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Scoping Review of Judgement-Based Measures of Ambulation with Assistive Devices for Children and Youth

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Abstract

Aim: To identify available judgement-based measures of ambulation with assistive devices for the purpose of examining item content and responses to aid in the expansion of the Pediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT) Mobility Domain.

Methods: PubMed and CINAHL databases were used to identify measures meeting the following criteria: 1) applicable for children/youth; 2) self-report, proxy-report, or interview administration; and 3) assistive device (walker, cane, crutches, gait trainer) use specified or considered with responses. Population, administration, respondent(s), items, and responses were compiled. Item content was categorized and response scales grouped by type.

Results: Fifteen measures met inclusion criteria. Measures included child and proxy-report. Item categories included Surfaces, Steps/Stairs, Dual Tasks, Negotiation of Environment, Distance, and Time. Only two measures distinguished between device type within items. One measure specified gait trainers. "Difficulty" and "Assistance" were the most frequently used response scales.

Conclusions: Available measures have content examining device use; however, none of the measures are comprehensive, devices are not consistently specified, and responses are imprecise. Items with well-defined responses for measuring a child's ambulation with an assistive device are needed for clinical practice, research, and program evaluation.

Keywords

Dependent ambulation; pediatrics; self-report; walkers; assistive devices

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Ambulation is a common goal for children and youth receiving physical therapy services and use of an assistive device during ambulation has been shown to increase activity and participation for individuals with disabilities (Bertrand, Raymond, Miller, Marin Ginis, & Demers, 2017). Devices such as a walker, crutches, cane, or gait trainer may allow ambulation for children who are otherwise unable to walk independently. For other children, use of an assistive device may reduce the amount of physical assistance and/or increase speed, distance and safety (Ivanyi et al., 2015). Ambulation and device options require a thorough assessment by the physical therapist, which should include input from the child and his/her caregivers (LaForme Fiss, McCoy, Chiarello & Move Play Study Team, 2012).

A physical therapist's examination of ambulation may include an observational gait analysis, a timed or categorical capacity measure, and/or a judgement-based measure, patient-or parent/caregiver-report of typical performance and assistive device use. A capacity-based measure such as a 6-minute walk test (Bartels, de Groot, & Terwee, 2013) or the Gross Motor Function Measure (Russell, Rosenbaum, Wright & Avery, 2013) is a standardized test in which a child is asked to perform an activity in a specific manner in a standard environment (with or without a device). For this review, judgement-based measures were defined as those containing standard questions that are completed by the patient or a person familiar with the patient's typical performance (parent, caregiver, or clinician). Judgement-based measures provide information about how the child typically completes a functional activity during their usual daily routine (West, Dunford, Mayston, & Forsyth, 2013). Judgement-based measures may or may not specify if respondents should consider the use of an assistive device when responding to the questions and they may or may not include items specific to device use. These types of questions create challenges for measuring improvement with ambulation, particularly if a child progresses to a less restrictive device (e.g. walker to cane) over time.

Valid and sensitive measures that include child and caregiver report of the child's typical performance, including usual use of an assistive device, are needed to conduct a meaningful assessment of ambulation and measure progress with ambulation with rehabilitation interventions. Requiring less assistance from another person or a device, being able to walk fast enough to keep up with peers, or being able to walk on uneven surfaces are important therapeutic goals. Objective documentation using a valid and sensitive measure can provide a measure of progress as well as justification for therapy services.

The objective of this scoping review was to identify available judgement-based measures that assess ambulation with assistive devices for the purpose of examining item content and responses to aid in the expansion of the Pediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT) Mobility Domain. The PEDI-CAT is a judgement-based measure used to identify functional delay, measure change in function over time for an individual child and/or to evaluate group progress in program evaluation or research across all pediatric diagnoses, conditions and settings (Haley, Coster, Dumas, Fragala-Pinkham, & Moed, 2012). Computer adaptive tests, such as the PEDI-CAT have the advantage of individualizing tests as they use a computer algorithm to select items from a large item bank that are targeted to the individual child (Hambleton, R.K., 2005). In addition, items can be added to a CAT formatted measure using a calibration study and adjusting the algorithm.

The PEDI-CAT Mobility Domain item bank includes 85 items, but only 10 items in the item bank are available to assess ambulation with a cane, crutches, or walker (Haley et al., 2012). While the walking device items combined with the other 75 mobility items have been shown to cover an adequate spread along the scoring metric, an expanded item bank has been recommended to increase sensitivity to functional changes for children of different ages and abilities (Dumas, Fragala-Pinkham, Feng, & Haley, 2012; Fragala-Pinkham, Dumas, Lombard, & O'Brien, 2016).

METHODS

This scoping review follows the framework described by Arksey and O'Malley (2005) with the intent to determine the depth and breadth of the available judgment-based measures related to our research objective. To identify relevant studies, a keyword literature search of original articles in the Medline and CINAHL databases was completed using combinations of the following terms: "ambulation", "gait", "assistive device", "walking device", "walker", "cane", "crutches", "gait trainer" with "test", "measure", "patient-report", self-report", "parent-report" and "judgement-based". The search was aimed at identifying studies describing, validating or utilizing judgement-based measures and that met the following criteria: 1) published in English between 1975 and 2018; 2) applicable for children and youth; 3) administered via self-report, proxy-report or interview; and 4) assistive device use during ambulation (walker, cane, crutches, gait trainer) was specifically asked or could be considered with responses based on the administration instructions. In addition to judgement-based measures of ambulation, multi-dimensional scales of function were evaluated for inclusion if ambulation-related items were included. Disease-specific measures were also included if inclusion criteria were met. Lastly, consistent with the Guide to Physical Therapist Practice 3.0 (American Physical Therapy Association, 2014), we considered only assistive devices for ambulation listed as "Aids for Locomotion" (e.g. walkers, crutches, canes, gait trainers) and have excluded orthotics, prosthetics, and seating and positioning technologies. Capacity measures completed via direct testing measuring time, speed, distance or gait characteristics were also excluded.

Studies with the identified measures and the tests and measures themselves were reviewed by the authors of this article for final determination of inclusion or exclusion in the scoping review. Instrument details including intended population, administration method, and respondent(s), item content, type of device(s) allowed, and response options were compiled in table format. Item content was categorized and response scales grouped by type by this study's authors. Reviews providing evidence of the psychometric properties of the measures were compiled for reference.

The authors of this study include two physical therapists and one nurse each with more than 30 years of clinical practice, program evaluation, and/or research experience examining mobility and health care outcomes for children with disabilities.

RESULTS OF REVIEW

Fifteen measures met the inclusion criteria for this review (Table 1). Two measures, the Caregiver Priorities & Child Health Index of Life with Disabilities (CPCHILD) (Narayanan, Fehlings, Weir, Knights, Kiran, & Campbell, 2006) and Abilico-Kids (Caty, Arnould, Thonnard, & Lejeune, 2008) had no instruction or item content specifying assistive devices but were included as these measures are specifically intended for use with children with disabilities. Two other measures, the Gillette FAQ (Novacheck, Stout, & Tervo, 2000) and the Mob Ques (Van Ravesteyn, Scholtes, Becher, Roorda, Verschuren, & Dallmeijer, 2010a; van Ravesteyn, Dallmeijer, Scholtes, Roorda, & Becher, 2010b), did not have assistive device items but instructs respondent to rate items with assistive device use if applicable. The remaining 11 measures included specific items regarding assistive device use during ambulation or included specific question(s) about device use.

Most measures grouped assistive devices (e.g. walker, cane, crutches; crutches, two canes) and only the CP-CAT LE (Tucker et al., 2008, 2009) assessed gait trainer use. Item content categories included Surfaces, Steps/Stairs, Dual Task Performance, Negotiation of the Environment, Distance, and Time. Item content were displayed in varying formats including full sentences or questions, phrases or as part of a list of activities. Table 1 provides information on the intended population and respondents, administration format, general item content and assistive device use specifications for each of the identified measures. Table 2 provides additional information regarding item content categories and sample items.

One measure was described as child or self-report only, the Spinal Cord Independence Measure Self-Report for Youth III (SCIM-SRIII) (Mulcahey et al., 2016). Three measures, the Mobility Questionnaire (MobQues) (Van Ravesteyn, Scholtes, Becher, Roorda, Verschuren, & Dallmeijer, 2010a; van Ravesteyn, Dallmeijer, Scholtes, Roorda, & Becher, 2010b), the Child-Health Assessment Questionnaire (CHAQ) (Singh, Athreya, Fries, & Goldsmith, 1994), and the CP-CAT (Tucker et al., 2008) were described as parent-report only. Five measures were described as self- (child) and/or parent-report including the Abilico-Kids (Caty, Arnould, Thonnard, & Lejeune, 2008), the CP-CHILD (Narayanan et al., 2006), the Gillette Functional Assessment Questionnaire (Gillete FAQ) (Novacheck, Stout, & Tervo, 2000), the PROMIS-Physical Function-Mobility (Amtmann, Cook, Johnson, & Cella, 2011), and the Pediatric Outcomes Data Collection Instrument (PODCI) (Daltroy, Liang, Fossel, & Goldberg, 1998). Lastly, five measures were reported as “other proxy”, administered via clinician observation and/or interview with the child and/or parent report measures. These included the Functional Mobility Scale (FMS) (Graham, Harvey, Rodda, Nattrass, & Pirpiris 2004), the PEDI (Haley Coster, Ludlow, Haltiwanger, & Andrellos, 1992), the PEDI-CAT (Haley, Coster, Dumas, Fragala-Pinkham, & Moed, 2012), the School Function Assessment (SFA) (Coster, Deeney, Haltiwanger, & Haley, 1998), and the Wee-Functional Independence Measure (WeeFIM) (Msall et al., 1994). Administration methods for all of these measures included completion by the respondent or via interview recorded on paper, computer, or iPad.

Four measures included assistive device use within the response scale options including the Top Down Motor Milestone Test (TDMT) (van der Putten, Vlaskamp, Reynders, & Nakken,

2005), FMS (Graham et al., 2004), FAQ (Novacheck et al., 2000), and MobQues (Van Ravesteyn et al., 2010a; 2010b). Table 3 details the type of response scale and specific response options for each measure. Five of the measures used “Difficulty” for the response scale and four measures used “Assistance”, while three other measures had scales for both Difficulty and Assistance and one measure used consistency of performance to assess mobility. Most measures provided definitions for the rating scale options, while others did not. None of the measures included all types of devices, surfaces, dual tasks, distances, and environments to represent a comprehensive continuum of easy to hard items for children of all abilities. Reviews of the psychometric properties of the identified measures vary in number and content. Table 4 provides a reference list of reviews for the identified measures for those interested in evidence of the psychometric properties.

DISCUSSION

Physical therapists commonly provide intervention to children and youth who use assistive devices for ambulation. A comprehensive judgement-based measure which specifies a variety of ambulation devices and is responsive to functional changes in ambulation is important for clinical practice. The objective of this scoping review was to identify judgement-based measures for children that assess ambulation with assistive device use and examine item content and response options to aid in expansion of the Pediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT) Mobility Domain.

One in six children with CP (Novak, Smithers-Sheedy, & Morgan, 2012) and more than half of adult patients with an incomplete spinal cord injury (Saensook et al., 2014) use an assistive device for ambulation. In addition, gait trainers are used by 10% of children with disabilities who use wheelchairs as a primary means of mobility (Peredo, Davis, Norvell, & Kelly, 2010). Of the measures identified, few had the use of assistive devices specified within items and only one measure separated assistive devices by type within items. This lack of detail limits the ability to measure change over time such as progressing from using a walker to crutches or a cane.

In a review of potential outcome measures for children with cerebral palsy who use gait trainers, Livingstone and Paleg (2015) identified 12 clinical assessments, of which three, the PEDI (Haley et al, 1992), WEE-FIM (Msall et. al, 1994) and SFA (Coster, Deeney, Haltiwanger, & Haley, 1998) were judgement-based measures. The PEDI was suggested to have the best evidence of reliability, validity and clinical utility for use with children who used gait trainers (Livingstone & Paleg, 2015). The PEDI, however, does not specify walking or a specific device within mobility items, but rather, uses the verb “moves”, allowing the respondent to choose the method of mobility and whether a device is considered. Use of the Top Down Motor Milestone Test (van der Putten et al., 2005), developed for use with the MOVE curriculum (Capone, Hoopes, Kiser, & Rolph, 2007), is scarcely reported. The measure was designed to be used with the Rifton© gait trainer (Livingstone & Paleg, 2015), however, only two of the movement skill ambulation items included can be accomplished with a gait trainer (“walks forward” and “walks backward”). The PEDI-CAT version 1.4.0 (Haley et al., 2012) Mobility Domain contains 10 ambulation

items which include assistive devices; however, the devices are grouped together ("walker, cane or crutches") and there is no item content for children who use a gait trainer.

Two additional possibilities for evaluating the effects of physical therapy intervention on ambulation performance with an assistive device may be the Canadian Occupational Performance Measure (COPM) (Law, Baptiste, McColl, Opzoomer, Polatajko, & Pollock, 1990) and Goal Attainment Scaling (GAS) (Cusick A, McIntyre, Novak, Lannin, & Lowe, 2006). These outcome assessments depict a client's self-perception of performance with everyday activities and thus, could be used to measure and document ambulation with an assistive device if specified. While these measures are appropriate to measure change in individual patients, because the goals are individualized, they cannot be aggregated to evaluate outcomes for groups of children.

A physical therapy plan of care may include goals that specify progressing from a more supportive assistive device to a less supportive device for ambulation or changing from a less supportive device to a more supportive device to improve function or independence. In general, item content in the identified measures referred to time, distance, and/or speed, surfaces (e.g. level, stairs), environmental negotiation and dual task performance during walking. Item overlap was apparent between measures, supporting content validity. There does, however, appear to be opportunity to build from the existing items to further define and delineate measurement properties such as distance, time, and speed with use of a specific device.

A review of existing measures and item content is a common approach in the development or refinement of a measure to develop an item bank (Ruo, Choi, Baker, Grady, & Cella, 2010; Carlozzi et al., 2016; Dumas, Fragala-Pinkham, & Haley, 2010; Dumas, Fragala-Pinkham, Haley, Coster, et al. 2010). A comprehensive search can yield a wide array of potential items and ensure content validity (PROMIS Standards, 2012). The PEDI-CAT is a judgement-based measure used to identify functional delay, measure change in function over time for an individual child and/or to evaluate group progress in program evaluation or research across all pediatric diagnoses, conditions and settings (Haley et al., 2012). Computer adaptive tests, such as the PEDI-CAT have the advantage of individualizing tests as they use a computer algorithm to select items from a large item bank that are targeted to the individual child (Hambleton, R.K., 2005). In addition, items can be added to a CAT formatted measure using a calibration study and adjusting the algorithm.

The PEDI-CAT (Haley et al, 2012) Mobility domain currently includes 10 items specific to the use of assistive devices for ambulation. These items combine "walker, cane, and crutches". It became evident through this review that in general, content for functional mobility with a walker, cane, or crutches is covered, however, separating by device type similar to the CP-CAT (Tucker et al., 2008), and SCIM-SR-Youth (Mulcahey et al., 2016) may be useful. This appears to be a clinically meaningful distinction to measure change for children who may shift from a more or less restrictive type of device during their lifetime and would appear to have the potential to improve measurement sensitivity.

Response scales for the identified measures included “Difficulty”, “Assistance” or both, for 13 of 16 of the measures. It was noted that the options were not always clearly defined. The PEDI-CAT uses a “Difficulty” scale but combines level of difficulty with assistance, time and effort. For example, for the PEDI-CAT response options, “Hard” is defined as “the child does with a lot of help, extra time, or effort” and “Easy” is defined as “the child does with no help, extra time or effort, or child’s skills are past this level” (Haley et al., 2012). With a response scale, that combines these concepts, it creates uncertainty as to a child’s progress. Despite this limitation, the PEDI-CAT Mobility domain has been shown to discriminate functional abilities of children with disabilities who walk with devices from those who use wheelchairs as a primary means of movement transportation (Dumas et al., 2015).

Responsiveness of the PEDI-CAT Mobility domain has been demonstrated in a sample of 66 children admitted and discharged from a post-acute care hospital, but responsiveness of the specific mobility device items is not known (Fragala-Pinkham et al., 2016). During inpatient rehabilitation, in general, children are making rapid progress but measuring progress in children who are progressing more slowly yet demonstrating gains that are relevant to the child and family (such as progressing to the use of loftstrand crutches instead of a walker since crutches are lighter and easier to transport in a car or to maneuver in tight spaces) is also important. Further consideration and development of a clear and sensitive response scale is warranted to accurately document a child’s mobility function and progress with intervention.

Implications for Practice

Clinicians may find this review a resource for identifying and evaluating judgement-based measures of ambulation with assistive devices; improve objectivity in content and description in therapy documentation; and for describing present levels of performance needed in writing Letters of Medical Necessity for assistive devices.

Directions for Further Research

Following this review, additional steps for item bank development are necessary. Focus groups with physical and occupational therapists who work with children who use assistive devices will allow for the identification and confirmation of needed item content and identify setting-specific, environmental, age-specific, and cultural considerations for new item development. After new items have been developed, cognitive interviews with additional therapists will assure item clarity and identify wording ambiguity and the need for qualifiers (PROMIS Standards, 2012).

When a final revised item bank is created, a calibration study with a large sample of children who use walking devices will be conducted to allow different subsets of questions to be selected for administration and scored on a common scale. In the development of the current PEDI-CAT, three walking device items were not included in the final item bank due to high Differential Item Function and item misfit calculations. These items were: ‘Opens/closes door to enter/exit home while walking with walking aid’; ‘Using walking aid, walks quickly indoors’; and ‘With walking aid, walks fast enough to cross two-lane street safely’(Haley et al., 2012). These items as well as new items should be reviewed to determine if the items are

functioning as intended or if they need to be reworded to represent the content differently. The scoring metric should also be reviewed to determine if there are gaps in the scale. Expansion of the PEDI-CAT Mobility domain Walking Device content area appears warranted.

CONCLUSION

This scoping review highlights limitations in the available number of standardized judgement-based measures for assessing typical performance of ambulation with an assistive device for children and youth. The 15 measures identified have general content regarding the use of an assistive device, but content is limited as evidenced by the similar item content within each of the measures and the use of assistive devices is often not depicted within items. Response options are not well-defined and thus, may diminish the sensitivity of the measures as respondents may not be able to distinguish between options. A comprehensive yet practical judgement-based measure with item content and responses that are well-defined and responsive for measuring a child's ambulation with an assistive device will be useful in clinical practice, research, and program evaluation.

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Table 1.

Judgment-Based Measures including Ambulation Items

Measures	Intended Population	Administration Method and Respondent(s)	General Item Content Categories	Walking Device
Abilico-Kids (Caty et al., 2008)	Children with cerebral palsy ages 6–15 years	10-item self-administered parent questionnaire to measure locomotion abilities	Stairs-without railing Stairs-alternating feet Escalator Dual-Task (while holding something) Distance Backwards Narrow Space/Turning Running	No specific items or questions about device use or exclusion
Caregiver Priorities & Child Health Index of Life with Disabilities (CPCHILD) (Narayanan et al., 2006; 2007)	Children with cerebral palsy ages 5–18 years	Parent-Report and Self-Report options; questionnaire about child's health, comfort and well being includes section titled, "Positioning, Transferring and Mobility" with 2 items on moving indoors and outdoors	(Move) In home ("in whatever way possible") (Move) Outdoors ("in whatever way possible")	No specification of device use or exclusion
Cerebral Palsy-Computer Adaptive Test – Lower Extremity Skills (CP-CAT-LE) (Tucker et al., 2008, 2009; Mulcahey et al., 2015)	Children with cerebral palsy (GMFCS Levels I-V); responsive to mobility changes after surgery for children GMFCS Levels I-III, 4–20 years of age	Parent-report 15-item computer adaptive test with an item bank of 91 items for assessment of basic mobility, transfers, wheeled mobility and ambulation (44 items)	Level Surfaces Uneven Surfaces Ramps Curbs/Stairs Carry small/large object Push/pull object Negotiate objects/people Thresholds Narrow surface Turn/Change directions Open/Close doors Elevator Slippery surfaces	Yes, as specified *within* items (cane or crutches; walker, or gait trainer)
Child-Health Assessment Questionnaire (CHAQ) (Singh et al., 1994; Huber et al, 2001; Morales et al., 2008)	Children with juvenile idiopathic arthritis 1–19 years; has been used with other conditions including cerebral palsy, spina bifida, juvenile dermatomyositis	30-item functional health status measure; self-administered parent-report questionnaire to assess how child's illness affects his/her ability to function in 8 daily life domains "over the past week"; Walking Domain has 2 items	Level surface outdoors Up stairs	Yes specific device (cane, walker, crutches) used is checked separately
Functional Mobility Scale (FMS) (Graham, et al., 2004)	Children with cerebral palsy 4–18 years	Clinician-rated based on parent responses to questions about child's mobility performance (what the child actually does) at the present time. Mobility is rated for three distances: home (5 meters), school (50 meters), community (500 meters) according to the need for assistive devices of canes, crutches, walker or wheelchair.	Surfaces Device Use Distance	Devices and wheelchair use are included in the scoring
Gillette FAQ (Novacheck et al., 2000; Stout et al., 2012)	Children (ages not specified)	Self or parent/caregiver report with 2 parts: 1) 10-level ambulation classification scale in which the respondent selects one statement that best depicts a child's typical walking ability and a 22 item skill set with walking and other mobility activities	Walking only for exercise Distance (household, community) Surfaces Walk and carry items Step over items Walk in tight areas	Yes, instructions to rate with device as applicable for 10-level classification scale

Measures	Intended Population	Administration Method and Respondent(s)	General Item Content Categories	Walking Device
			Escalator Run	
Mobility Questionnaire 47 (Clinical Version) and Mobility Questionnaire 28 (Research Version) (van Ravesteyn et al., 2010a, 2010b; Dallmeijer et al., 2011)	Clinical Version-Children with cerebral palsy Research Version-Children with cerebral palsy (GMFCS Levels I-III)	Parent report of mobility limitations in daily life; response to: How difficult was it for your child to perform these activities in the usual way during the past week (with the use of assistive devices if needed) but without help from someone else.	Walk indoors (e.g. to/from toilet) Up/Down Stairs Walk outdoors (e.g. to/from car, on asphalt, in sand)	Parents are asked to indicate how difficult it was for their child to perform these activities in the usual way (with the use of assistive devices if needed)
Pediatric Evaluation of Disability Inventory Functional Skills and Caregiver Assistance Scales-Mobility Domain (PEDI) (Haley et al., 1992)	Children 6 months to 7.5 years or for older children with functional skills less than what is expected for a typical 7.5 years	Professional judgement or parent/caregiver report via interview of child's typical performance	Indoor Locomotion: Methods - walks with support; without support Moves-Distance/ Speed Pulls/Carries Objects Outdoor Locomotion: Methods- walks with support, without support Moves - Distance/ Speed and Surfaces Up Stairs Down Stairs	Allows for use of device as indicated *within* item; Does not specify which device and does not differentiate between assistive devices and wheelchair
Pediatric Evaluation of Disability Inventory Computer Adaptive Test-Mobility Domain (PEDI-CAT) (Haley et al., 2012)	Children and youth birth to 21 years	Parent-report or professional judgement of child's typical performance	In Home Outdoor Surface Wet Surface Keeps Place in Line Ramps Curbs/Stairs On/Off Bus For Several Hours	10 walking device items specifying walker, cane or crutches; does not differentiate between device types in scoring
Pediatric Outcomes Data Collection Instrument (PODCI) (Daltroy et al., 1998)	Children and youth 2 – 18 years	Parent-Report (ages 2–10); Self-Report (ages 11+)	Walk-distance (1 block, 3 blocks, >1 mile) Stairs-up 1 flight, up 3 flights On/Off Bus	Yes, but not specified within item; also asks "How often does your child uses assistive devices (such as braces, crutches, or wheelchair) for walking and climbing?"
Patient-Reported Outcomes Measurement System (PROMIS): Physical Function-Mobility (DeWitt et al, 2011; Irwin et al., 2012; PROMIS®, 2012)	Children and youth 8–17 years	Child Self-Report V2.0 (8–17 years) computer adaptive test (item bank 24 items) and short form (8 items) Parent Proxy Report V2.0 for children 5–17 years; Short forms (8 items) and computer adaptive test versions (23 items) 7-day recall for all versions	Get around Up stairs Down stairs	Device use (walker, cane, or crutches) specified in item stem; does not differentiate between device types
School Function Assessment (SFA) (Coster et al., 1998)	Children in kindergarten through 6th grade	Report by those who work with child regularly in school 6 Up/Down Stairs items; 11 Manipulation with Movement items; items 19 Travel (Moves) items	Activity Performance-Physical Tasks: Travel Subscale: Moves-flat surfaces, across room, within room, through doorways and narrow hallways, slippery surfaces moderate distances-room to room, level surfaces, in aisles; up/down inclines and ramps, Keeps pace with peers-short	Yes; Device used is checked separately but does not differentiate cane, walker, crutches

Measures	Intended Population	Administration Method and Respondent(s)	General Item Content Categories	Walking Device
			distance; uneven surface; in a line, through congested areas, around holes/ other dangerous surfaces; outdoors Manipulation with Movement Subscale: carries fragile, spill able/ small/large objects, opens/closes doors, moves objects along floor Up/Down Stairs Subscale: single, short (4–5 steps) flight, up/down flight (12 steps), regular speed, carrying an object	
SCIM-III Self-Report-Youth (Mulcahey et al., 2015; 2016)	Children and youth 8 –18 years with a spinal cord injury	Diagnosis-specific self-report outcome assessment; items and response options modified from adult version; paper-pencil questionnaire; 4 of 17 total items address walking and stairs	Indoor-Distance/ Assistance Outdoors Stairs	Within specific individual items
Top Down Motor Milestone Test (van der Putten et al., 2005)	School-age children with significant limitations in mobility	Placement test for Mobility Opportunities Via Education® Curriculum; Parent or teacher report (interview) based on direct observation of typical performance; 16 total motor skills with 8 walking items	Walk: forward, backward, turning Up and down stairs Up and down slopes	Use of walker included in items and scoring levels
Wee-FIM (Msall et al., 1994)	Infants and children 6 months to 7 years; may be used with children older than 7 years with functional abilities less 7 year olds without disability	Minimal data set with a total of 18 items (2 ambulation items); Clinician-respondent following training	Walking-Level Surface Stairs	Yes, scoring changes to “modified”

Table 2.

Assistive Device Item Content: Categories, Types, and Examples

Categories		Item Types	Example Items (Test)
Surfaces	Indoor	Level Carpeted Threshold In/Out of Elevator Wet, Slippery Narrow	Walks indoors, but holds onto furniture, walls, caregivers or uses devices for support (PEDI) A “gait trainer” is an assistive device that has extra supports for the trunk and pelvis, such as a seat. When using his/her gait trainer, my child can walk across a carpeted floor. (CP-CAT-LE)
	Outdoor	Slightly rough, uneven Rough, uneven (grass, mulch, gravel)	Walks with walking aid (e.g. cane, crutches, walker) on grass, mulch or gravel (PEDI-CAT)
Steps/Stairs	Indoor	Partial flight-up and down Full flight-up and down With Rail-up and down Without Rail-up and down	Climb one flight of stairs? (PODCI) Walks down partial flight of stairs (PEDI)
	Outdoor	Single Step/Curbs-up and down Partial flight-up and down Full flight-up and down With Rail-up and down Without Rail-up and down Ramps/Inclines/Hills-up and down On/off Bus	A “curb” is a 6-inch single step that one steps up or down going from a street to a sidewalk. When using his/her crutch(es) or cane, my child walks up and down curbs. (CP-CAT-LE)
(Dual) Tasks	Upper Extremity Use while Walking	Push/pull heavy object on wheels Carry Object-small/1 hand/fragile Carry Object-large/heavy Open/Close doors Carry a backpack	A “backpack” is a bag/backpack worn on one or both shoulders, containing lightweight objects. When using his/her walker, my child can walk and carry his/her backpack from the house to the car (30 feet/9 meters). (CP-CAT-LE)
Negotiation of the Environment	Indoor and Outdoor	In Home Outside Home Change Directions Turning Walking Backwards Step Over Object in path Narrow Space (Tight Area) Crowd of people Keeps place in line On/off: escalator, elevator, bus, subway	Moving about in the home? (in whatever way possible) (CP-Child) Moving about outdoors? (in whatever way possible) (CP-Child) Can maneuver in tight areas (Gillette FAQ) Going up an escalator alone (Abilico-kids)
Distance	Home	Within Room/Classroom Between Rooms Short Distance- <10 Yards/Meters	Walks with walking aid (e.g. cane, crutches, walker) from room to room in home (no stairs) (PEDI-CAT)
	Community	Car lengths Blocks Miles	How does your child move around for long distances such as at the shopping centre? (500m) (FMS)

Categories		Item Types	Example Items (Test)
Time	For Exercise For Length of an Event	Hours	Walks with walking aid (e.g. cane, crutches, walker) several hours at family or school outing such as zoo, amusement park or fair (PEDI-CAT)

Table 3.

Response Option Type by Measure

Difficulty Scales	
Abilico-Kids	3-point scale: Impossible, Difficult, Easy (Not scored if not attempted in last 3 months)
CP-CAT LE	5-point scale: Unable to do, With much difficulty, With some difficulty, With Little Difficulty, Without Difficulty
CHAQ	4-point scale: During the past week-Without any difficulty, With Some Difficulty, With Much Difficulty, Unable (If either devices and/or help from another person is indicated, score = 2 (Much Difficulty))
MobQues	Total scores are expressed on a scale of 0 to 100 Response options are: impossible without help (score 0); extremely difficult, very difficult and difficult (score 1); moderately difficult and somewhat difficult (score 2); slightly difficult and very little difficulty (score 3); and not difficult at all (score 4). Total scores are calculated by adding all item scores (range 0–4) divided by the maximum possible score and multiplied by 100 to obtain scores on a scale of 0 to 100 (with a low score representing severe limitations in mobility): MobQues47=(Sitem⁄188)•100; MobQues28=(Sitem⁄112)•100. T
PEDI-CAT	4-point scale: Unable, Hard, A Little Hard, Easy
PROMIS	5-point scale: Without any difficulty, With a little difficulty, With some difficulty, With much difficulty, Unable
Assistance Scales	
FMS	6-point scale: Independent on all surfaces (no device or assistance), Independent on level surfaces (no device or assistance from another person; requires a rail for stairs), Uses sticks (one or two) without help from another person, Uses crutches without help from another person, Uses a walker or frame (without help from another person), uses wheelchair; Scored for 5, 50 and 500 meters. .
SCIM-SR Youth	Specific to individual items: assistance, supervision, or devices
Top Down Motor Milestone Test	4 levels to describe independence with mobility ranging from independence (Grad Level) to total dependence (Level III)
WeeFIM	7-level ordinal scale: Complete and Modified Independence (Levels 7 and 6) without a helping person to Modified and Complete Dependence (Levels 5 to 1) with a helping person
Difficulty and Assistance or Frequency	
CPCHILD	Difficulty (7-point scale) During the past 2 weeks - Not Possible (Almost Impossible), Very Difficult, Difficult, Slightly Difficult, Easy, Very Easy, No Problem at All AND Assistance (4-point scale): Total, Moderate, Minimal Supervised, Independent
FAQ	Rank Order 10-Level Walking Scale (Non-ambulatory to No Difficulty or Assistance on level and uneven terrains)
PEDI	Functional Skills Scale: (2-point capability scale) –Unable, Capable AND Caregiver Assistance: 6-point Level of Assistance – Independent, Supervision, Minimal, Moderate, Maximal, Total
PODCI	4-point scale: During the last week - Easy, A little hard, Very hard, Can't Do At All and Too young for this activity AND How often does your child need help from another person for walking and climbing? – Never, Sometimes, About half the time, Often, All the time
Consistency of Performance Scales	
SFA	4-Point scale (Activity Performance, Physical Tasks-Travel): Does not perform, Partial Performance, Inconsistent Performance, Consistent Performance

Table 4.

Reviews Detailing Psychometric Properties of Selected Measures

Measure	Review(s)
Abilico-Kids (Caty et al., 2008)	Ammann-Reifter et al., 2014 Himuro, et al., 2017 Zanudin et al., 2017
Caregiver Priorities & Child Health Index of Life with Disabilities (CPCHILD) (Narayanan et al., 2006; 2007)	Carlon et al., 2010
Cerebral Palsy-Computer Adaptive Test – Lower Extremity Skills (CP-CAT-LE) (Tucker et al., 2008, 2009; Mulcahey et al., 2015)	Mensch et al., 2015
Child-Health Assessment Questionnaire (CHAQ) (Singh et al., 1994; Huber et al, 2001; Morales et al., 2008)	Klepper, S.E., 2011
Functional Mobility Scale (FMS) (Graham, et al., 2004)	Harvey et al., 2008 Debuse & Brace., 2011 Adair et al., 2012 Ammann-Reifter et al., 2014Himuro et al., 2017 Zanudin et al., 2017
Functional Assessment Questionnaire (FAQ) (Novacheck et al., 2000; Stout et al., 2012)	Harvey et al., 2008 Debuse & Brace., 2011 Adair et al., 2012 Ammann-Reifter et al., 2014 Himuro et al., 2017 Zanudin et al., 2017
Mobility Questionnaire 47 (Clinical Version) and Mobility Questionnaire 28 (Research Version) (van Ravesteyn et al., 2010a, 2010b; Dallmeijer et al., 2011)	Ammann-Reifter et al., 2014
Pediatric Evaluation of Disability Inventory Functional Skills and Caregiver Assistance Scales-Mobility Domain (PEDI) (Haley et al., 1992)	Harvey et al., 2008 Dumas et al., 2009 Debuse & Brace, 2011 Bisaro et al., 2015 Williams et al., 2017 Ferre-Fernandez et al., 2020
Pediatric Evaluation of Disability Inventory Computer Adaptive Test-Mobility Domain (PEDI-CAT) (Haley et al., 2012)	Grieco et al., 2019
Pediatric Outcomes Data Collection Instrument (PODCI) (Daltroy et al., 1998)	Harvey et al., 2008 Debuse & Brace, 2011 Klepper, S.E., 2011
Patient-Reported Outcomes Measurement System (PROMIS): Physical Function-Mobility (DeWitt et al, 2011; Irwin et al., 2012; PROMIS®, 2012)	None identified
School Function Assessment (SFA) (Coster et al., 1998)	Sakzewski et al., 2007 Chien et al., 2014
SCIM-III Self-Report-Youth (Mulcahey et al., 2015; 2016)	None identified
Top Down Motor Milestone Test (van der Putten et al., 2005)	Ammann-Reifter et al., 2014 Mensch et al., 2015

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Measure	Review(s)
Wee-FIM (Msall et al., 1994)	Harvey et al., 2008 Dumas et al., 2009 Debuse & Brace, 2011 Bisaro et al., 2015 Mensch et al., 2015 Williams et al., 2017 Ferre-Fernandez et al., 2020