

**Table e-1. Scales and outcome measures**

Scale	Domain/Symptom measured	Scale range
<b>Objective</b>		
Timed 500-Meter Walk (T500MW) <sup>e40</sup>	Endurance/walking speed	<ul style="list-style-type: none"> <li>Measures motor fatigue and ambulation impairment</li> <li>Participants are asked to walk as fast as they can for 500 meters</li> </ul>
6-Meter Walk (6MW)	Walking speed	<ul style="list-style-type: none"> <li>Measures motor fatigue and ambulation impairment</li> <li>Participants are asked to walk as fast as they can for 6 meters</li> </ul>
9-Hole Peg Test (9-HPT) <sup>e31</sup>	Dexterity and upper-extremity function	<ul style="list-style-type: none"> <li>Measures time to move individual pegs from a container to a board with holes, then move the individual pegs back to the container</li> <li>Part of the MSFC</li> </ul>
10-Meter Walk Test (10-m WT)	Walking speed	<ul style="list-style-type: none"> <li>Measures motor fatigue and ambulation impairment</li> <li>Participants are asked to walk as fast as they can for 10 meters</li> </ul>
20-m timed walking velocity	Walking speed	<ul style="list-style-type: none"> <li>Measures motor fatigue and ambulation impairment</li> <li>Participants are asked to walk as fast as they can for 20 meters</li> </ul>
Ambulatory Fatigue Index (AFI) <sup>e52</sup>	Endurance	<ul style="list-style-type: none"> <li>Measures maximum speed to walk 500 meters</li> </ul>
Action Research Arm Test (ARAT) <sup>e90</sup>	Upper-limb function	<ul style="list-style-type: none"> <li>19-item measure of grasp, grip, pinch, and gross arm movement</li> <li>Scores from 0 (cannot perform) to 3 (normal performance)</li> <li>Maximum score of 57</li> </ul>
Berg Balance Scale (BBS) <sup>e66</sup>	Balance	<ul style="list-style-type: none"> <li>14-item objective measures of static and dynamic activities of varying difficulty</li> <li>Scores from 0 to 4</li> <li>Maximum score of 56</li> </ul>
Dynamic Gait Index (DGI) <sup>e67</sup>	Gait	<ul style="list-style-type: none"> <li>Measures ability to modify balance while walking in presence of external demands</li> <li>Scale from 0 (severe) to 3 (no dysfunction)</li> <li>Maximum score of 24 points</li> </ul>
Expanded Disability Status Scale (EDSS) <sup>10</sup>	Disability	<ul style="list-style-type: none"> <li>8 functional systems: pyramidal, cerebellar, brainstem, sensory, bowel and bladder, visual, cerebral, and other</li> <li>Divided into 20 half steps ranging from 0 (normal) to 10 (death due to MS)</li> <li>EDSS 1–4.5 refer to full ambulation, 5–8 impaired ambulation, 8–9.5 nonambulatory</li> <li>Mild = 1.0–2.5, moderate = 3.0–4.0, severe = 4.5–9.5</li> </ul>
Fatigue Index (FI)	Fatigue	<ul style="list-style-type: none"> <li>Calculated index is determined by the decline in force in knee flexor and extensor</li> </ul>

		muscles during a static, 30-second maximal sustained muscle contraction
Forced expiratory volume in 1 second (FEV <sub>1</sub> )	Lung function	<ul style="list-style-type: none"> <li>Volume exhaled during first second of a forced expiratory maneuver starting from level of total lung capacity</li> </ul>
Forced vital capacity (FVC)	Lung function	<ul style="list-style-type: none"> <li>Volume of air that can be forcibly exhaled after maximal inspiration</li> </ul>
Functional Independence Measure (FIM) <sup>e16</sup>	Disability/ADL	<ul style="list-style-type: none"> <li>18 items measuring degree of independence in self-care, sphincter control, transfers, locomotion, communication, and cognition</li> <li>Scores range from 1 (total assistance) to 7 (complete independence)</li> <li>Scale from 18–126</li> </ul>
Functional reach	Stability	<ul style="list-style-type: none"> <li>Measures maximum distance one can reach forward while standing in fixed position</li> </ul>
Functional Systems Scores	Disability	<ul style="list-style-type: none"> <li>Subscores of the EDSS measuring pyramidal, cerebellar, brainstem, sensory, bowel and bladder, visual, cerebral, and other functional system</li> <li>Higher scores indicate greater disability</li> </ul>
Health-Promoting Lifestyle Profile (HPLP and HPLF-II) <sup>e105</sup>	Lifestyle	<ul style="list-style-type: none"> <li>52 items with 6 subscales (physical activity, spiritual growth, health responsibility, interpersonal relationships, nutrition, and stress management)</li> <li>Assesses a participant's frequency in undertaking activities</li> <li>Score from 1 (never) to 4 (routinely)</li> </ul>
Maximum inspiratory pressure (PI-max)	Lung function	<ul style="list-style-type: none"> <li>Measures lung volume</li> </ul>
Modified Ashworth scale	Spasticity	<ul style="list-style-type: none"> <li>Measures spasticity from 0 (no spasticity) to 4 (rigid) with a 1+ scoring category to indicate resistance through less than half of the movement, for a total of 6 choices</li> </ul>
Multiple Sclerosis Functional Composite (MSFC <sup>29</sup> )	Function/Impairment/Disability	<ul style="list-style-type: none"> <li>Measures leg function/ambulation (T25W), arm/hand function (9-HPT) and cognitive function (PASAT)</li> </ul>
Paced Auditory Serial Addition Test (PASAT <sup>e98</sup> )	Cognition	<ul style="list-style-type: none"> <li>Part of the MSFC</li> <li>Involves working memory, attention, and arithmetic capabilities</li> <li>Participant hears a number every 3 seconds and adds it to the number he or she heard previously</li> </ul>
Maximal expiratory pressure (PE <sub>max</sub> )	Lung function	<ul style="list-style-type: none"> <li>Measured at total lung capacity after deep inspiration following a maximal expiration</li> <li>Pressures sustained &gt; 1 second</li> </ul>
Physical Work Capacity (PWC)	Physical fitness	<ul style="list-style-type: none"> <li>Measures aerobic performance capacity</li> </ul>
Rivermead Mobility Index (RMI <sup>12</sup> )	Disability/Mobility	<ul style="list-style-type: none"> <li>15 items and 1 performance measure</li> <li>Score of 0 or 1 based on ability to perform task</li> <li>Maximum score 15</li> <li>Higher score indicates better mobility</li> </ul>
Range of motion	Flexibility	<ul style="list-style-type: none"> <li>Measures distance and direction a joint can move between flexion and extension</li> </ul>
Strength <sup>31</sup>	Muscle Strength	<ul style="list-style-type: none"> <li>Maximum voluntary isometric contractions</li> </ul>

		<ul style="list-style-type: none"> <li>• Score 0 to 5</li> </ul>
Timed 25-Foot Walk (T25W/7.62 MWT) <sup>e40</sup>	Walking Speed	<ul style="list-style-type: none"> <li>• Time to walk 25 feet as fast as possible</li> <li>• It can be used alone or in combination with the 9-HPT and the PASAT to make up the MSFC measure</li> </ul>
Timed Up and Go (TUG) <sup>e39</sup>	Dynamic balance	<ul style="list-style-type: none"> <li>• Time to rise from a chair, walk 3 m, turn around, and sit down</li> <li>• Times <math>\geq 13.5</math> seconds are related to increased risk of falling in older adults</li> </ul>
Maximal oxygen consumption (VO <sub>2</sub> max)	Physical fitness	<ul style="list-style-type: none"> <li>• Maximum rate of oxygen consumption during incremental exercise</li> <li>• Expressed either as absolute rate or relative rate</li> </ul>
<b>Patient-reported</b>		
Activities-specific Balance Confidence Scale (ABC) <sup>e69</sup>	Balance confidence	<ul style="list-style-type: none"> <li>• 16-item self-report</li> <li>• Rating scale 0–100</li> <li>• 0 = no confidence, 100 = complete confidence</li> </ul>
Barthel Index (BI) <sup>e86</sup>	Activities of daily living	<ul style="list-style-type: none"> <li>• 10 questions assessing feeding, bathing, grooming, dressing, bowel control, bladder control, toileting, chair transfer, ambulation, stair climbing</li> <li>• Rated on basis of amount of assistance required to complete activity</li> </ul>
Beck Depression Inventory (BDI)	Depression	<ul style="list-style-type: none"> <li>• 21 questions</li> <li>• Rating scale 0–63 (0–9: minimal; 10–18: mild; 19–29: moderate; 30–63: severe)</li> </ul>
Borg Rate of Perceived Exertion (RPE) <sup>e35</sup>	Exercise intensity	<ul style="list-style-type: none"> <li>• 15-point scale using verbal descriptors</li> <li>• 6 = rest, 20 = absolute maximum</li> </ul>
Center for Epidemiologic Studies Depression Scale (CES-D)	Depression	<ul style="list-style-type: none"> <li>• 20 questions</li> <li>• Scale 0–60</li> <li>• <math>&gt; 16</math> = depression</li> </ul>
Functional Assessment of MS (FAMS) <sup>e36</sup>	Functional assessment of QOL	<ul style="list-style-type: none"> <li>• 88 questions each of which is assigned to 1 of 6 subscales: mobility, symptoms, emotional well-being, general contentment, thinking/fatigue, and family/social well-being</li> <li>• Version 2 has 59 questions</li> </ul>
Fatigue Impact Scale (FIS)	Fatigue	<ul style="list-style-type: none"> <li>• 40 items evaluating effect of fatigue on cognitive, physical, and social functioning</li> <li>• Score 0 (no problem) to 4 (extreme problem)</li> <li>• Scale 0–160</li> </ul>

Fatigue Severity Scale (FSS) <sup>e21</sup>	Fatigue	<ul style="list-style-type: none"> <li>• 9-item scale measuring severity of fatigue and its effect on activities</li> <li>• 7-point scale with 1 = strongly disagree, 7 = strongly agree</li> <li>• Maximum score of 63 (higher scores indicate greater fatigue severity)</li> </ul>
General Health Questionnaire-28 (GHQ-28) <sup>e26</sup>	Psychological well-being	<ul style="list-style-type: none"> <li>• 28 items measuring emotional distress in the form of depression, anxiety, social impairment, and hypochondriasis</li> <li>• Higher scores indicate greater risk of depression</li> </ul>
Goal Attainment Scale <sup>e72</sup>	Effectiveness	<ul style="list-style-type: none"> <li>• Measures effectiveness across several different modalities</li> </ul>
Hospital Anxiety and Depression Score (HADS) <sup>e32</sup>	Anxiety and depression	<ul style="list-style-type: none"> <li>• 14 items measuring depression, anxiety, and emotional distress</li> <li>• Scale 0–3, with 3 indicating higher frequency</li> <li>• Score from 0–42, with higher scores indicating greater distress</li> </ul>
Hamburg Quality of Life Questionnaire in Multiple Sclerosis (HAQUAMS) <sup>e62</sup>	QOL	<ul style="list-style-type: none"> <li>• 38 items measuring fatigue/thinking, mobility of upper and lower limbs, social function, and mood</li> </ul>
Leeds MSQOL	QOL	<ul style="list-style-type: none"> <li>• 8 items</li> </ul>
London Handicap Scale (LHS) <sup>e23</sup>	Disability	<ul style="list-style-type: none"> <li>• Assesses social participation over 6 domains: mobility, physical independence, occupation, social integration, orientation, and economic self-sufficiency</li> <li>• 6 items each on 6-point scales</li> </ul>
Mental Health Inventory <sup>e75</sup>	Mental health	<ul style="list-style-type: none"> <li>• Measures anxiety, depression, behavioral control, positive affect, and general distress</li> <li>• 38 items</li> </ul>
Modified Dizziness Handicap Inventory <sup>e68</sup>	Dizziness	<ul style="list-style-type: none"> <li>• Severity of dizziness assigned score from 0–100</li> <li>• Higher scores indicate greater symptom severity</li> </ul>
Modified Fatigue Impact Scale (MFIS) <sup>e20</sup>	Fatigue	<ul style="list-style-type: none"> <li>• Modified form of the FIS</li> <li>• A component of Multiple Sclerosis Quality of Life Inventory (MSQLI)</li> <li>• Full-length MFIS consists of 21 items (Cognitive – 10, Physical – 11, and Psychosocial – 2)</li> <li>• Scores range from 0–84, with 0–40 for Cognitive, 0–36 for Physical, and 0–8 for Psychosocial</li> <li>• Abbreviated MFIS has 5 items with score of 0–20</li> <li>• Higher scores indicate a greater impact of fatigue on a patient’s activities</li> </ul>
Multiple Sclerosis Self-Efficacy Scale (MSES) <sup>e63</sup>	Self-efficacy	<ul style="list-style-type: none"> <li>• 14-item scale</li> <li>• Function subscale assesses a participant’s confidence in behaviors involved with ADL</li> <li>• Control subscale assesses a participant’s confidence to manage disease symptoms,</li> </ul>

		<p>reactions to disease-related limitations, and the impact of disease on activities</p> <ul style="list-style-type: none"> <li>• 6-point scoring ranging from strongly disagree to strongly agree</li> <li>• Higher scores are correlated with increased function</li> </ul>
Multiple Sclerosis Impact Scale (MSIS-29) <sup>e25</sup>	QOL	<ul style="list-style-type: none"> <li>• Measures physical and psychological impact of MS</li> <li>• 29 questions</li> <li>• 5-point scale</li> <li>• Higher scores indicate greater impact</li> </ul>
Multiple Sclerosis Spasticity Scale (MSSS-88) <sup>e94</sup>	Spasticity	<ul style="list-style-type: none"> <li>• 88 items</li> <li>• 8 subscales address muscle stiffness, pain and discomfort, muscle spasms, physical impact (ADL, walking, body movements), and psychosocial impact (emotional health and social functioning)</li> </ul>
Multiple Sclerosis Quality of Life Inventory (MuSiQoL) <sup>e75</sup>	QOL	<ul style="list-style-type: none"> <li>• 10 scales: <ul style="list-style-type: none"> <li>○ Health Status Questionnaire (SF-36) – 36 items</li> <li>○ MFIS – 21 items</li> <li>○ PES (Pain Effects Scale) – 6 items</li> <li>○ SSS (Sexual Satisfaction Scale) – 5 items</li> <li>○ BLCS (Bladder Control Scale) – 4 items</li> <li>○ BWCS (Bowel Control Scale) – 5 items</li> <li>○ IVIS (Impact of Visual Impairment Scale) – 5 items</li> <li>○ PDQ (Perceived Deficits Questionnaire) – 20 items</li> <li>○ MHI (Mental Health Inventory) – 18 items</li> <li>○ MSSS (Modified Social Support Survey) – 18 items</li> </ul> </li> </ul>
Multiple Sclerosis Quality of Life – 54 (MSQOL-54) <sup>e53,e71</sup>	QOL	<ul style="list-style-type: none"> <li>• 54 items</li> <li>• 12 subscales with 2 summary scores and 2 additional single-item measures</li> <li>• Measures physical function, role limitations – physical, role limitations – emotional, pain, emotional well-being, energy, health perceptions, social function, cognitive function, health distress, overall QOL, and sexual function</li> </ul>
Pulmonary Dysfunction Index (PDI)	Respiratory muscle weakness	<ul style="list-style-type: none"> <li>• 4 clinical signs</li> <li>• Predicts presence or absence of significant respiratory muscle weakness</li> </ul>
Phone-FITT	Physical activity	<ul style="list-style-type: none"> <li>• Measures frequency, intensity, time, and type of physical activity</li> </ul>
Profile of Mood States (POMS) <sup>e78</sup>	Mood	<ul style="list-style-type: none"> <li>• 65 questions related to 6 affective states (tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, confusion-bewilderment)</li> </ul>

		<ul style="list-style-type: none"> <li>• Responses range from “not at all” to “extremely”</li> <li>• Lower scores indicate stabler mood profiles</li> </ul>
Perceived Stress Scale (PSS) <sup>e84</sup>	QOL	<ul style="list-style-type: none"> <li>• 14 questions assessing perception of stress of life events</li> <li>• Scores from 0 (never) to 4 (very often)</li> <li>• Lower scores indicate less stress and better coping</li> </ul>
Rivermead Mobility Index (RMI) <sup>e29,e30</sup>	Mobility	<ul style="list-style-type: none"> <li>• 15 items and 1 performance measure</li> <li>• Score 0 or 1 on the basis of ability to perform task</li> <li>• Maximum score of 15</li> <li>• Higher score indicates better mobility</li> </ul>
Social Experiences Checklist of Tempelaar (SEC, SET) <sup>e15</sup>	Social support	<ul style="list-style-type: none"> <li>• Measurement of positive and negative social support based on emotional support, affirmational support, instrumental support, and presence</li> <li>• Assess how social function influenced 16 statements during the previous 2 weeks</li> <li>• Score from 0 (no problem) to 4 (extreme problem)</li> </ul>
Short Form (36) Health Survey (SF-36)	QOL	<ul style="list-style-type: none"> <li>• Part of MSQLI</li> <li>• 36 questions evaluating 8 scales: Physical Functioning, Physical Role Functioning, Bodily Pain, General Health, Vitality, Social Functioning, Emotional Role Functioning, and Mental Health</li> <li>• Higher scores indicate better health</li> </ul>
Sickness Impact Profile (SIP) <sup>e58</sup>	QOL	<ul style="list-style-type: none"> <li>• 68 questions assessing QOL and level of dysfunction on the basis of illness</li> <li>• Evaluates physical dimension (somatic autonomy and mobility control), psychological dimension (psychological autonomy/communication and emotional stability), and social dimension (mobility range and social behavior)</li> <li>• Scored dichotomously, with 0 = best health to 68 = worst health</li> </ul>
Sloan Letters Test (SLT)	Vision	<ul style="list-style-type: none"> <li>• Low-contrast testing of visual acuity</li> <li>• Distance vision test available in 1.25%, 2.5%, 5%, 10%, and 25% contrast levels</li> </ul>
Self-Rated Abilities for Health Practices Scale (SRAHP) <sup>e106</sup>	Self-efficacy	<ul style="list-style-type: none"> <li>• 28-item scale measuring respondent’s beliefs about his or her ability to perform health-promoting practices</li> <li>• Rate 1–4</li> <li>• Maximum score 112</li> <li>• Higher scores indicate higher levels of self-efficacy</li> </ul>
Visual analog scale (VAS)	General impairments such as pain or fatigue	<ul style="list-style-type: none"> <li>• Measures subjective characteristics that cannot be directly measured</li> <li>• Respondent specifies level of agreement with a statement by indicating a position along a continuous line between 2 end-points</li> </ul>

Abbreviations: ADL = activities of daily living; MS = multiple sclerosis;  $PI_{\max}$  = maximal inspiratory pressure; QOL = quality of life.