⁹	Included	
Capacity of Daily Living in the Morning (CDLM) ²⁰	Excluded	Activities specific to morning symptoms
Chronic Respiratory Disease Questionnaire (CRQ or CRDQ) ^{21,22}	Included	
Clinical COPD Questionnaire (CCQ) ²³	Included	
COPD Activity Rating Scale (CARS) ²⁴	Excluded	First and last known use in 2003 when developed.
Community Healthy Activities Model Program for Seniors (CHAMPS) ²⁵	Included	
Customary Activity Questionnaire ²⁶	Excluded	Last known use in respiratory in 1998
Duke Activity Status Index (DASI) ²⁷	Included	
EuroQOL-ED 5D-5 L and VAS ^{28,29}	Included	
Fitness Arthritis and Seniors Trial (FAST) ³⁰	Excluded	No known use in pulmonary patients
Frenchay Activities Index (FAI) ⁹	Excluded	Multiple versions of scoring and variable number of activities make the FAI difficult to evaluate reliably
Functional Activities Questionnaire ³¹	Excluded	No known use in COPD patients
Functional Performance Inventory (FPI) ³²	Included	
Functional Performance Inventory (Short Form) (FPI-SF) ³³	Included	
Functional Status Questionnaire ³⁴	Excluded	No known use in COPD patients since 1980s
Glittre Test ³⁵	Included	
Groningen Activity Restriction Scale (GARS) ³⁶	Included	
Human Activity Profile (HAP) ³⁷	Included	
Index of Independent Activities of Daily Living Scale (Index of ADL) ³⁸	Excluded	Limited testing and little use in COPD
Instrumental Activities of Daily Living ³⁹	Excluded	Last known use in COPD patients was 1994
Karnofsky Performance Scale (KPS) ⁴⁰	Excluded	Measure of functional impairment (health to death)
London Chest Activity of Daily Living Scale (LCADL) ⁴¹	Included	
London Handicap Scale ⁴²	Excluded	Measure of handicap
Londrina Activities of Daily Living Protocol ⁴³	Included	
Manchester Respiratory Activities of Daily Living Questionnaire (MRADL) ⁴⁴	Included	
Meaningful Activity Participation Assessment (MAPA) ⁴⁵	Excluded	Developed for those with mental illness to describe the quality/meaningfulness of activities
Medical Research Council (MRC) ^{46,47}	Included	
Milliken ADL Scale (MAS) ⁴⁸	Included	

(continued)

Table 1. (continued)

Measure	Included/ excluded	Reason for exclusion
Minnesota Leisure Time Physical Activity Questionnaire ⁴⁹	Excluded	Limited use in COPD patients
Monitored Functional Task Evaluation (MFTE) ⁵⁰	Included	
Motor subscale of the Functional Independence Measure (FIM) ⁵¹	Excluded	Designed for inpatient rehabilitation assessing mobility, toilet function and cognition, not specifically evaluated for COPD patients
Nagasaki University Respiratory Activity of Daily Living Questionnaire ⁵²	Excluded	No known use or testing since original development in 2009
Nottingham Extended Activities of Daily Living Questionnaire (NEADL) ³	Included	
Oxygen Cost Diagram (OCD) ⁵³	Included	
Oxford Participation and Activities Questionnaire (Ox-PAQ) ⁵⁴	Excluded	No known use in COPD patients
Physical Activity Scale for the Elderly (PASE) ⁵⁵	Included	
ProActive ⁵⁶	Included	
Pulmonary Functional Status Scale (PFSS) ⁵⁷	Included	
Pulmonary Functional Status Scale (PFSS-11) ⁵⁸	Excluded	Testing to limited to development
Pulmonary Functional Status Scale (Short Version) (PFSS-35) ⁵⁷	Included	
Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ) ⁵⁹	Included	
Pulmonary Functional Status and Dyspnea Questionnaire modified version (PFSDQ-M) ⁶⁰	Included	
Saint George's Respiratory Questionnaire (SGRQ) ⁶¹	Included	
Short Form 36 of Medical Outcomes Study (SF-36) ⁶²	Included	
Stanford 7-Day Physical Activity Recall (PAR) ⁶³	Included	
The Valued Life Activity Scale ⁶⁴	Included	
Townsend's Disability Scale ⁶⁵	Excluded	No known use in COPD patients since 1989
University of San Diego Shortness of Breath Questionnaire (SOBQ) ⁶⁶	Included	
Yale Physician Activity Survey (YPAS) ⁶⁷	Included	
Zutphen Physical Activity Questionnaire (ZPAQ) ⁶⁸	Included	

FSM: functional status measure; AKA: also known as; COPD: chronic obstructive pulmonary disease; VAS: visual analog scale.

categories. For example, FSMs among the *Impact Measures* were a reflection of both an individual's participation in activities (*Activity Measure*) and symptoms with the activity (*Impact*). However, because these measures ask what activities individuals have reduced or no longer perform because of dyspnea (e.g. Oxygen Cost Diagram, MRC, etc.), they were also candidates for being considered *Activity Measures*. Where there was overlap, these measures are noted in the comment column of each table (Tables 1 to 5), and explicitly presented for each FSM in Table 6. For example, the MRC is an *Impact* measure, but overlaps with both the *Activity* and *Disability* measures.

Design and psychometric properties of the FSMs

Tables 1 to 5 summarize the characteristics of each measure, presenting measures by each of the aforementioned categories. The number of activities evaluated is reported for each measure (specifically the number of unique activities addressed in each measure). Those measures with more activities often allow a better understanding of the breadth of activities affecting the patient. The fewer the activities, the less time to complete, especially with dichotomous (Yes/No) answers. However, Yes/No responses may provide limited information. For example, brevity may sacrifice information on the frequency, the

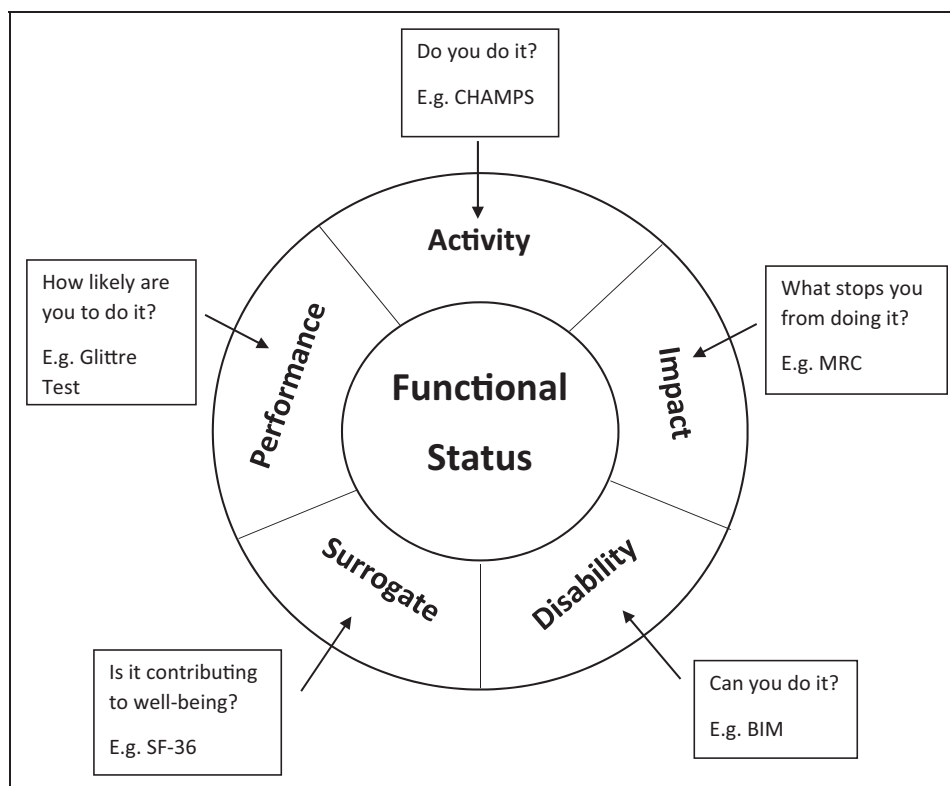


Figure 1. An illustration of the five categories of functional status measures.

difficulty or the need for assistance with the activity or if the activity is no longer performed due to a respiratory problem. It was noted that in selected FSMs, if the patient did not perform the activity, they are asked to estimate their performance if they could engage in the activity. No studies are known to evaluate the consequences of this type of estimate on the validity of the data.

The types of activities evaluated are diverse across all measures. The user should consider if the activities of the FSM satisfy their needs for understanding their population. For example, activities designed for a younger or healthier older population (e.g. playing soccer, cycling, etc.) are less relevant to patients who are impaired from their respiratory problem or other comorbidity such as poor balance. Activities that may be more gender-specific may result in missing data (e.g. cooking, washing laundry, mowing the lawn, etc.), because these activities may not be undertaken equally among genders. The type of scoring is important, since some responses are dichotomous, or on a 0–10 scale, while others ask for the frequency and time spent in the activity. Generally, the more complex the scoring (e.g. weighted or reversed scoring),

the more time-consuming scoring becomes, unless a computerized program is readily available.

Most measures reviewed were self-reports; however, some categories had predominantly observer/assessor ratings. This was true for the *Performance-based* measures. The time to take/administer the instruments were often under 10 minutes (range 1–20 minutes). Instruments varied in the time frame in which the activity was performed ranging from current to past 3 months. Time frame is a consideration if an intervention requires more time to take effect than identified in the FSM. Of note, the psychometrics of the instrument may be changed if a user randomly selects a time frame or does not utilize the entire measure (e.g. only administers one domain of an FSM) other than specified by the developer.

Discussion

This review of the literature has identified a diverse range of measures available to the clinician evaluating functional status for people with COPD. This diversity likely reflects the numerous reasons why functional status is measured for people with COPD in the

Table 2. Description and psychometric properties of daily activity measures.

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Community Healthy Activities Model Program for Seniors (CHAMPS) ²⁵	41 SA RA	Frequency (f) Times/week Hours/week (used to calculate energy exp.) Unable to perform option Four Scores 1. METS/week All act 2. METS/week Moderate act 3. f/week All act 4. f/week Moderate act	10–15 minutes 41 items	Typical week in past 4 weeks.	Content ⁷⁰ Construct ^{70,71} Discriminant ^{70, 71}	Test-retest @ 2 weeks by mail Moderate act $r =$ 0.96 All act $r = 0.62^{71}$ ICC = Moderate act 0.67 All act 0.66 over 6 months ⁷⁰ @ 2 weeks Moderate = 0.76, All = 0.62 ⁷¹	Responsive ^{25,70} MCID = NA	<ul style="list-style-type: none"> • A measure of physical activity to change behavior in older adults • Present list of activities, evaluate for f and duration • METS estimated for each act • Many act geared to older, healthy adults (e.g. golf, jogging) • Change in scores not associated with change in SF-36 PF²⁵ • Limited testing and use in COPD
Canadian Occupational Performance Measure (COPM) ¹⁹	9 RA	Rating 1–10 1 = not able to do/not satisfied at all to 10 = able to do/extremely satisfied. Scores on Performance and Satisfaction TS = 1–10	10–20 minutes 15 items	Current	Content ¹⁹ Construct ⁷²	Test-retest $r = 0.63$ satisfaction $r = 0.84$ performance ⁷³ ICC = 0.81 for satisfaction 0.76 for performance ⁷⁴	Responsive to pulmonary rehabilitation ^{74–76} Not responsive to OT intervention ⁷⁷ MCID = 2 points ⁷⁸	<ul style="list-style-type: none"> • Developed for occupational therapists to detect changes in domestic function • Five-step process, for example, identify difficult activity, rate its importance, satisfaction with performance, and so on. • Domains: self-care, productivity and leisure. • Weighted scoring • May not be responsive to all interventions
Duke Activity Status Index (DASI) ²⁷	12 SA	Yes/No Scores are weighted based on METS of activity Scoring = 0 to 58.2 (best)	3 minutes 12 items	Current	Construct ⁷⁹ Concurrent ²⁷ Discriminant ⁸⁰	Test-retest ICC = 0.95 ⁸¹ Internal consistency (in heart failure) $\alpha = 0.86^{79}$	NA	<ul style="list-style-type: none"> • Developed to measure functional capacity in cardiovascular patients • Limited use and testing in COPD • Weighted scoring

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	# items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Functional Performance Inventory (FPI) ³²	65 SA	Degree of difficulty 1 = none, 2 = some, 3 = much, 4 = don't do due to health TS = 0–3 (high scores better health, due to reverse scoring)	20 minutes	85 items	Current	Content ^{32,33} Construct ³² Concurrent ^{32,82,83}	Test–retest ICC = 0.87 ³² Internal consistency α = 0.97 ⁸⁴ and 0.93 ⁸³	NA	<ul style="list-style-type: none"> Developed to assess level of difficulty with activity in COPD Subscales: body care, housework, exercise, recreation, social and spiritual NA option if don't do activity for reasons other than health Reverse scoring Developed to assess level of difficulty with activities in COPD Subscales unchanged from FPI Rate activity as 0 if don't perform due to health reason or choose not to do. NA option if don't do activity for reasons other than health
Functional Performance Inventory Short Form (FPI-SF) ³³	32 SA	Difficulty: 0 = don't perform due to health or choose not to do, 1 = much difficulty, 2 = some, 3 = none TS = 0–3 (the mean of 6 subscales) (low scores better health)	10 minutes	NA	Current	Content ^{33,83} Construct ⁸³ Concurrent ⁸³ Discriminant ⁸³	Test–retest ICC = TS 0.88 ⁸³ 0.93 at 2 weeks ⁸⁵ Internal consistency TS α = 0.93 ⁸³ α = 0.89 ⁸⁵	NA	<ul style="list-style-type: none"> Subscales unchanged from FPI Rate activity as 0 if don't perform due to health reason or choose not to do. NA option if don't do activity for reasons other than health
Human Activity Profile ⁸⁶ (HAP) ³⁷ Formerly called Additive Activities Profile Test	94 (activity) 8 (dyspnea) SA	Act = still doing, stopped doing, never did activity Dysp = none, yes a little, yes noticeable, yes severe Scores: MAS—maximum act score AAS—adjusted act scores Scoring: 0–94 (high scores, higher function)	5–7 minutes	102 items	Current	Content ⁸⁶ Concurrent ⁸⁶ Criterion ⁸⁶	Test–retest 5–14 days MAS r = 0.76 AAS r = 0.79 ⁸⁷ @ 2 weeks MAS r = 0.97 AAS r = 0.97 ⁸⁸ ICC = MAS 0.76, AAS 0.87 ⁸⁷ Internal consistency α = 0.84 ³⁷	Responsive to PR ⁸⁹ MCID = 8.4 ³⁷ MAS = 7.8 AAS = 6.8 ⁹⁰	<ul style="list-style-type: none"> Scoring differs from FPI Developed to evaluate energy expenditure for COPD patients in PR Domains: activity and dyspnea with 4 subscales: self-care, personal/housework, entertainment/social, and independent exercise SF-36PF and MAS r = -0.63 AAS r = -0.70⁸⁸ VO₂ and MAS ρ = 0.76 AAS ρ = 0.85, p < 0.05⁸⁷ 6MWD and MAS = 0.45 AAS = 0.61 (both p < 0.01)⁸⁹ Limited use and testing in COPD since its development overlaps with Impact Measures

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	# items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Milken ADL Scale (MAS) ⁴⁸	47 SA	5-point scale on ability (1 = unable to, 5 = able to do) as "prior to surgery" 3-point scale on necessity. Scoring = ability 47-235 necessity 47-141	10 minutes	47 items	current	Content ⁴⁸ Construct ⁴⁸ Concurrent ^{48,91} Criterion ⁴⁸	Test-retest at 2-7 days, $r = 0.91$ ⁴⁸ ICC 0.77 ⁹¹ Internal consistency $\alpha = 0.96$ ⁹¹ Test-retest 14 days ⁹⁴	Responsive to PR (only for housecleaning and other tasks) ⁶ MCID = NA	<ul style="list-style-type: none"> Developed to measure upper extremity disability Six sections representing clusters of tasks = meal preparation, personal hygiene, dressing, object manipulation, housecleaning, and other. Developed to assess healthy people Domains: leisure and occupational activities Estimates individual's time spent in physical activity by category of METS (moderate, hard, and very hard) Reliability predominantly done in young, healthy Accel. time spent in >3 METS $r = 0.83$, $p < 0.001$ <3 METS $p \geq 0.05$⁹³ Weak assessing activity level at individual level, but potential for stratifying COPD according to activity levels⁹³ Measures physical activity in the elderly Domains: leisure, household, and occupational Many (8/12) sports and household activities PASE and VO_2 $r = 0.56$, $p < 0.01$⁹⁶ 6MWD $r = 0.68$, $p < 0.01$⁷¹ SF36 PF $r = 0.30$ $p < 0.01$⁷¹ Accel $r = 0.19$ $p > 0.05$⁹³ Cutoff of <11 for sedentary act, TS⁹⁵ Limited use and testing in COPD Weighted scores
Stanford 7-Day Physical Activity Recall (PAR) ⁶³ (AKA Modified Activity Recall Questionnaire (MARQ))	4 RA	Integrated score 47-705 Identify time spent in sleep and activities for 7 days. Scoring: Total EE score (kcal/kg/day) Time spent in moderate act	20 minutes	71 items	Past 7 days	Concurrent ⁹² In COPD Discriminant ⁹³ Predictive ⁹³	Total EE $r = 0.67$ vigorous act $r = 0.83$ moderate act $r = 0.75$ ⁹⁴ NA in COPD	NA TEE SWA ($r = 50.83$, $p < 0.001$). ≥ 3 METs correlated significantly with SWA-derived time o3 METs ($r = 0.54$, $p < 0.001$) and with SWA-derived PAL $r = 0.46$, $p = 0.002$ ⁹³	<ul style="list-style-type: none"> Reliability predominantly done in young, healthy Accel. time spent in >3 METS $r = 0.83$, $p < 0.001$ <3 METS $p \geq 0.05$⁹³ Weak assessing activity level at individual level, but potential for stratifying COPD according to activity levels⁹³ Measures physical activity in the elderly Domains: leisure, household, and occupational Many (8/12) sports and household activities PASE and VO_2 $r = 0.56$, $p < 0.01$⁹⁶ 6MWD $r = 0.68$, $p < 0.01$⁷¹ SF36 PF $r = 0.30$ $p < 0.01$⁷¹ Accel $r = 0.19$ $p > 0.05$⁹³ Cutoff of <11 for sedentary act, TS⁹⁵ Limited use and testing in COPD Weighted scores
Physical Activity Scale for the Elderly (PASE) ⁵⁵	12 SA	Frequency and duration TS a two-step process 1. Time (hours/week) in each activity 2. Weighting of each activity Scoring: 0-361 (high scores high act level)	5 minutes	19 items	Past 7 days	Construct ^{55,71} Discriminant ⁷¹	Test-retest 3-7 weeks $r = 0.75$ ⁵⁵ At 5 days $r = 0.75$ ⁹⁵ Internal consistency $\alpha = 0.69$ ⁵⁵	NA	<ul style="list-style-type: none"> Reliability predominantly done in young, healthy Accel. time spent in >3 METS $r = 0.83$, $p < 0.001$ <3 METS $p \geq 0.05$⁹³ Weak assessing activity level at individual level, but potential for stratifying COPD according to activity levels⁹³ Measures physical activity in the elderly Domains: leisure, household, and occupational Many (8/12) sports and household activities PASE and VO_2 $r = 0.56$, $p < 0.01$⁹⁶ 6MWD $r = 0.68$, $p < 0.01$⁷¹ SF36 PF $r = 0.30$ $p < 0.01$⁷¹ Accel $r = 0.19$ $p > 0.05$⁹³ Cutoff of <11 for sedentary act, TS⁹⁵ Limited use and testing in COPD Weighted scores

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Pulmonary Functional Status Scale (PFSS) ⁵⁷	22 SA	Rating varies with questions (e.g. difficulty, yes/no, blocks, frequency, independent, etc.) Scoring mean of each scale (9–34), high scores better function	15 minutes 56 items	Current, past week, past month	Content ⁵⁷	Internal consistency $\alpha = 0.83$ ⁵⁷	Responsive to PR ⁹⁷ MCID = NA	<ul style="list-style-type: none"> Developed as a disease-specific outcome measure of older adults with chronic lung disease. 3 subscales: daily activities/ social, psychological, and sexual functioning Weighted and reverse scoring PFSS reduced from 56 to 35 items Domains unchanged Weighted and reverse scoring
Pulmonary Functional Status Scale (modified) (PFSS- modified) ^{57,98}	18 SA	Scoring (1–15) with high scores better function	NA 35 items	Current, past week, month	Construct ⁹⁸ Concurrent ⁹⁸	Test-retest $r = 0.67$ ⁵⁷ Internal Consistency $\alpha = 0.93$ ⁵⁷	Responsive to PR ⁹⁹ MCID=NA	<ul style="list-style-type: none"> Weighted and reverse scoring PFSS reduced from 56 to 35 items Domains unchanged Weighted and reverse scoring
Pulmonary Functional Status and Dyspnea Questionnaire* (PFSDQ) ⁵⁹	79 activities act (79) dysp (79) SA	Act: 0 = as active as ever to 10 = omitted entirely due to breathing Dysp: 0 = none to 10 = extreme dysp Act and dysp TS = 0–790 on each Mean = 0–10 dysp has five stand-alone scores for f and intensity	15mins 164 items	Current	Content ⁵⁹ Construct ⁵⁹ Discriminant ⁵⁹	Internal Consistency $\alpha = 0.88$ – 0.92 ⁶⁰	Responsive ⁵⁹ MCID TS = 10	<ul style="list-style-type: none"> Developed to evaluate changes in activity and dyspnea levels and dyspnea in COPD Activities (79) evaluated for participation and 79 for impact of dyspnea Option to check if never performed the activity PFSDQ act and 6MWD Spearman $p = 0.42$; PFSDQ dysp $p = 0.47$, $p < 0.001$³⁵ Dyspnea scale overlaps with Impact Measures

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Pulmonary Functional Status and Dyspnea Questionnaire (modified version)* (PFSDQ-M) ⁶⁰	10 activities Act (10) Dysp (15) Fat (15) SA	Three domains (<i>act</i> , <i>dysp</i> , <i>fat</i>) <i>act</i> : 0 = as active as ever to 10 = <i>omitted entirely due to breathing</i> <i>dysp/fat</i> 0 = none 10 = extreme For each domain report TS = 0–100 Mean = 0–10	7 minutes 40 items	Current	Construct ^{60,100}	Test-retest 2 weeks <i>act</i> = 0.70 <i>Dysp</i> = 0.83 <i>fat</i> = 0.79 ⁶⁰ ICC= <i>act</i> = 0.79 <i>dysp</i> and <i>fat</i> = 0.77 at 1 week, ¹⁰¹ <i>act</i> = 0.90 <i>dysp</i> = 0.93 <i>fat</i> = 0.92 at 2 days ¹⁰⁰ Internal consistency α = <i>act</i> 0.93; <i>dysp</i> and <i>fat</i> α = 0.95 ⁶⁰ with arm <i>act</i> α = 0.87 all <i>act</i> α = 0.93 ¹⁰²	Responsive to PR ^{101,103–105} MCID = 5 each component ¹⁰¹	<ul style="list-style-type: none"> Modified from PFSDQ to reduce # activities and measure fatigue. PFSDQ-M <i>act</i> and δMWD $r = 0.34, p < 0.01$¹⁰⁶ $r = -0.30, p < 0.001$¹⁰¹ PFSDQ-M <i>act</i> and CRQ <i>dysp</i> $r = -0.32, p < 0.001$¹⁰¹ PFSDQ-M <i>act</i> and SGRQ <i>act</i> $r = 0.76, p < 0.0001$¹⁰⁰ 6–8 grade reading level <i>Dysp</i> and <i>fat</i> domains overlap with <i>Impact Measure</i>
PROActive Questionnaire* 56	4 SA	5 ratings; none at all to all the time rarely, sometimes, frequently and all the time. Scoring: NA	NA 12 items	Past 7 days	Content ⁵⁶ Construct ¹ Convergent ¹	Test-retest ICC ≥ 0.90 ¹ Internal consistency α ≥ 0.80 ¹	NA	<ul style="list-style-type: none"> Developed to evaluate the impact of disease on activities Measures amount and difficulty with activities. Several activities relate to symptoms Newly developed measure, still undergoing psychometric testing 8–9-year-old reading level Overlap with <i>Impact Measure</i>

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
The Valued Life Activities (VLA) ^{64,107}	28 act in COPD version SA	0-3 rating 0 = no difficulty 3 = unable to do. TS 0-1.0 or 0-100% Sub scores for -obligatory -committed -discretionary activities	NA	Current	Content ⁶⁴ Predictive ¹⁰⁸ Discriminant ¹⁰⁹	Internal consistency on 13 domains (arthritis) $\alpha = 0.63-0.88$ ¹¹⁰ Controls $\alpha = 0.60-0.86$ ¹¹⁰	NA	<ul style="list-style-type: none"> Developed to evaluate the impact of arthritis by assessing disability based on personal values 3 subscales (# act) obligatory (6), committed (9), discretionary (13) Rate act perform or don't perform due to respiratory condition Then rate difficulty with performance Limited testing and use in COPD
Yale Physician Activity Survey (YPAS) ⁶⁷	27 RA	Summary indices: -Total time/each act -EE (kcal/week); -act dimension (on 5 act)	20 minutes 27 items	Typical week in past month	Construct ⁶⁷ Convergent weak ¹¹¹	Test-retest 14 day Total time $r = 0.57$; EE $r = 0.58$ act $r = 0.65$ ⁶⁷	NA	<ul style="list-style-type: none"> Developed to measure activity in healthy older adults Activities; work (10 act), yardwork (3 act), caretaking (2 act), exercise (5 act), recreation (7 act) 2 sections to develop 8 indices to determine vigorous, act, low intensity general movement, and time in recreation act May be useful screen of sedentary activities¹¹¹ EE and 6MWT $r = 0.58$, $p < 0.01$ EE and SF36 PF $r = 0.31$, $p < 0.01$; accel $r = 0.61$, $p < 0.01$⁷¹ Limited use and testing in COPD Weighted scoring Scoring may be cumbersome

(continued)

Table 2. (continued)

Measure	Activities (#) Self-/rater-	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Zutphen Physical Activity Questionnaire (ZPAQ) ⁶⁸	27 SA	Yes/no, duration, normal, fast, calm Scoring: time converted to minute/ week for each act. Total weekly minutes and % contribution to total are calculated. Calculate time in light, mod, and heavy act.	15mins 29 items	Past week or month (varies with question)	Concurrent ¹¹²	Test-retest $r = 0.87$ ¹¹³	NA	<ul style="list-style-type: none"> • Developed to evaluate men longitudinally born 1900-1920. • Mets calculated in response to intensity, duration of exercise • 7/27 act relate to sports or biking • Insensitive to extremely inactive patients¹¹² • Scoring may be cumbersome

MCID: minimal clinically important difference; SA: self-administered; RA: rater-administered; NA: not available; ICC: intra class coefficient; METS: metabolic equivalent units; COPD: chronic obstructive pulmonary disease; TS: total score; act: activities; dysp: dyspnea; PR: pulmonary rehabilitation; VO₂: oxygen consumption; PF: physical function; EE: energy expenditure; Accel: accelerometer.

*Overlap with another category.

Table 3. Description and psychometric properties of impact measures.

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Baseline Dyspnea Index/ Transitional Dyspnea Index* (BDI/TTDI) ¹⁸	Variable # 3 categories: magnitude of impairment, effort, and task RA SA	Levels of severity 0–4 (0 = most severe) Scores summed for each category BDI TS = 0–12 TTDI 7 points from –3 to +3 (major improvement), TTDI TS = –9 to +9 (0 = no change, +9 = improved)	4–5 minutes 3 items	Current	Concurrent ¹¹⁴	Test–retest $r = 0.76$ ¹¹⁴ $ICC = 0.90$ ¹¹⁵ Internal consistency $\alpha = 0.80$ ¹¹⁴ TTDI = 1 unit ¹¹⁷	Responsive to PR ¹¹⁶ Responsive to treatment ¹¹⁷ MCID TTDI = 1 unit ¹¹⁷	<ul style="list-style-type: none"> Developed to assess dyspnea in COPD Initial assessment with BDI, follow-up with TTDI for change score BDI and OCD $r = 0.67, p < 0.01$¹¹⁸ BDI and 6MWD $r = -0.02, p > 0.05$¹¹⁸ $r = 0.54, p < 0.001$¹¹⁹ Overlap with Activity Measure
London Chest Activity of Daily Living scale* (LCADL) ⁴¹	15 SA	0 = wouldn't do anyway 1 = no breathlessness 2 = moderate 3 = very breathless 4 = can no longer do 5 = need someone else to do TS = 0–75	<5 minutes (estimate) 15 items	Past few days	Content ⁴¹ Construct ⁴¹ Concurrent ^{41,120} Discriminant ¹²¹ Convergent ¹²⁰ LCADL	Test–retest $ICC = 0.96$ Internal consistency $\alpha = 0.98$ ⁴¹ and 0.90 ¹²⁰	Responsive to PR ^{103,122} MCID = 4 points ¹²³ Self-care = 0.9 Domestic = 2.6 Physical = 0.4 Leisure = 0.6 ¹²³	<ul style="list-style-type: none"> Developed to measure dyspnea with routine activities in COPD Domains: self-care, domestic, physical activity, leisure 20% ceiling effect on domestic domain¹²⁰ CRQ <i>dysp</i> $r = 0.56, p <$ $0.001$¹²⁰ Ped $r = -0.50, p <$ $0.01$¹²¹ Numerical rating scale @ rest $r = 0.25, p <$ $0.05$¹²⁰ Overlap with Activity Measure

(continued)

Table 3. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Medical Research Council* (MRC) ¹²⁴	3 RA SA	Grade 0–4 Score 0–4 (0 = no impairment) Also reported as grade 1–5 (1 = no impairment)	1 minute 1 item	Current	Content ¹²⁴ Discriminant ^{47,125}	Test–retest ICC 0.82 ¹¹⁵ 0.83 ¹⁰³	Responsiveness is variable for PR ^{103,126} MCID = 1 point ¹²⁶	<ul style="list-style-type: none"> Developed to study respiratory epidemiology. The MRC grading of dyspnea is one segment of a larger questionnaire of 17 questions on symptoms 4/5 activities relate to walking due to breathlessness. BDI $r = -0.56$, $p < 0.05$¹¹⁸ 6MWD $r = 0.52$, $p < 0.001$¹¹⁹ Poor response to PR may be due to baseline MRC grade.¹²⁷ MRC ≥ 3 sensitive to severe physical activity Overlap with Activity and Disability Measures

(continued)

Table 3. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Oxygen Cost Diagram* (OCD) ⁵³	13 RA SA	0–10 cm vertical line (sleeping to dyspnea with brisk walking uphill). Mark line at point become dyspneic. Activities listed reflect progressive increase in energy expenditure Score in cm from 0–10 Ability score is distance (cm) from 0 to point marked.	1 minute 1 item	Current	Concurrent ^{53,118} Construct ¹¹⁹	Test–retest $r = 0.64$	Responsiveness unclear, ^{128,129} MCID = NA	<ul style="list-style-type: none"> Developed to evaluate level of breathlessness based on the incremental energy expenditure of walking and household activities Scaling based on oxygen requirements of activities OCD and 6MWD $r = 0.65, p < 0.001$¹³⁰ $r = 0.52, p < 0.001$¹¹⁹ $r = 0.20, p > 0.05$¹¹⁸ OCD and MRC $r = -0.54 (0.05 > p < 0.1)$¹¹⁸ OCD and BDI $r = 0.67, p < 0.01$ $r = 0.56, p < 0.05$¹¹⁸ Overlaps with Activity Measure
University of California San Diego Shortness of Breath Questionnaire (UCSD SOBQ) ⁶⁶	21 SA	0 = not at all breathless 5 = maximum/unable to do activity Scores summed, TS 0–120, high scores worse	5 minutes (estimate) 24 items	Average over past week	Content ⁶⁶ Construct ¹¹⁴	Test–retest $r = 0.94$ ¹¹⁴ ICC = 0.95 ¹¹⁵ Internal consistency $\alpha = 0.91$ ¹¹⁴	Responsive to PR ¹³¹ MCID = 5 points ¹³²	<ul style="list-style-type: none"> Developed to assess severity of dyspnea with act in PR programs Dyspnea rating also on activity related to fear Overlaps with Activity Measure

MCID: minimal clinically important difference; SA: self-administered; RA: rater-administered; ICC: intra class coefficient; PR: pulmonary rehabilitation; NA: not available; Ped: pedometer.
*Indicate the instrument overlapped with another category.

Table 4. Description and psychometric properties of subscales of surrogate measures.*

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	# items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Clinical COPD Questionnaire* (CCQ) ²³	5 RA SA	Rating = 0 (never/ not limited) to 6 (almost all the time/totally limited). Low scores better health Symptom 0–6 Function 0–6 Mental 0–6 TS 0–6	2 minutes 10 items	2 minutes 10 items	Past 7 days	Content ²³ Convergent ¹³³ Concurrent ¹³⁴	Test–retest (2 weeks) ICC = 0.94 ²³ Internal consistency $\alpha = 0.91$ ²³ function = 0.77 ¹³³ and 0.94 ¹³⁴	Responsive to smoking cessation ²³ PR ¹³⁵ and exacerbations ¹³⁴ MCID = 0.4 ¹³⁶ 0.4 with PR ^{135,137} CCQsx = 0.5 CCQfs = 0.6 CCQmental = 0.7 ¹³⁷	Developed to measure health status in COPD Domains: symptoms, functional and mental states. Functional evaluates 4 act Overlaps with Activity and Impact Measures
Chronic Respiratory Disease Questionnaire* (CRQ) ²¹	5 RA SA	Dysp domain 0 = extremely dyspneic to 7 = not at all. Other domains 1 = maximum to 7 = no impairment Scores: Dysp 1–7 Fat 1–7 Emo 1–7 Mastery 1–7 TS= 20–140	5–10 minutes 20 items	5–10 minutes 20 items	Past 2 weeks	Content ^{21, 22}	Test–retest ICC = 0.83 dysp on CRQ-SA ¹³⁹ 0.73–0.95 ¹⁴⁰ CRQdysp $\alpha =$ 0.91 ¹⁴¹ $\alpha = 0.90$ ¹³³ $\alpha = 0.53$ ¹⁴² $\alpha = 0.53$ – 0.84 ¹⁴⁰	Dysp domain has variable response to PR ^{143–146} MCID = on CRQ-IA, dysp and TS = 5 ¹⁴⁷ CRQdysp = 5 TS = 10 ¹⁰¹ dysp = 0.5 fat = 0.5 emotion = 0.4 mast = 0.4 per item ¹³⁸	Developed to determine the frequency and importance of areas of dysfunction in resp patients. Domains: dysp, fat, emo function, and mastery Dysp domain and symptom of SGRQ r = 0.46 CRQ-SAS act relate to emotions, basic needs, walking, chores, and social ¹³⁸ Patients don't often select same act to evaluate dysp on posttest with CRQ- individualized ¹³⁹ CRQdysp and SGRQsx r = 0.46, p < 0.01 ¹⁴¹ TS not well tested ¹⁴⁰ Overlaps with Activity and Impact Measures

(continued)

Table 4. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes) # items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
EuroQol* (EQ-5D-5 L) ^{28,29} EQ VAS	3 SA RA I	Rating of each activity/ dimension on 5 levels of severity: <i>no problem to extreme problems.</i> Ratings converted to Index Value of 0–100 Rating 0 = <i>worse</i> 100 = <i>best</i> <i>imaginable health</i> <i>imaginable health</i> Scoring 0–100 on vertical 20 cm VAS	5 minutes (estimate) 5 items 1 minute 1 item	Today Today	Content ²⁸ Construct ^{29,148} Discriminant ¹⁴⁹ Convergent ¹⁴⁸	Test–retest κ 95% CI 0.69 mobility, 0.64 activity ¹⁴⁸ ICC 0.75 ¹⁴⁸ NA	Responsive to PR ¹⁴⁹ MCID = 0.05 ¹⁴⁹ MCID = 7 ¹⁴⁹	<ul style="list-style-type: none"> • Measure of health status • 2 parts, the EQ-5D-5 L and EQ VAS • Act/dimension: mobility, self-care, usual act, pain/discomfort, anxiety/depression • Scoring does not separate act from emotion and pain rating • Relation to SGRQ <i>act</i> $r = -0.60$, $p < 0.001$; CRQdys $r = 0.40$, $p < 0.001$; CCQFunc $r = -0.67$, $p < 0.001$¹⁴⁹ • Weighted scoring • Overlaps with Activity Measure • Developed to measure health status in respiratory patients • Domains: <i>act</i>, <i>symp</i>, <i>impact</i> • TS 6MWD $r = -0.56$, $p < 0.001$³⁵ • Items are weighted • Overlaps with Activity and Impact Measures
St. George's Respiratory Questionnaire* (SGRQ) ⁶¹	14 on activity domain SA	Scoring each domain 0–100 TS = 0–100 (high scores worse)	10 minutes 56 items	Current and past 4 weeks	Content ⁶¹ Construct ^{61, 150}	Test–retest (2 weeks) ICC = total score 0.92 and 0.87 on activity domain ⁶¹ Internal consistency $\alpha = 0.83$ activity ¹⁵¹	Responsive to: PR ^{103,131} exacerbations ^{146,152} and pharmacology tx ¹⁵³ MCID = 4 points per domain and 7 with PR ¹³⁷ IPF sx = 8 <i>act</i> = 5 <i>impact</i> = 7 TS = 7 ¹⁵⁴	

(continued)

Table 4. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	# items	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Medical Outcomes Study* (SF-36) ⁶²	10 on Physical Function scale SA	Limited a lot, a little, not limited at all on activity TS = 0–100 (low more limitation)	5–10 minutes	36 items	Current	Content ⁶⁹ Construct ^{69,155,156}	Test–retest ≥0.90 physical scale ¹⁵⁵	PCS responsive to PR ¹³¹ MCID ILD 3–5 ¹⁵⁴	<ul style="list-style-type: none"> Developed to survey health Scales (8): physical, social, mental health, vitality, pain, general health, and so on Physical function scale and physical component score (PCS) often used for comparison as physical function standard PCSs are scores from PF, role physical, pain, and general health Overlaps with Activity Measure

COPD: chronic obstructive pulmonary disease; MCID: minimal clinically important difference; RA: rater-administered; SA: self-administered; ICC: intra class coefficient; PR: pulmonary rehabilitation; act: activities; dysp: dyspnea; VAS: visual analog scale; CI: confidence interval; NA: not available; TS: total score; ILD: interstitial lung disease; PCS: physical component score; PF: physical function

*Overlap with another category. The domains representing activity levels (e.g. dyspnea, physical function) were reported: CRQ: dyspnea; CCQ: functional state; SGRQ: activity; SF36: physical function scales.

Table 5. Description and psychometric properties of protocol/performance-based measures.

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Glittre-ADL Test ³⁵	4 RA	4 activities constituting a “lap” Scoring: time spent to complete laps in minutes	<10 minutes 4 items	Current	Content ³⁵ Concurrent ³⁵ Discriminant ^{157, 158}	Test-retest @24 hours = 0.93 ³⁵	Responsive to pulmonary rehabilitation ³⁵ MCID = NA	<ul style="list-style-type: none"> Developed to measure functional status in COPD with standardized ADL-like activities Backpack (2.5 kg/women, 5 kg/men) carried during activity Complete 5 laps as fast as possible, rest if needed 6MWD $r = -0.82, p < 0.001$³⁵ $r = -0.87, p < 0.01$¹⁵⁹ $VO_2 r = 0.87, p < 0.05$¹⁵⁹ May not be responsive to upper extremity exercise⁷⁶ Developed to assess upper and lower extremities and trunk activities Assesses ADL performance in COPD 5 stations demonstrating upper, lower extremity, trunk flexion/rotation/ inclination Complete at own pace, rest as needed 6MWD $r = -0.53$¹⁶⁰ Developed to evaluate physical components contributing to occupational performance in COPD with moderate-severe disease 5 tasks: walk, sit-stand, lift, walk carrying load Done at usual pace Scores transformed 6MWD $r = 0.32, p \leq 0.01$⁵⁰ CRQdysp $r = 0.18, p > 0.05$⁵⁰ Limited testing in COPD
Londrina Activity of Daily Living Protocol (LAP) ⁴³	5 RA	Total seconds to complete 5 tasks	7 minutes 5 items	Current	Content ⁴³ Concurrent ^{43, 160}	ICC = >0.94 ⁴³ 0.91 ¹⁶⁰	NA	
Monitored Functional Task Evaluation (MFTE) ⁵⁰	5	5 tasks each done within 2 minutes. Scoring 0–4 each task Scoring 0–20 for overall performance	15–20 minutes 5 items	Current	Content ⁵⁰ Concurrent ⁵⁰	Test-retest ICC = 0.82 ⁵⁰	Responsive to gigong added to PR ¹⁶¹ MCID = NA	

MCID: minimal clinically important difference; NA: not available; COPD: chronic obstructive pulmonary disease; ICC: intra class coefficient; RA: rater-administered.

Table 6. Description and psychometric properties of disability-based measures.

Measure	Activities (#) Self-/rater- administered	Rating of activities	# items	Time to complete (minutes)	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Barthel Index (BI) ¹⁶	10 SA RA	Rating varies with item and study (0, 5; 0, 5, 10; and 0, 5, 10, 15): 0 = dependent 10 or 15 = independent TS = 0–100 Alternative rating and scoring Rating 0, 1, or 2 TS = 0–20 ¹⁶²	<5 minutes SA 20 minutes RA 10 items	Current	Concurrent ¹⁶³ Discriminant with pneumonia ¹⁶⁴	NA in COPD. Test-retest: Interrater: Coefficient of concordance W = 0.93 ¹⁶² Internal consistency α = 0.87 ¹⁷	Responsiveness not available in COPD MCID = 4.02 pts. In chronic stroke ¹⁶⁵ NA in COPD	<ul style="list-style-type: none"> Developed to evaluate independence in frail elderly and stroke NEADL has greater sensitivity (76% vs 19%) than Barthel⁴ for differentiating elderly with respiratory disability BI and MRC $r = 0.53$, $p < 0.001$¹⁶³ Good psychometrics among acute and chronic stroke Limited testing and use in COPD Modified scoring metric 0–4 = very severely disabled 5–9 = severely 10–14 = moderately 15–19 = mildly disabled 20 = independent Items are weighted No known use in COPD 	
BI modified (BIM) ¹⁷	10 SA	Coding of original act as 1–5 TS = 0–100	<5 10	Current	NA	Internal consistency α = 0.90 ¹⁷	NA respiratory patients	<ul style="list-style-type: none"> Modified scoring metric 0–4 = very severely disabled 5–9 = severely 10–14 = moderately 15–19 = mildly disabled 20 = independent Items are weighted No known use in COPD 	

(continued)

Table 6. (continued)

Measure	Activities (#) Self-/rater- administered	Rating of activities	Time to complete (minutes)	Time frame	Validity	Reliability	Responsiveness and MCID	Comments
Groningen Activity Restriction Scale (GARS) ³⁶	18 SA	4-point scale 1 = can do independently without difficulty 2 = independent, some difficulty 3 = independent, great difficulty 4 = cannot do independently (with or without help) Scores 18–72 (max disability)	NA 18 items	Past week	Content ³⁶ Construct ³⁶ Concurrent ^{36,166} Discriminant ³⁶	Internal consistency $\alpha = 0.94$ ¹⁶⁷	NA	<ul style="list-style-type: none"> Developed to assess disability in domains of personal care and domestic activities Activities: grooming, feeding self GARS and 6MWD $r = 0.77$¹⁶⁸ $r = 0.53$ with steps¹⁶⁶ GARS and SF36 PF $r = 0.48$, $p < 0.01$ CCQ Funct $r = -0.51$, $p < 0.01$ SGRQ act $r = -0.57$, $p < 0.01$¹⁶⁶ If don't engage in act, asked to "imagine" if they could Developed to evaluate disability in elderly with COPD Domains: mobility, kitchen, domestic tasks, and leisure Limited testing
Manchester Respiratory Activity of Daily Living Questionnaire (MRADL) ⁴⁴	21 SA	Ability to perform 0 = not at all or with help 1 = alone with difficulty or alone easily Scoring 0–21 (no impairment)	10 minutes 21 items	Current	Discriminant ⁴⁴	Test-retest ICC 0.92 and 0.86 ¹⁶⁹ mailed 2 weeks apart Internal consistency $\alpha = 0.91$ ¹⁶⁹	Responsive to PR ⁴⁴ MCID NA	<ul style="list-style-type: none"> Developed to assess stroke patients via mail Sections: mobility, kitchen, domestic, and leisure activity Greater sensitivity than Barthel⁴ Limited use and testing in COPD
Nottingham Extended Activities of Daily Living Questionnaire (NEADL) ³	22 SA	Rate performance from 0 = not perform or with help 1 = on my own with difficulty or on my own Score 0–22 (high score, more independent)	<10 minutes 22 items	Past week	Content ³ Concurrent ¹⁷⁰ Discriminant ^{4,47}	Test-retest Reliability κ coefficient 0.83–1.00 (mailed 2 weeks apart) ³ ICC 0.89 ¹⁷¹	Responsiveness Not tested in COPD MCID = 6.0 ¹⁷¹	<ul style="list-style-type: none"> Developed to assess stroke patients via mail Sections: mobility, kitchen, domestic, and leisure activity Greater sensitivity than Barthel⁴ Limited use and testing in COPD

MCID: minimal clinically important difference; SA: self-administered; RA: rater-administered; TS: total score; NA: not available; COPD: chronic obstructive pulmonary disease; ICC: intra class coefficient.

Table 7. Listing of FSMs by categories and identifying categories with which they overlap(X).

Measures ^a	Categories				
	ACT	IMP	SURR	DIS	PB
Activity (ACT)					
CHAMPS ²⁵					
COPM ⁷³					
DASI ²⁷					
FPI ³²					
FPI-SF ³³					
HAP ³⁷		X			
MAS ⁴⁸					
PAR ⁶³					
PASE ⁵⁵					
PFSS ⁵⁷		X			
PFSS-35 ⁵⁷		X			
PFSDQ ⁵⁹		X			
PFSDQ-M ⁶⁰		X			
ProActive ⁵⁶		X			
VLA ⁶⁴					
YPAS ⁶⁷					
ZPAQ ⁶⁸					
Impact (IMP)					
BDI ¹⁸	X				
LCADL ⁴¹	X				
MRC ⁴⁶	X			X	
OCD ⁵³	X				
SOBQ ⁶⁶	X				
Measures ^a	Categories				
	ACT	IMP	SURR	PB	DIS
Surrogate (SURR)					
CCQ ²³	X	X			
CRQ ²¹	X	X			
EuroQOL-ED 5D-5 L ²⁸	X				
SGRQ ⁶¹	X	X			
SF-36 ⁶²	X				
Performance-Based (PB)					
Glittre Test ³⁵					
LAP ⁴³					
MFTE ⁵⁰					
Disability (DIS)					
BI ¹⁶					
BIM ¹⁷					
GARS ³⁶					
MRADL ⁴⁴					
NEADL ³					

FSM: functional status measure. Shaded columns indicate the activities within the respective categories.

^aRefer to Table 1 for abbreviations of FSMs.

clinical and research objectives. Considering the diversity of measures available for use, selection must be thoughtful based on the nature of the population

being studied, and evaluation being conducted, not simply used because it is a standard at the institution. The options are varied and may be overwhelming. Through categorizing the FSMs and providing a summary of design and psychometric properties of the measures, this article aims to guide clinicians and researchers alike in the selection of the most appropriate measure for their situation.

While measuring functional status is a complex construct, not all measures could be easily categorized into one theme. We found measures that overlap between categories. Further, some aspects of FSMs may not be considered “activity measures” by some. For example, the chronic respiratory disease questionnaire (CRQ)²² *dyspnea* domain can be considered an “impact” measure, as this most closely measures function in the CRQ (see Surrogate category). On the other hand, the Saint George’s Respiratory Questionnaire (SGRQ),⁶¹ also a health status measure, has an “activity” as well as a symptom domain. However, this domain queries about many symptoms, not only dyspnea with an activity. Arguably, the dyspnea domain of the CRQ could be an *Impact-Based Measure* because it asks patients to rate the severity of their dyspnea with each activity. However, because it is a subscale of the CRQ, we determined it best fit with other *Surrogate Measures*. On the other hand, the Medical Research Council Modified version (mMRC) with 5 grades (0–4)^{46,172} has been used as both a measure of dyspnea and disability.^{47,95} While more commonly known as a dyspnea measure, the mMRC evaluates the impact of dyspnea on activity levels (primarily walking) and therefore meets our criteria for an *Impact-Based Measure*. However, the mMRC could also arguably be justified as a disability measure because the grades provide a distinct indication of impairment, that is, activity limitation (breathlessness only with strenuous exercise) to severe limitation (too breathless to leave the home). In interpreting the categorization, clinicians and researchers therefore may select an FSM based on the overlap. This could be of particular use when more than one domain or construct is to be measured, saving patients time in completing only one tool instead of multiple. While the creation of this framework and categorization of FSMs has attempted to simplify selection of instruments, extensive consideration by clinicians and researchers alike is still needed prior to selection of an FSM to ensure that the most efficient and targeted tool is indeed selected.

Psychometric testing is a critical feature to a strong instrument and issues of reliability, validity, and responsiveness should have been demonstrated, and through this review a summary of these properties has been synthesized for clinicians to access. Where psychometric properties of an instrument are not available in the literature, further research should be completed prior to clinical application of the tool. The framework presented in this article provides information only on tools that have been assessed, and therefore, this article is intended as one of many resources for clinicians to draw on.

The available FSMs to date have predominantly been developed and evaluated in English language countries with European-based cultures, and this should be considered when selecting a measure. Some activities identified in the original development of the instruments may not be relevant for some countries/cultures/genders/age groups. For example, FSMs containing activities such as soccer, shoveling snow, and ice skating may not be relevant to certain areas of the world or to the elderly individual with moderate to severe disease. Further, some instruments used gender-specific terms or stereotypes to describe activities. This may result in significant missing data. In the development of an instrument, there should be virtually no missing data (i.e. the instrument must make allowances for activities never performed, unrelated to COPD). On the other hand, if a study finds missing data occurring, they should be vigilant for the reasons for lack of response. For culturally responsive and adaptable health-care practice, ethnocultural interpretation of the measures should be evaluated prior to selection for application, and research into application of the FSMs to broader diverse communities is needed.

In evaluation of reading level of FSMs included in this review, most instruments attempt to attain reading at the 5th or 6th grade reading level (although not always stated); however, the nature of terms used in health care (e.g. breathlessness) may result in higher than desirable reading levels and may impact the psychometric properties of the FSMs. Understanding the reading and health literacy of the population group should also be a factor in selecting an instrument. Health literacy is the level to which an individual has the capacity to obtain, process, and understand basic health information and health-care services available to make informed decisions on health-care management.¹⁷³ Low levels of health literacy are readily reported for people with COPD and are linked to

poorer health outcomes.^{174–176} Cognitive capacity may also impact the ability to complete the FSM. The incidence of cognitive impairment for people with COPD is greater than the general population with structural brain abnormalities, such as decreased hippocampal volume,¹⁷⁷ increased deep or infratentorial microbleeds,¹⁷⁸ and white matter lesions,¹⁷⁹ being more frequently evident. When measuring functional status, should the patient's reading, cognitive, and literacy level be below that required, this could significantly impact the psychometric properties of the tool and lead to inaccurate information and conclusions. Further, research in understanding the impact of reading or literacy levels on the psychometric properties of FSMs is warranted to ensure that the tools are valid and reliable across different cultural groups.

Conclusions

A diverse range of measures are available to the clinician and researcher looking to evaluate functional status for people with COPD. The establishment of the many FSMs is likely related to the numerous reasons for why functional status is measured for people with COPD. Considering the diversity of measures available for use, selection must be thoughtful based on the nature of the population being studied, and evaluation being conducted, not simply because it is a standard at the institution. Psychometric testing is a critical feature to a strong instrument and issues of reliability, validity, and responsiveness need to be understood prior to measurement use. Contextual nature of measures such as language used and activities measured is also important. One approach to categorizing FSMs was presented to include *daily activities measures*, *impact measures*, *surrogate measures*, *indirect performance-based measures*, and *disability-based measures*. A summary of design and psychometric properties of the measures was provided as a guide to clinicians and researchers in the selection of the most appropriate application of a measure.

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