

Evidence Based Practice Review

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The quality and usability of selected evaluation and outcome measures in home-based occupational therapy for children and young people with physical disabilities: extended findings from a systematic review

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Abstract

Background: This investigation critically appraises selected measures from a previous systematic review and links these with occupational therapy in the home.

Objectives: To identify, describe and determine the quality of selected evaluation and outcome measures applicable to occupational therapy in the home for children and young people with predominantly physical disabilities, and to provide qualified guidance for occupational therapists in selecting high-quality measures for best practice.

Search Methods: Searches for each named measure were conducted in PubMed, COSMIN Database of Systematic Reviews of Outcome Measurement Instruments, Google Scholar, measure-specific webpages, and other on-line sources.

Data Collection and Analysis: Data collection for selected measures used a modified Law and MacDermid's 'Appraisal for Clinical Measurement Research Reports Evaluation' approach. This method includes critically appraisal of both psychometric and clinimetric properties, particularly usability and responsiveness to change, to determine the quality of the evidence. The 'Quality Appraisal for Clinical Measurement Research Reports Evaluation' was used to grade the design of single studies including excellent, adequate and unsuitable and 'A Measurement Tool to Assess Systematic Reviews' for systematic reviews.

Results: Twenty-two eligible primary evaluation and outcome measures were selected and appraised for quality in the areas of - Activities for self-care and functional mobility; Participation - household tasks, and physical environment; Occupational Performance; Neuromuscular and Movement-related Functions, and Disability and Development.

Measures with an excellent rating of quality and usability were the Child and Adolescent Scale of Participation; Canadian Occupational Performance Measure; Goal Attainment Scaling; Paediatric Evaluation of Disability Inventory-Computer Adaptive Test; Participation and Environment Measure for Children and Youth.

Measures with an adequate rating were the Assisting Hand Assessment - Kids; Assisting Hand Assessment - Mini; Activities Scale for Kids ©; Children's Assessment of Participation and Enjoyment; Child and Adolescent Factors Inventory; Child and Adolescent Scale of Environment; ; Children Helping Out: Responsibilities, Expectations, and Supports; European Child Environment Questionnaire; School, Home and Neighbourhood Accessibility: Physically Disabled Children's Assessments; Young Children's Participation and Environment Measure.

Measures with an unsuitable rating were the Box and Blocks Test, Bruininks-Oseretsky Test of Motor Proficiency; Bayley Scales of Infant and Toddler Development; Infant Motor Profile; Peabody Developmental Motor Scales; Quality of Upper Extremity Skills Test.

Author's Conclusions: The most useful measures are those that combine the evaluation of the client's occupational performance within the home environment and focus on the Occupational Therapy Practice Framework. The usability of measures needs to be considered in addition to validity, particularly responsiveness and reliability.

Abbreviations of Measures

ASK©=Activities Scale for Kids
AHA Kids=Assisting Hand Assessment - Kids
AHA Mini=Mini Assisting Hand Assessment
BBT=Box and Blocks Test
BOT-2=Bruininks-Oseretsky Test of Motor Proficiency
BSID-III=Bayley Scales of Infant and Toddler Development
CASP=Child and Adolescent Scale of Participation
COPM=Canadian Occupational Performance Measure
CAFI=Child and Adolescent Factors Inventory
CAPE=Children's Assessment of Participation and Enjoyment
CASE=Child and Adolescent Scale of Environment
CEDL=Child Engagement in Daily Life
CHORES=Children Helping Out: Responsibilities, Expectations, and Supports
ECEQ=European Child Environment Questionnaire
GAS=Goal Attainment Scaling
IMP=Infant Motor Profile
PDMS=Peabody Developmental Motor Scales
PEDI-CAT=Pediatric Evaluation of Disability Inventory-Computer Adaptive Test
PEM-CY=Participation and Environment Measure for Children and Youth
QUEST=Quality of Upper Extremity Skills Test
ScHaN©=School, Home and Neighbourhood Accessibility: Physically Disabled Children's Assessments
YC-PEM=Young Children's Participation and Environment Measure

Keywords

Measures, Psychometric, Clinimetric, Usability, Responsiveness, Children, Young People, Physical Disabilities, Home Environment, Occupational Therapy.

Contribution of Author

Dr Bess Fowler PhD, Master Hlth Sc, Post Grad Dip Hlth Sc, Grad Dip OH&S, BAppSc (OT) devised the project, developing the main conceptual ideas, research design, selected the measures, critically appraised evaluation and outcome measures, and wrote the manuscript.

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Glossary

Activity	The execution of a task or action by an individual. ¹
Activities of Daily Living	Activities oriented towards taking care of your own body: bathing/showering; toileting and toilet hygiene; dressing; eating and swallowing; feeding; functional mobility; personal device care - personal; personal hygiene and grooming; sexual activity. ²
Administrative Burden	Ease of method used to administer and score a measure. For performance based measures, equipment and training procedures need to be considered. ³
Appraisal	The process of carefully and systematically examining research to judge its trustworthiness, and its value and relevance in a particular context. ⁴
Assessment	Includes techniques and procedures for classification and measurement of a variable pertaining to a person. ⁵
Bias - Risk of Bias (RoB)	A bias is a systematic error, or deviation from the truth, in results or inferences. ⁶
Clinimetrics	A clinically based evaluation method that has been defined as the science of clinical measurements. ⁷
Clinical Utility (Measures)	Involves multiple aspects such as administration, time, simplicity of the format,

	clearness of the questions. It should permit an interpretation of the findings and the benefits of the use of the instrument as well as an acceptance degree of the tool by the client or therapist. ⁸
Clinimetric Properties	Quantitative measurement of clinical and personal phenomena of patient through collection and analysis of comparative clinical data that involves rating scales, indexes, and other quantitative instruments. ⁹
Computerised-Adaptive Testing (CAT)	A CAT algorithm that selects questions directly tailored to the child's ability level, based on previous responses. ¹⁰
Construct	A construct is an assembly of observable or directly experienced phenomena. ¹¹
Domain	An aspect of a measurement property. ¹²
Diagnostic Tests	Approaches used in clinical practice to identify with high accuracy the disease of a particular patient and thus to provide early and proper treatment. ¹³
Domestic Life	Includes household tasks - preparing meals; doing house work; caring for household objects; and assisting others. ¹⁴
Evidence-Based Practice (EBP)	Evidence-based practice is essentially a clinical decision making framework that encourages clinicians to integrate information from high quality quantitative and qualitative research with the clinician's clinical expertise and the client's background, preferences and values when making decisions. ¹⁵
Feasibility	Ease of administration, scoring, and interpretation. ¹²
Floor-Ceiling Effects	The measure is unable to indicate a poorer (worsening) score in patients who have a clinically deteriorated and/or an improved score patients who have clinically improved. ⁴
Functional Assessment	Functional assessment means a decision process that results from the interaction between classifications and measures, and that aims to recognize, anticipate or modify the interaction between the disabled person and her/his environment. ⁵
Functional Mobility	Moving from one position or place to another (during performance of everyday activities), such as 'in-bed mobility', 'wheelchair mobility', and 'transfers'. ²

Gold Standard	Any standardised clinical assessment, method, procedure, intervention or measurement of known validity and reliability which is generally taken to be the best available, again which new tests or results and protocols are compared. ¹⁶
Home Safety	The awareness and education of risks and potential dangers in and around a home which may cause bodily harm, injury, or even death to those residing in and around the physical structure of a home. ¹⁷
Home Modification (HM)	Changes made to the home environment to help people to be more independent and safer in their own home and reduce any risk of injury to their carers and care workers. ¹⁸
Household Tasks	Preparing meals; doing house work; caring for household objects; and assisting others. ¹⁴
Internal Consistency	The degree of internal relatedness among the items. ¹⁹
Interpretability	The degree to which one can assign <i>qualitative</i> meaning, that is, clinical or commonly understood connotations to an instrument's quantitative scores or change in scores. ¹⁹
Measure (Clinical)	Health measurement scales are those tools and items used to collect and analyse data regarding health indicators and outcomes to evaluate health status of both individuals and populations. ²⁰
Measurement Error (ME)	The systematic and random error of a patient's score that is not attributed to true changes in the construct to be measured. ¹⁹
Minimal Detectable Change (MDC)	This indicator reflects the amount of change required before you can be confident that change exceeds the random error that occurs in stable clients. ⁴
Minimal Clinically Important Difference (MCID)	The smallest improvement considered worthwhile by a patient. ⁹
Occupational Therapy	A client-centred health profession concerned with promoting health and well-being through occupation. ²¹
Occupational Performance	The ability to perceive, desire, recall, plan and carry out roles, routines, tasks and sub-tasks for the purpose of self-maintenance, productivity, leisure and rest in response to demands of the internal and/or external environment. ²²

Outcome Measure	A test or a scale administered and interpreted by therapists that has been shown to measure accurately a particular attribute of interest to patient and therapists and is expected to be influenced by an intervention. ²³
<i>Primary Outcome Measure</i>	The pre-specified outcome considered to be of greatest importance to relevant stakeholders (such a patients, policy makers & clinicians). ²⁴
<i>Patient Reported Outcome Measures (PROMS)</i>	Self-rated scales and indices developed to improve the detection of the patients' subjective experience. ⁷
Participation and Environment Measure Plus (PEM+)	A new electronic health application to help caregivers contribute to client-centred and participation-focused care planning for their young child. ²⁵
Participation	(i) Nature and extent of involvement in life situations and events. ²⁶ and; (ii) Comprising two essential elements: attendance and involvement. ²⁷
Physical Home Environment	Physical layout or amount of space and furniture in the home. ²⁸
Psychometric Properties	Elements that contribute to the statistical adequacy of the instrument in terms of reliability, validity, measurement error, and internal consistency. ⁹
Rasch Analysis	Rasch analysis allows researchers to use a respondent's raw test or scale scores and express the respondent's performance on a linear scale that accounts for the unequal difficulties across all test items. ²⁹
Reliability	The degree to which the measurement is free from measurement error. ¹²
<i>Test-retest</i>	The ability of a test to produce consistent results when it is used multiple times under nearly equivalent conditions. ¹²
<i>Inter-rater</i>	A test whose results fluctuate minimally when reused is said to have good test-retest reliability. ¹⁶
Self-care	The set of activities that comprise daily living, such as bed mobility, transfers, ambulation, dressing, grooming, bathing, eating and toileting. ³⁰
Sensitivity	The ability of a clinimetric index to differentiate between wanted and unwanted effects of treatments and to discriminate between an active drug and placebo or between a specific

	psychotherapeutic treatment and attention placebo or clinical management. ⁷
Specificity	Is the proportion of people of people who do not have the disease or problem in question who have a positive test. ⁴
Standardised Measure	A published measurement tool designed for a specific purpose in a given population, with detailed instructions provided as to when and how it is to be administered and scored, interpretation of the scores, and results of investigations of reliability and validity. ³¹
Target Population	Is the group of individuals that the intervention intends to conduct research in and draw conclusions from. ³²
Usability	Practicality, ease in administration, scoring, interpretation and application, and low cost. ²⁵
Validity	The degree to which an outcome measure measures the construct(s) it purports to measure. ¹²
<i>Construct validity</i>	The degree to which the scores of an outcome measure are consistent with hypotheses (for instance with regard to internal relationships, relationships to scores of other instruments, or differences between relevant groups) based on the assumption that the outcome measure validly measures the construct to be measured. ¹²
<i>Criterion validity</i>	The degree to which a measure or test correlates with other measures or tests of the same construct assessed concurrently or in the future; test's ability to predict a criterion. ⁹
<i>Face validity</i>	The degree to which (the items of) an outcome measure indeed looks as though they are adequate reflection of the construct to the measured. ⁹
<i>Structural validity</i>	The degree to which the scores of an outcome measure are an adequate reflection of the dimensionality of the construct to be measured.
<i>Responsiveness</i>	A special kind of validity that reflects the ability of an instrument to detect (real) change. ⁴
<i>Face validity</i>	The degree to which (the items of) an outcome measure indeed looks as though they are adequate reflection of the construct to the measured. ⁹

Structural validity

The degree to which the scores of an outcome measure are an adequate reflection of the dimensionality of the construct to be measured.

Responsiveness

A special kind of validity that reflects the ability of an instrument to detect (real) change. ⁴

1. Background

In the current extended investigation, measures derived from a 2021 systematic review of 29 quantitative interventional and observational studies in children and young people with physical disabilities³³ were appraised for their clinimetric and psychometric properties.

1.1. Importance of the Review

Selecting an appropriate measure is considered an evidence-based practice. To foster that, the measures need to be appraised and this review serves this purpose.

Rigorous measurement underpins the comparative quality in interventional and observational research. Critically appraising measurement properties using a systematic approach, provides the positive or negative research evidence on which to base the selection of measures and the translation of this knowledge into occupational therapy practice.^{34 35} This process is equivalent to appraising the quality of evidence in the selection of the most effective interventions in clinical practice.³⁶ The findings of this review provide guidance for occupational therapists in relation to the most appropriate measures to use in home-based practice.

While there are many systematic reviews relevant to measures of activities and participation in children and young people with physical disabilities published in the last 10 years including^{37 38 39 40 41 42 43 44 45 46 47 48 36}, this work uniquely links the American Occupational Therapy Association's, Occupational Therapy Practice Framework: Domain and Process including evaluation, intervention and outcomes⁴⁹ to measures for occupational therapy in the home environment.

While related, this review focuses on the Occupational Therapy Practice Framework⁵⁰ and not on the eligibility requirements for programs such as the National Disability Insurance Scheme.⁵¹

1.2. Applying Both Psychometric and Clinimetric Properties for Clinical Practice

Excellent validity,⁴ and reliability are essential for robust measurement.⁵² Excellent psychometric properties however, while of critical importance, alone are inadequate to provide guidance on quality measurement in clinical practice. Consequently it is not recommended to use only psychometric properties in quality appraisal but to consider *clinimetric* properties as well in determining the quality of measures in clinical practice.⁵³

The 'COnsensus-based Standards for the selection of Health Measurement Instruments' (COSMIN)¹⁹ has provided an important model to improve the quality of measurement in health,⁵⁴ and these concepts are used extensively in this review. With the exception of feasibility, COSMIN encompasses predominantly psychometric, and not clinimetric properties. COSMIN was developed to appraise self-reported health related quality of life

questionnaires and is often unsuited to individualised, norm-referenced, and functional occupational therapy measures⁵⁵ and should not be used automatically without due consideration to the requirements of clinical practice.

The following sections outline some important properties of measures that relate to clinical occupational therapy practice.

1.3. Important Components of Clinical Measures

The following section outlines and discusses some important components of clinical measures with particular emphasis on 'usability' and 'responsiveness to change'.

In broad terms the *focus of a measure* relates to a specific frame of reference that forms the conceptual basis for selection of a measure in occupational therapy.

One model applicable to occupational therapy, particularly in relation to function include the World Health Organisation, International Classification of Functioning, Disability and Health (WHO ICF).⁵⁶ International Classification of Functioning, Disability and Health: Children and Youth Version: ICF-CY.¹ The most recent model is the ICF 2021⁵⁷ second edition which has now subsumed the ICF-CY 2007.¹

The WHO ICF reflects the important concept of the person-environment (home) – occupation fit that is uniquely applicable in the context of occupational therapy in the home. In addition, this framework is often used in occupational therapy for children and young people,^{58 45 59 60} particularly the context of occupational performance.⁶¹

Equally important frameworks in appraising the quality of measures, are the models of human occupation including, the 'Occupational Performance Model (Australia)'⁶² and the 'Canadian Occupational Performance Model',^{63 64 65} focusing individualised goal setting. Another essential framework particularly in the home setting is 'Client and Family-Centred Care'.^{66 67 25}

1.4. Responsiveness to Change

Responsiveness to change is a special kind of validity that reflects the capacity of a measure to detect change in status.⁴ This property is essential in determining whether an occupational therapy approach or intervention is successful over time.^{4 68} For example in the COPM,⁶⁹ responsiveness refers to the measure's ability to detect statistically significant and clinically important changes in nominated occupational performance. In the study by Ferre,⁷⁰ using the 'H Habitat' intervention, a change of 2 points on the COPM scale demonstrates clinically meaningful change.

In addition, in relation to responsiveness to change, if a construct is too uniform the measure becomes less sensitive to change in performance by a client over time - an important component for outcomes.⁷

1.5. Usability

Clinical utility or 'usability' ²⁵ represents the relative 'balance of benefits and drawbacks' ⁷¹ of using a specific intervention or measure. This concept is also expressed as 'utility versus (administrative) burden'. ⁴² Usability includes such properties as the clarity of instructions, format, time to completion, cost-effectiveness, professional development requirements, examiner's qualification, availability, and ease of interpretation - all characteristics particularly relevant to clinical practice. ^{4 69}

In a positive step towards improving usability and often reliability, many measures, for example COPM ⁶⁹ now use web-based applications or an on-screen administration mode. Often these applications include scoring, interpretation, reporting, and producing summary data for organisations such as PEDI-CAT. ⁷² These methods often use mobile devices such as mobile phones, tablets or through video links particularly with telerehabilitation particularly in the recent restriction from the pandemic to enhance their usability in the home environment. ⁷³

1.6. Capitalise evaluation and intervention

Another feature of usability is the deliberate linking of measures and interventions. ²⁵ This development is seen in the 'Participation and Environment Measure Plus (PEM+)' ²⁵ which focusses on care planning following evaluation, a natural extension as part of the Occupational Therapy Practice Framework. ²⁵

In addition, a well-established approach that improves usability, particularly in relation to enhanced speed and accuracy, is computer assisted technology (CAT). This method applies in measures which contain a bank of items, such as PEDI-CAT ⁷² and include such areas as daily activities, mobility, social and cognitive factors. To save time and frustration for clients and their families, a computer algorithm selects items directly tailored to the client's level of ability, based on previous responses that will provide a shorter ⁷⁴ more targeted assessment experience.

In relation to *administration, scoring and interpretation*, the time taken to complete a test, is an important clinimetric property in a busy practice. The stated administration time, however, often does not include the cost of scoring, grading, report writing and feedback to clients, their families and colleagues. The increasing use of web-based application of measures provides direct entry of information (thus improving accuracy over double-entry of data from paper records) computerised scoring and report generation, all of which are related to usability. ⁷⁵ Also some commercial systems are available such as Q-global® ⁷⁶ that allow rehabilitation services to establish customised suites of measures and their administration that are suitable for the specific needs of target client populations.

The *format* of a measure used in occupational therapy practice may be interview, questionnaire, task performance or naturalistic observations. ⁴ Some measures combine two formats, for instance, the Assisting Hand Assessment (AHA) Kids ⁷⁷ consists of functional task performance undertaken in a naturalistic environment, in this instance spontaneous play, that is usually pleasurable for children and parents. ⁷⁷

An important aspect of validity and usability is the requirements for *qualifications* and *professional development*. Evaluation and outcome measures must be administered by qualified occupational therapists, who in conjunction with the client and their families,

understand the health conceptual frameworks, attitudes, knowledge and skills to select and interpret the findings.⁵⁰

If, however, the acquisition of specific measurement skills is too expensive and time consuming, this may be a deterrent for using a particular measure. To ensure, however, both reliability and validity it is important for the administrator to have the necessary skills and proficiency, that is, the measure needs to be performed regularly to ensure currency of the administrator's skills and knowledge. More recently with the pandemic there is more need and facility to undertake professional development online that is often a more flexible option, fitting in with caseloads, and potentially less expensive than face-to-face learning.⁷³

This review provides practicing occupational therapists and managers of occupational therapy services with research evidence to satisfy their professional responsibilities to use published research in combination with professional expertise, person-centred and family-centred practice, to guide decision making/make informed decisions.³¹

The present work strengthens and deliberately links the measurement components of evaluation and outcome as outlined in the Occupational Therapy Practice Framework: Domain and Process⁴⁹ with home-based occupational therapy interventions.

1.7. Prior Review

This current investigation is an extension of a quantitative systematic review published in 2021 by Fowler and Kirwan entitled: 'Evidence Based Practice Review: Activities, Participation, Accessibility and Safety in the Home Environment for Children and Young People with Physical Disabilities: A Systematic Review'³³ and published by the Home Modification Information Clearinghouse.

2. Objectives

1. To identify, describe and determine the quality of selected evaluation and outcome measures applicable to occupational therapy in the home for children and young people with predominantly physical disabilities; and
2. To provide recommendations on the selection of the most suitable measures for in-home occupational therapy within the target populations; and
3. To demonstrate a linkage between measures and home-based occupational therapy; and
4. To provide an evidence-based practice resource for occupational therapists to select appropriate evaluation and outcome measures for practice.

3. Methods

3.1. Research Question

'What is the quality and usability of selected evaluation and outcome measures applicable to home-based occupational therapy for children and young people with predominantly physical disabilities compared to established psychometric and clinimetric standards?'

3.2. Question Refinement Strategy

In relation to the refinement of research questions, decisions were required for the usage of key words.

In preference to the terms 'tool' ⁵¹, 'instrument' ⁵⁴, 'test' ⁷⁸, 'scale' ⁷⁹ or 'index', ⁸⁰ the principal key word '*measure*' was chosen for this review as it equates to Law 1987. ⁸¹ and Law and McDeramid, 2014 ⁴ providers of primary methodology for quality appraisal. The term 'usability' ²⁵ was preferred to 'clinical utility' ⁸ as it is more readily understandable.

Another dilemma associated with the selection of key words is the usage of the terms 'assessment' or 'evaluation'. The author's concern was that 'evaluation' may cover both the initial 'assessment' phase and 'outcome' measurement. Ultimately, however, 'evaluation' was chosen as it is the terminology applied in Occupational Therapy Practice Framework ⁴⁹ and by Law and McDeramid, 2014, ⁴ and more recently by Romli and Wan Yunus. ³⁴

In addition, the key word 'participation' has long presented some theoretical and practical usage challenges ²⁷ and consequently a dual definition is adopted. Firstly, the broad concept outlined by WHO ICF ¹ of 'Involvement in a life situation' and secondly by Imms et al ²⁷ that included two essential elements both 'attendance' and 'involvement'.

Another issue is the meaning of 'interpretability'; that relates to how quantitative scores have *qualitative* meaning from the view point of the assessors or value for money from the

perspective of young people family or carers.⁴² Also whether they can detect change in function following an intervention.¹⁹ Occupational therapy in the home refers to both standalone interventions and home programs associated with other regimes.

3.3. Expression of Interest

An expression of interest was submitted to the intended publisher prior to the commencement of the review. (Appendix 1)

3.4. Summary of Problem, Intervention, Outcomes, Comparisons, Target Populations

Table 1. Summary of Problem, Intervention, Outcomes, Comparisons and Target Populations

Problem	Intervention	Outcome	Comparison	Target population
Identification, selection and applicability of high-quality assessment and outcome measures	Occupational therapy in the home	Improvements in self-care; functional mobility; domestic life; accessibility; and home safety Psychometric and clinimetric quality and qualified recommendations for use of the selected measures	Compared to optimal psychometric and clinimetric standards and study designs for assessment and outcome measures for occupational therapy in the home	Children and young people (0-18 years) with predominantly physical disabilities

3.5. Search Terms

Table 2. Search Terms for Problem, Interventions, Outcomes, Comparisons and Target Populations

Problem	Intervention	Outcome	Comparison	Target population
Measures OR Assessments OR Outcomes AND Psychometric properties AND Clinimetric properties AND Usability (Clinical Utility) AND Responsiveness AND Therapy	To plan occupation therapy in the home OR Within scope of occupational therapy OR Rehabilitation	Outcomes	Comparison of quality of measures within specified target populations	Female and male children and young people - 0-18 years of age; Predominantly physical disabilities.

3.6. Search Strategy

The current search of the literature is based on that conducted for the previous systematic review which encompasses several databases (e.g., PubMed, COSMIN Database of Systematic Reviews of Outcome Measurement Instruments, Google Scholar, measure-specific webpages, and other on-line sources).³³

The named primary evaluation and outcome measures, identified in interventions that were examined in the previous systematic review,³³ were investigated using the search terms in outlined in Table 2.

3.7. Selection Criteria

The inclusion and exclusion of groups was based on the rationale included in the original systematic review.³³

The nominated *inclusion criteria* encompass:

- (i) children and young people 0-18 years,
- (ii) long-term - six months and over,
- (iii) predominantly physical health conditions, including neurological disorders - particularly cerebral palsy, developmental delay, congenital/genetic disorders, spinal cord or brain injuries, juvenile arthritis, and amputation,
- (iv) receiving occupational therapy in the home.³³

The *exclusion criteria* cover children and young people with:

- (i) Downs Syndrome, mental health issues, intellectual disability, autism, and developmental co-ordination disorder,
- (ii) as well as intended injury,
- (iii) hospice, end-of-life, or palliative care services delivered in the home; carers and care workers; quality of life,
- (iv) exercise programs with no activity component,
- (v) pain,
- (vi) psycho-social home environments.³³

3.8. Standard Electronic Database Search

Each evaluation and outcome measure was identified from the original systematic review and conformed to the inclusion and exclusion criteria previously specified.³³

The primary outcome measures for this study were selected by the author of the current work.

The studies selected for appraisal were identified by searching the name and acronym of the selected measure as a key word, such as the 'Mini Assisting Hand Assessment (Mini-AHA)'.⁸² Only primary⁸³ measures from original studies were appraised to contain the scope of the project.

Excluded measures are reported in Appendix 2.

Duplicates were removed from the overall total number of studies.

On the assumption that insufficient research evidence would be identified on 'responsiveness to change'³⁷, a critical property in clinical measurement, all studies in which the specific measure was cited by name were included in the search as a potential illustrated proxy of responsiveness.

Systematic reviews were of particular interest as these are used extensively in the quality appraisal process in Appendix 5.

Following the initial search by selected named measures, a word sub-search was conducted on relevant literature to identify psychometric and clinimetric terms of relevance such as validity (particularly responsiveness), reliability and clinical utility or usability. Relevant full text papers were retrieved, often through ResearchGate or the Occupational Therapy Australia webpage. The references, including the full texts were stored on the electronic referencing system Mendeley.

3.9. Quality Appraisal of Single Studies

The standard of the research design and implementation of reported studies on specific measures is a critical factor in providing credible evidence for best practice in measurement.³⁷

The quality appraisal of single studies? and associated measures used in this systematic review are in **two** parts:

- Evaluation of the quality of single research studies on reported clinical measurement/s

To evaluate the quality of the reported studies on clinical measurement properties the 'Quality Appraisal for Clinical Measurement Research Reports Evaluation' by Law and MacDermid ⁴ p326-330 and by Romli ⁸⁴ was used. The scoring is from 0-2, with 2 being best practice; 1 acceptable; and 0 inadequate or inappropriate. The total score out of 24 is then showed as a percentage. The only exception for this is 'Item 6-follow-up' that may not be applicable, when the denominator is then reduced to 22.

In this review, the studies chosen for quality appraisal were often the original publication, and subsequent studies published in high quality journals, on validity (including responsiveness) and reliability.

- Quality appraisal of reported psychometric and clinimetric properties of specified measures

To appraise the metric properties the 'Outcome Measures Rating Form' approach originally devised by Law in 1987, ⁸¹ and MacDermid revised and re-published in 2014 ⁴ pp 339-356 was used.

Extraction of the data for each measure used an amended Law and MacDermid's Quality Appraisal Tool 2014 format. ⁴ The COSMIN check list was used as a statistical reference. ⁸⁵

See Appendix 3 for legend and grades.

Detailed findings are reported in Tables 3, 4 and 5.

3.10. Quality Appraisal of Systematic Reviews

The quality appraisal of systematic reviews employed the second version of 'A MeaSurement Tool to Assess Systematic Review - AMSTAR-2'.⁸⁶ AMSTAR consists of 16 items and has good face and content validity in measuring the quality of systematic reviews. In the current work, as reviews are directed towards measurement not intervention, randomised controlled trials or metaanalyses are not usually included.

The following outlines the overall confidence levels in the results of the review following using the inclusion of critical and non-critical weaknesses in grading a systematic review using the AMSTAR-2 approach. These having a protocol registered before commencement of the review (item 2); adequacy of the literature search (item 4); justification for excluding individual studies (item 7); risk of bias from individual studies being included in the review (item 9); appropriateness of meta-analytical methods (item 11); and consideration of risk of bias when interpreting the results of the review (item 13); and assessment of presence and likely impact of publication bias (item 15).⁸⁶

AMSTAR-2 Confidence levels:

High: No or one non-critical weakness; Moderate: More than one non-critical weakness; Low: One critical flaw with or without non-critical weaknesses; Critically low; More than one critical flaw - multiple non-critical weaknesses. ⁸⁶ p6

These grades influence the categories assigned in the quality appraisal.

3.11. Linking Selected Primary Measures to Occupational Therapy Interventions

This review links selected primary measures from single studies in the previous systematic review.³³ This information connects the occupational therapy intervention with appropriate evaluation and outcome measures, in the Occupational Therapy Practice Framework.⁴⁹ It should be noted that while the measures appraised were chosen for the original interventional studies other measures may have been equally or more suitable.

4. Outcomes of Search

The review process, with the number of relevant studies and other documentation, is outlined in Figure 1.

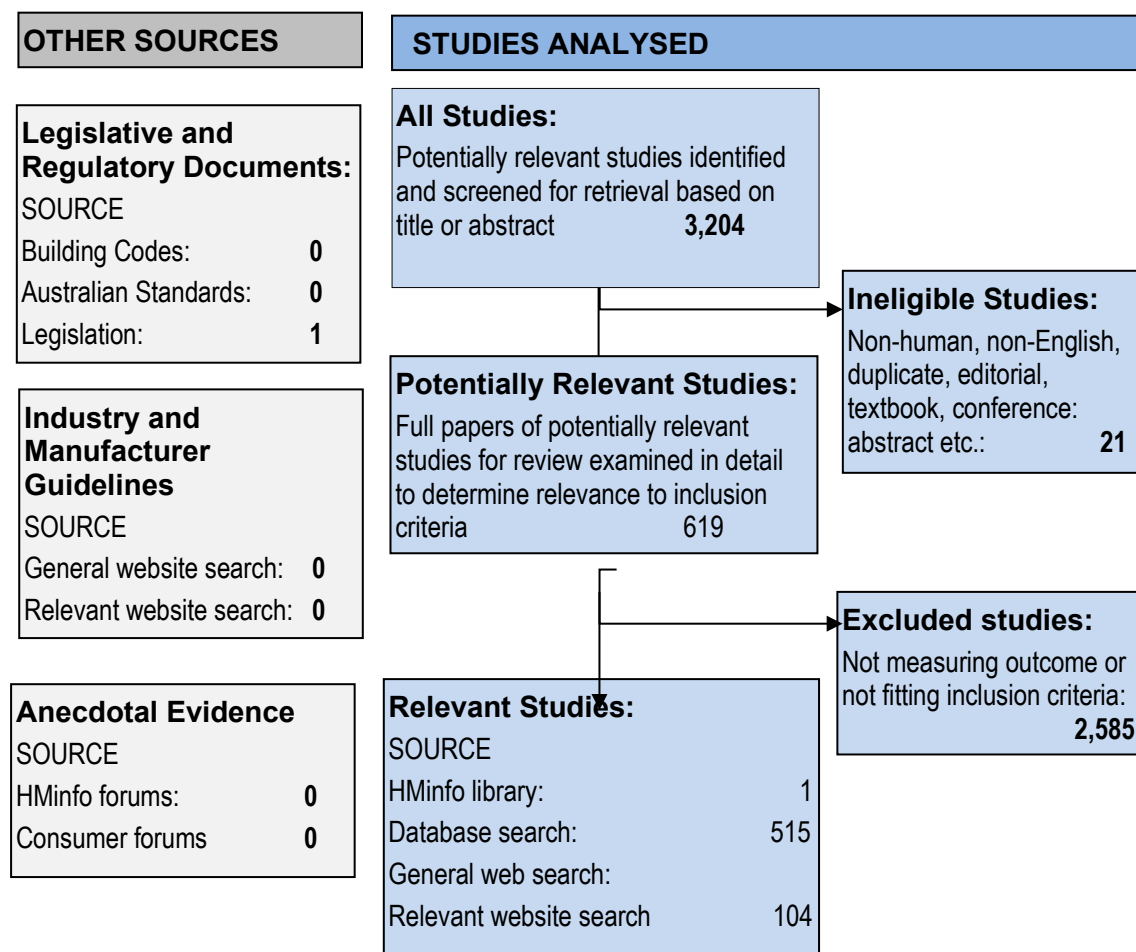


Figure 1. Number of Studies Analysed

4.1. Measures Analysed

The following 22 primary evaluation and outcome measures (1 with 2 versions - AHA Kids⁷⁷ and AHA Mini)⁸² as this has a separate target group, were identified from the previous systematic review.³³ In addition, only PEDI-CAT⁷² is reported here as PEDI⁸⁷ is now rarely used in its original form.

The measures, cited below, often include multiple attributes, consequently each one is placed in the major category considered by the author to be most appropriate.

4.1.1 Activities (*Self-care & Functional mobility*)

- Activities Scale for Kids (ASK©)⁸⁸
- Child Engagement in Daily Life (CEDL)⁸⁹
- Paediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT)⁷²

4.1.2 Participation and the Home Environment

- Child and Adolescent Scale of Participation (CASP)⁹⁰
- Children's Assessment of Participation and Enjoyment (CAPE)⁹¹
- Children Helping Out: Responsibilities, Expectations, and Supports (CHORES)⁹²
- Child and Adolescent Scale of Environment (CASE)©⁹³
- European Child Environment Questionnaire (ECEQ)⁹⁴
- Participation and Environment Measure for Children and Youth (PEM-CY)⁹⁵
- School, Home and Neighbourhood Accessibility: Physically Disabled Children's Assessments (SchHaN©)⁹⁶
- Young Children's Participation and Environment Measure (YC-PEM)⁹⁷

4.1.3 Occupational Performance

- Canadian Occupational Performance Measure (COPM)⁶⁹
- Goal Attainment Scaling (GAS)⁹⁸

4.1.4 Neuromuscular and Movement-Related Functions

- Assisting Hand Assessment (AHA)Kids⁷⁷
- Assisting Hand Assessment Mini (AHA)⁸²
- Box and Blocks Test (BBT)⁹⁹
- Bruininks-Oseretsky Test of Motor Proficiency (BOT™-2)¹⁰⁰
- Infant Motor Profile (IMP)¹⁰¹
- Quality of Upper Extremity Skills Test (QUEST)¹⁰²

4.1.5 Disability and Development

- Child and Adolescent Factors Inventory(CAFI) ¹⁰³
- Bayley Scales of Infant and Toddler Development (BSID-III) ¹⁰⁴
- Peabody Developmental Motor Scales (PDMS) ¹⁰⁵

4.1.6 Linking Occupational Therapy with Evaluation and Outcome Measures

Outlined below in Table 3 is the linkage between selected primary measures from single studies in the previous systematic review. ³³ This information connects the occupational therapy intervention with appropriate evaluation and outcome measures, that is the Occupational Therapy Practice Framework. ⁴⁹

Table 3. Linking Primary Evaluation and Outcome Measures with Interventions

Occupational Therapy, First Author, Year Reference, Intervention & Abbreviation	Primary Evaluation and Outcome Measure/s
CareToy Early intervention, Tele-rehabilitation, Intensive, Customised, Family-centred care Sgandurra, 2019 ¹⁰⁶	Infant Motor Profile (IMP) ¹⁰¹
Modified ride on toy cars (MROC) Pritchard-Wiart, 2019 ¹⁰⁷	Descriptive questionnaire
Constraint-induced movement therapy (mCIMT) : Bimanual therapy(BIM) Chamudot, 2018 ¹⁰⁸	Mini Assisting Hand Assessment (Mini-AHA) ⁸²
Pathways and Resources for Engagement and Participation (PREP) Anaby, 2018 ¹⁰⁹	Activity Scale for Kids (ASK) ¹¹⁰ Canadian Occupational Performance Measure (COPM) ⁶⁹
Modified ride-on cars (MROC) - Mobility and social training Huang 2018 ¹¹¹	Paediatric Evaluation of Disability Inventory (Chinese version)(PEDI) ¹¹² Goal Attainment Scaling (GAS) ⁹⁸
Occupational Therapy (OT) Daily activities, Mobility Albrecht, 2017 ¹¹³	Young Children's Participation and Environment Measure (YC-PEM) ¹¹⁴ Paediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT) ¹¹⁵
Powered mobility - Modified ride-on cars (MROC) Alghamdi, 2017 ¹¹⁶	Child Engagement in Daily Life (CEDL) ⁸⁹
Accessibility to essential everyday spaces - bathrooms and toilets. Home modification. Stephens, 2017 ¹¹⁷	School, Home and Neighbourhood Accessibility: Physically Disabled Children's Assessment (ScHaN©) ⁹⁶
Mother Handling Training (MHT) Self-care, Feeding, Dressing, Lifting, Carrying, Bathing, Toileting.	Bruininks-Oseretsky Test of Motor Proficiency

Johari, 2016 ¹¹⁸	(BOT-2) ¹⁰⁰
Personal and environmental factors affecting participation Anaby, 2014 ¹¹⁹	Participation and Environment Measure for Children and Youth (PEM-CY) ⁹⁰
Participation in household tasks - self-care and family care Do Amaral, 2014 ¹²⁰	Children Helping Out: Responsibilities, Expectations, and Supports (CHORES) ⁹²
Focus on Function (FOF) Functional goal directed tasks and the home environment Law, 2011 ¹²¹	Paediatric Evaluation of Disability Inventory (PEDI) ^{87 122} Use PEDI-CAT ⁷²
Constraint Induced (Movement) Therapy (CIT) Reaching, grasping, manipulating, self-care and mobility activities. Lin, 2011 ¹²³	Peabody Developmental Motor Scales (PDMS-2) ¹²⁴ Bruininks-Oseretsky Test of Motor Proficiency TM (BOT-2) ¹⁰⁰
Access physical environment at home, equipment, home modification (SPARCLE) Colver, 2010 ⁹⁴	European Child Environment Questionnaire (ECEQ) ¹²⁵
Participation, Household tasks, Family tasks, Self-care, Mobility around the home Gavin, 2010 ¹²⁶	Child and Adolescent Scale of Environment (CASE) ⁹³ Child and Adolescent Factors Inventory (CAFI) ¹⁰³ Child and Adolescent Scale of Participation (CASP) ¹²⁷ (All part of CFFS) ¹⁰³
Participation outside school including home Engel-Yeger, 2009 ¹²⁸	Children's Assessment of Participation and Enjoyment (CAPE) ¹²⁹
Occupational Therapy Home Program (OTHP) Novak, 2009 ¹³⁰	Canadian Occupational Performance Measure (COPM) ⁶⁹
Adaptive seating, Self-care Rigby, 2009 ¹³¹	Quality of Upper Extremity Skills Test (QUEST) ¹⁰²
Goals for independence in self-care and use of the affected arm Novak, 2007 ¹³²	Canadian Occupational Performance Model (COPM) ⁶⁹ Goal Attainment Scaling (GAS) ⁹⁸ Quality of Upper Extremity Skills Test (QUEST) ¹⁰²
Accessibility and usability of the home environment Prellwitz, 2006 ¹³³	Descriptive questionnaire
Functional skills, caregiver assistance, and modifications of the environment Østensjø, 2005 ¹³⁴	Paediatric Evaluation of Disability Inventory (PEDI) ⁸⁷ Use PEDI-CAT ⁷²

The following section outlines some useful legislative and regulatory documents.

4.1.7 Legislative and Regulatory Documents

- Commonwealth of Australia. Disability Discrimination Act 1991, Act no 26
Australia: Commonwealth of Australia; 2018.
- Australian Commission on Safety and Quality in Health Care. ¹³⁵
- Occupational Therapy Association Australia. ¹³⁶

4.2 Completeness and Quality of Evidence

This systematic review has several limitations as it is based *only* on those applicable primary measures identified in the initial work by Fowler and Kirwan, 2021 ³³ on occupational therapy in the home for children and young people with predominantly physical disabilities. This limitation or risk of bias is particularly relevant to home safety, where no studies and hence no measures related to the target populations and setting were identified or examined.

While in the original systematic review studies were selected by two authors, only BF selected the measures to be quality appraised in this study. Each item however, in the appraisal of properties tables was individually referenced.

The use of the Law and McDermid ⁴ methodology provides the most applicable and comprehensive information on both psychometric and clinimetric properties of measures, the quality of studies, and produces more complete evidence than other methodologies relevant to the practicing occupational therapist.

5 Findings

Six hundred and nineteen (619) studies were reviewed in the current work.

To be selected by practicing occupational therapists or services managers, measures must have the appropriate psychometric and clinimetric properties. Particularly the nominated demographic characteristics including age, health conditions, needs and preferences of the client and family, and the occupational therapy services available, and should only, be selected for the nominated target group.

This does not imply, however, that only the following measures should be used alone as there are many other, new measures or improved extensions such as PEM+ ²⁵ (Participation and Environment Measure Plus) that provide a suitable foundation for harnessing the expertise of clinical researchers and clinicians.

The approach adopted in the current review to analysing any measures provides a blueprint for practicing occupational therapists to appraise all potential evaluation and outcome measures in a systematic manner. ⁴

5.1 Quality of Included Studies

The quality and results of the single studies were factored into the assigned grades and outlined in Appendix 4 and Appendix 5 for systematic reviews.

5.2 Grading of Evidence and Recommendations for Use

The following *qualified guidance* is based on the grade of measurement with an overall quality and utility rating of 'excellent', 'adequate' or 'poor' (probably unsuitable):

- **'Excellent'**: Excellent or adequate to excellent clinical utility, easily available, *excellent* validity, and reliability.
- **'Adequate'**: Adequate to excellent clinical utility, easily available, *adequate to excellent* validity and reliability.
- **'Unsuitable'**: Poor clinical utility, not easily available, poor validity and reliability. ⁴

The findings are presented in the following domains specifically 'Activities', 'Participation', 'Environment (Home)', 'Neuromuscular and Movement-Related Functions', 'Occupational Performance' and 'Disability and Development'.

These domains were chosen as they reflect the terminology used in the frames of reference used, such as the WHO ICF ¹ (Activities, Participation Environment and Neuromuscular and Movement-Related Functions), and Occupational Performance. ⁶³ The domain 'Disability and Development' describes the content of the measures.

Please refer to Tables 3, 4 and 5 for additional details of each measure and Appendix 3 for definitions of properties.

5.3 Activities

‘Excellent’: ‘Paediatric Evaluation of Disability Inventory-Computer Adaptive Test’ (PEDI-CAT) ⁷²

- Valid, responsive to change, reliable
- Good range of health areas
- Usability - electronic, targeted precision entry (CAT), norms, scoring, reports

‘Adequate’: ‘Activities Scale for Kids’ (ASK©)

- Valid, responsive to change, reliable
- Lack of model in original development paper ⁸⁸ though subsequent work does reference the WHO ICF ⁵⁶ and is client- and family-centered care ⁶³
- Does not include organised activities and a larger meaningful goal nor purposeful activity ¹³⁷
- Does not include interaction with home environment

‘Adequate’/‘Unsuitable’ : ‘Child Engagement in Daily Life’ (CEDL) ⁸⁹

- Validity, reliable
- Responsiveness - adequate ³⁷
- Framework not stated however equates to ‘Client and Family-Centred Care’. ⁶⁶ and WHO ICF
- Does not include organised activities and a larger meaningful goal nor purposeful activity ¹³⁷
- Usability - brief and easy to use
- Does not include interaction with home environment

5.4 Occupational Performance

‘Excellent’: ‘Canadian Occupational Performance Measure’ (COPM) ⁶⁹

- Valid, responsive to change, reliable
- Usability - electronic entry, scoring and reports, summary data
- COPM is the ‘gold standard’ for individual goal setting in occupational therapy
- Well established widely used
- Goals can be related to the home environment

Excellent/Adequate’: ‘Goal Attainment Scaling’ (GAS) ⁹⁸

- Valid, responsive to change, reliable
- Usability – good, has app
- COPM better than GAS ¹³⁸

- Goals may be related to the home environment

5.5 Participation and Environment (Home)

Excellent: 'Participation and Environment Measure for Children and Youth' (PEM-CY) ⁹⁰

- Valid, responsive to change, reliable
- Usability - easy, moderate length, digitised
- Includes relevant activities, specific settings, and a larger, meaningful goals ¹³⁷
- Links participation and home environment

'Adequate': Young Children's Participation and Environment Measure (YC-PEM) ⁹⁷

- Moderately valid, responsive to change, reliable
- Usability - Web-based mode of administration ²⁵
- Yields care plans via PEMS +²⁵
- Links participation and home environment

'Excellent'/adequate: 'Child and Adolescent Scale of Participation' (CASP) ¹²⁷

Valid, responsive to change, reliable ¹²⁷

- Usability - brief, easy, not digitised
- Includes relevant activities, specific settings, and a larger, meaningful goals ¹³⁷
- Participation in the home environment
- In ABI, for participation only one available with preliminary evidence of satisfactory measurement properties ³⁷

'Adequate': 'Children's Assessment of Participation and Enjoyment' (CAPE) ⁹¹

- Valid - adequate for ABI, responsive to change, reliable
- Includes the important attribute of enjoyment but this measure is focused on leisure and recreation not self-care that is not related to home domains in this study

'Adequate': 'Child and Adolescent Scale of Environment' (CASE)⁹³

- Valid, including moderate responsiveness to change, reliable
- Usability - brief, easy, not digitised
- Links participation and home environment
- Assesses physical, social and attitudinal environmental barriers

'Adequate': 'Children Helping Out: Responsibilities, Expectations, and Supports (CHORES)' ⁹²

- Valid and reliable ⁹²

- No information on responsiveness to change
- Usability - no website, not digitised
- However, very relevant to participation in household tasks in the home environment

'Adequate': 'School, Home and Neighbourhood Accessibility: Physically Disabled Children's Assessments' (ScHaN©) ⁹⁶

- Valid and reliable ⁹⁶
- No information on responsiveness to change
- Usability - 'Kid and disability friendly' ⁹⁶
- Designed for interaction in the home environment ⁹⁶

Adequate: 'European Child Environment Questionnaire' (ECHQ) ⁹⁴

- Valid and reliable
- Responsiveness - not applicable (from cross sectional study) ¹²⁵
- Participation in the home environment ¹²⁵
- Directed towards population studies, not occupational therapy in the home

5.6 Neuromuscular and Movement-Related Functions

'Adequate': 'Assisting Hand Assessment' (AHA) Kids ⁷⁷

- Valid, responsive to change, reliable
- Functional - task oriented
- Usability - time consuming, needs specialist professional development
- Play is a natural part of home environment for children
- Probably more suitable for specialist, clinic-based occupational therapy services

'Adequate': 'Assisting Hand Assessment' (Mini AHA) ⁸²

- Valid, responsive to change, reliable
- Functional - task oriented
- Usability - time consuming, needs specialist professional development
- Play is a natural part of home environment for children
- Probably more suitable for specialist clinic based occupational therapy services

'Unsuitable': 'Quality of Upper Extremity Skills Test' (QUEST) ¹⁰²

- Construct validity poor, responsiveness, reliable
- However, doubts on uni-dimensionality of constructs should be considered.
- Domains should be scored separately ¹⁴⁰
- Not based on functional movements
- Usability - costly and time consuming ³⁹

*'Unsuitable': 'Box and Blocks Test' (BBT)*⁹⁹

- Valid, responsive to change, reliable,¹⁴¹
- Usability - easy-to-use
- Not functional or purposeful
- Not related to the home environment

*'Unsuitable': 'Bruininks-Oseretsky Test of Motor Proficiency' (BOT-2)*¹⁰⁰

- Valid, responsive to change, reliable
- Usability - time consuming, needs specialist professional development
- Not related to the home environment

*'Unsuitable': 'Infant Motor Profile (IMP)'*¹⁰¹

- Valid, responsive to change, reliable
- Usability - time consuming, needs specialist professional development
- Not related to the home environment

5.7 Disability and Development

*'Adequate': 'Child and Adolescent Factors Inventory' (CAFI)*¹⁴²

- Valid, responsive to change, reliable
- Usability - brief, easy-to-use
- Not functional or purposeful
- Related to the home environment

*'Unsuitable': 'Bayley Scales of Infant and Toddler Development' (BSID-III)*¹⁰⁴

- Valid, responsive to change, reliable
- Usability - time consuming, needs specialist professional development
- Not related to the home environment

*'Unsuitable': 'Peabody Developmental Motor Scales'(PDMS)*¹⁰⁵

- Valid, responsive to change, reliable
- Usability - time consuming, needs specialist professional development
- Not related to the home environment

5.8 Detailed Critical Appraisal of Measures

Tables 4, 5 and 6 (below) describe in detail the critical appraisal of each measure based on the Law and McDermid ³³ Appraisal for Clinical Measurement Research Reports Evaluation' approach.

Due to extensive information, the measures are listed alphabetically and presented in separate tables.

Table 4. Critical Appraisal of Measures for Home Application ASK©-CAFI

GENERAL INFORMATION							
Name of measure	Activities Scale Kids (ASK©) ⁸⁸	Assisting Hand Assessment Kids (AHA Kids) ⁷⁷	Mini Assisting Hand Assessment ⁸² (Mini AHA)	Box and Blocks Test (BBT) ⁹⁹	Bruininks-Oseretsky Test of Motor Proficiency (BOT™-2) ¹⁰⁰	Canadian Occupational Performance Measure (COPM) ⁶⁹	Child and Adolescent Factors Inventory (CAFI) ⁸⁰
Acronym, Original author	ASK©p ASK©c						Part of CFFS ¹⁰³
Version					Complete & short versions ¹⁴⁴	XC	
						5 th Edition	
FOCUS							
Focus of measure	Neuro-muscular & movement related functions Initially no specified conceptual framework ⁸⁸ However equates to 'Client and Family-Centred Care'. ⁶⁶ and WHO ICF ¹⁴⁵	Neuro-muscular & movement related functions ⁵⁶ ⁷⁷	Neuro-muscular & movement related functions ⁵⁶ ⁷⁷ ⁸²	Neuro-muscular & movement related functions ⁵⁶ ¹ ²	Neuro-muscular & movement related functions ⁵⁶	Occupational performance ¹⁴⁷ WHO ICF ¹⁴⁸ Child- & family-centred care ¹⁴⁹ ⁶⁴	Activities & participation ⁸⁰ ⁵⁶
Attribute being measured	Activities of daily living: self-care & play ¹⁵⁰	Bi-manual performance ⁷⁷	Bi-manual performance ⁸²	Unilateral fine & gross manual dexterity ⁹⁹	Motor proficiency ⁴¹ ¹⁵¹	Self-care, leisure, productivity ¹⁴⁹ Performance & satisfaction ¹⁴⁷ ¹⁵²	Participation in movement related activities & domestic life ⁸⁰
Primary purposes	To describe physical functioning capacity & actual performance ¹⁵⁰	To discriminate, To plan therapy, To evaluate ⁷⁷ ¹⁵³ ¹⁵⁴	To discriminate To plan therapy To evaluate ⁸²	To discriminate unilateral manual skills ³⁸ To determine outcome ¹⁴¹	To discriminate, To evaluate motor skills ⁴¹ ¹⁵⁵	To evaluate outcomes ¹⁵⁶ ¹⁵⁷ To plan therapy ¹⁴⁷	To discriminate extent of impairments To evaluate ⁸⁰
Perspective	Client (self-report with assistance under 9 years) ¹⁵⁸	Service provider (OT) ⁷⁷	Service provider (OT) ⁷⁷	Service provider (OT) ⁹⁹	Service provider (OT) ¹⁰⁰	Child, parent ¹⁴⁷	Caregiver ¹⁰³
Populations	Children, young people ⁸⁸	Toddlers, children ⁷⁷ Extended age range to 12 years ¹⁵⁹	Infants ⁸²	Children, young people ⁹⁹ ¹⁴⁶	Children, young people ⁴¹	All ages ¹⁴⁷ For children under 8 years completed by parent ¹⁶⁰	Children, young people ¹⁰³
Health conditions	Musculo skeletal, ⁸⁸ CP, Arthrogryposis ¹⁵⁰ Spina Bifida ¹⁶¹	Hemiplegic CP, obstetric brachial plexus palsy, ABI ⁷⁷ ¹⁶² ¹⁵⁴	Unilateral CP ¹⁶²	Unilateral CP ⁹⁹ ¹⁶³ ¹⁴¹	Moderate motor skills deficit ¹⁶⁴ CP ¹⁴⁴	Variety of disabilities across all developmental stages ¹⁴⁹	ABI ¹⁰³

Evaluation context (Setting)	Home, Community Health Care Setting ^{88 165}	Rehabilitation Centre ⁷⁷	Rehabilitation Centre ¹⁶²	Home ⁷⁰ Rehabilitation Centre Health Care Setting ¹⁶⁶	Health Care Setting ¹⁰⁰	Home Community Clinic Research ¹⁶⁷	Home School Community ¹⁰³
CLINICAL UTILITY (USABILITY)							
Clarity of instructions	Adequate/Poor http://www.activitiescaleforkids.com	Adequate http://www.ahnetwork.se/aha-how.php	Adequate http://www.ahanetwork.se/	Excellent https://www.youtube.com/watch?v=OOC6G3vO1kw	Excellent https://www.pearsonassessments.com	Excellent http://www.thecom.ca/http://www.thecom.ca/	Excellent ⁸⁰ https://www.cancchild.ca/en/resources/227-the-child-and-adolescent-factors-inventory-cafi
Format	Self-report Questionnaire ^{161 150} Paper http://www.activitiescaleforkids.com	Task performance Naturalistic observation: ¹⁵⁹ semi structured play session familiar & meaningful occupation Standardised video. ⁷⁷	Task performance Naturalistic observation: Play based video ⁸²	Task performance Naturalistic observational ⁹⁹	Task performance, observation ¹⁰⁰	Individualised, client centred goal setting ^{147 156} 5 step process ¹⁶⁹ http://www.thecom.ca/	Interview - Closed and open-ended questions ⁸⁰ Self or interviewer administered ⁸⁰
Digitised	Web administration ¹⁶¹	Web administration http://www.ahnetwork.se/aha.php	Web administration http://www.ahanetwork.se/aha.php	Automated BBT Test available (for adults) ⁷⁸	Tele-practice ¹⁶⁸	COPM Web-App https://app.thecom.ca	Pen and paper Online guide and forms available ⁸⁰
Time to completion	5-9 Minutes ⁸⁸	10-15 Minutes ^{77 82}	30- 60 Minutes ⁸²	Less than 10 Minutes ³⁸	15-60 Minutes-Short 40-60 Minutes Complete ⁴¹	30 Minutes ⁶⁴	5 Minutes separately from CFFS* ¹⁰³
Administration, Scoring	Complex-to-use Single summary score, range from 0 to 100 (best) ¹⁶¹	Complex-to-use ¹⁵³ Scoring videotape ³⁶ 4 point scale, converted to % ³⁶ Computer- based scoring http://www.ahnetwork.se	Complex-to-use Computer-based scoring http://www.ahanetwork.se The electronic Mini-AHA sum the raw scores, with units 0 to 100 scale	Easy-to-use ¹⁴⁶ Number of blocks transferred from one compartment to the other compartment in 60 seconds ⁹⁹	Complex-to-use Age-based standard scores, percentile ranks, https://www.pearsonclinical.com.au/products/view/223	Easy-to-use ^{138 170 138} Performance 10 point scale ¹⁷¹ Satisfaction on 5 problems ¹⁷²	Easy-to-use http://sites.tufts.edu/garybedell/files/2012/07/CFFS-Administration-Scoring-Guidelines-9-24-111.pdf 3 Point rating scale ⁸⁰

Interpretation	Easy - designed for self-report by children and young people. http://www.activitiesscaleforkids.com	Easy for parents to interpret – play, a familiar and meaningful occupation. ⁷⁷	Easy for parents to interpret - play, a familiar and meaningful occupation ⁸²	Easy to interpret - obvious tasks Good- minimal clinical difference ¹⁴¹	Not easy to use requires qualifications https://www.pe arsonclinical.com.au/	Complex Children & parents value as outcome measure ¹⁷³	Easy to interpret brief questionnaire ¹⁰³
Examiner Qualifications	Not required ¹⁵⁰	Required ^{154 38} https://www.ahanetwork.se	Required https://www.ahanetwork.se	Not required ³⁸	Required https://www.pe arsonclinical.com.au/products/view/223	Recommended https://www.thecopm.ca/buy/copm-learning-module/	Not required administrator should be aware of WHO ICF ^{56 103}
Cost / Payment	Required http://www.activitiesscaleforkids.com	Required ^{38 36}	Required ³⁶	Required ³⁸	Required https://www.pe arsonclinical.com.au/products/view/223	Required https://www.thecopm.ca/buy	Not required
SCALE CONSTRUCTION							
Item selection	Adequate Literature review Clinical and disability experts Interviews with physically disabled children and parents Contextual ¹⁴³ No initial specified frame of reference ⁸⁸	Excellent Literature review ^{77 162} Identified observable actions and constructed relevant items. Rasch analysis to determine validity and reliability.	Excellent Literature review Adapted for infants from AHA Kids ⁷⁷ Need for Mini AHA for young age group justified.	Excellent Literature review Normative study of values for 6-19 year olds. Large normative study of 471 participants ⁹⁹	Adequate Focus groups, pilot survey, standardisation professional feedback ¹⁷⁴	Excellent Literature review ⁶⁴ , Focus groups OT ¹⁶⁹ , Pilot testing ¹⁷⁵ Identified challenges not items ⁶⁴	Excellent Literature review Follow-up survey of 60 parents after clients discharge from hospital Feedback from parents, clinical & measurement experts. ¹⁰³
Level of measurement	Nominal/ Rasch ¹⁵⁰	Ordinal/Rasch ^{77 36 153}	Ordinal/ Rasch http://www.ahanetwork.se/aha.php	Interval ⁹⁹	Ordinal	Ordinal transformed to T scores ¹³⁸	Ordinal ⁸⁰ Rasch ¹⁷⁶
Number of items	38 Items ¹⁵⁰	22 Items ⁷⁷	20 Items ^{82 177 178 39}	Not applicable ⁹⁹	14 Items ¹⁷⁹	9 Items ⁵⁵	15 Items ⁸⁰

Sub-scales	7 Sub-scales ¹⁵⁰	6 Sub-scales ^{77 82}	No subscales	No Sub-scales ⁹⁹	8 Sub-scales & 4 composite scales ¹⁸⁰	2 Sub-scales ¹⁸¹	Sub-scale of CFFS ¹⁰³ Separate administration of sub-scales ¹⁰³
STANDARDIZATION							
Manual/website	Adequate http://www.activitiescaleforkids.com	Excellent http://www.ahaneetwork.se/aha.php	Excellent http://www.ahanetwork.se/aha.php	Excellent https://www.youtube.com/watch?v=OOC6G3vO1kw	Excellent (BOT™-2) SF ¹⁷⁴	Excellent http://www.theopm.ca/buy/	Adequate ⁸⁰
Norm-referenced	Norm-referenced limited ¹¹⁰	Criterion-referenced ⁷⁷	Norm-referenced CP ¹⁸²	Norm-referenced ^{99 6-19 years 146 166}	Norm-referenced ^{183 174 41}	Not applicable	Not applicable
RELIABILITY Rigour of studies	Excellent ⁸⁸	Excellent ^{184 185}	Excellent ^{163 141}	Excellent ^{141 144}	Excellent ^{180 144}	Excellent ¹⁶⁹	Excellent ^{103 186 79}
VALIDITY Rigour of studies	Excellent ^{143 110 165 150}	Excellent ^{82 184 159}	Excellent ^{82 163}	Excellent ^{187 188 41 189 179 141}	Excellent Concurrent ¹⁴⁴	Excellent ^{190 191 138 169 192 193 194}	Excellent ^{103 195}
Responsiveness	Excellent ⁸⁸	Excellent ^{159 184} Primary outcome measure in a study evaluating CIMT in young children with hemiplegia ¹⁹⁶	Excellent ¹⁶³ Responsiveness is of short duration.	Excellent/adequate ^{141 163}	Adequate Responsive in children with CP in a short period of intervention. ¹⁶³	Excellent ¹⁹⁰ Statistically significant improvement in goals attainment ¹⁹⁷	Not reported
OVERALL QUALITY & UTILITY For home use	Adequate Valid, responsive to change, reliable Framework however equates to 'Client and Family-Centred Care'. ⁶⁶ Does not include organised activities and a larger	Adequate Valid, responsive to change, reliable Usability - digitised Acceptable to parents but possibly too complex for home use	Adequate Valid, responsive to change, reliable Usability – digitised Acceptable to parents but possibly too complex for home use	Adequate Valid, reliable, easy-to-use, responsive ¹⁴¹ However not functional, purposeful, or related to the home environment Cannot be used with clients who severe motor or cognitive impairment	Unsuitable Not supported in clinical or research settings ¹⁷⁹ Short Form not recommended ¹⁸⁷	Excellent Valid, including responsiveness, reliable Clinical utility electronic entry, scoring and reports, summary data 'gold standard' in individual goal setting in OT Goals can be related to the	Adequate Good psychometric and clinimetric properties but is directed towards population studies, not home-based OT ¹²⁵

	meaningful goal nor purposeful activity ^{198 137}			https://stroke.ine.ca/en/assessments/box-and-block-test-bbt/ Usability – quick easy to use but requires equipment		home environment	
Linking measures to OT in previous systematic review ³³	Anaby, 2018 ¹⁰⁹	Ferre, 2017 ⁷⁰	Chamudot, 2018 ¹⁰⁸	Ferre, 2017 ⁷⁰	Lin, 2011 ¹²³ Johari, 2016 ¹¹⁸	Anaby, 2018 ¹⁰⁹ Ferre, 2017 ⁷⁰ Angsupaisal, 2015 ¹⁹⁹ Adair, 2015 ²⁰⁰ Novak, 2009 ¹³⁰ Rigby, 2009 ¹³¹	Galvin, 2010 ¹²⁶

ABI=Acquired Brain Injury; ASK@p=proficiency; ASK@c=capacity; CFFS=Child and Family Follow-up Survey; CIMT=Constraint Induced Movement Therapy; UCP=Unilateral Cerebral Palsy; WHO ICF=World Health Organisation International Classification of Functioning; US=United States of America.

Table 5. Critical Appraisal of Measures for Home Application CAPE-GAS

GENERAL INFORMATION							
Name Acronym Original author Versions	Children's Assessment of Participation and Enjoyment (CAPE) ⁹¹ Companion measure PAC ⁹¹	Child and Adolescent Scale of Environment (CASE) ²⁰¹ Part of CFFS ¹⁰³	Child and Adolescent Scale of Participation (CASP) ⁷⁹ Part of CFFS ¹⁰³	Child Engagement in Daily Life (CEDL) ⁸⁹	Children Helping Out: Responsibilities, Expectations, and Supports (CHORES) ⁹²	European Child Environment Questionnaire (ECEQ) ²⁰² SPARCLE ¹²⁵	Goal Attainment Scale (GAS) ⁹⁸
FOCUS							
Focus of measure	Participation ^{56 103}	Environment ^{56 103}	Activities and Participation ^{80 103}	Activities and Participation ⁵⁶	Participation Domestic life ^{56 92}	Participation Environment ⁵⁶ UN Convention Rights of Persons with Disabilities ²⁰³²⁰⁴	Family, client - centred care ²⁰⁵
Attribute being measured	Participation enjoyment recreational & leisure activities ^{206 143} Diversity and intensity ¹³⁷	Environmental factors ²⁰¹ Home, physical design/access ²⁰¹	Participation & environmental factors ¹⁰³	Self-care, participation, family & recreation ⁸⁹ Frequency & enjoyment ²⁰⁸	Self-care, household tasks, Responsibilities, expectations, assistance required ^{190 209}	Physical environmental access ^{202 125}	Individualised goal setting ²¹⁰
Primary purposes	To plan therapy ²¹¹ To evaluate ²¹²	To describe frequency & impact of environmental factors ²⁰¹	To discriminate ^{103 79} To plan therapy ²¹³	To discriminate gross motor function To evaluate ²¹⁴	To discriminate household tasks, participation performance & assistance needed ⁹²	To describe how physical environment facilitates or hinders participation ²¹⁵	Family, client - centred care ²⁰⁵
Perspective	Client self-report or parent interview, ²⁷ Questionnaire ⁴⁵	Client, parent or guardian report ^{201 216}	Family, caregivers report ^{103 90}	Parent or caregiver who knows the child well ⁸⁹	Parent, caregiver report ^{190 209}	Parent, Caregiver report ²¹⁷	Individualised goal setting ²¹⁰
Populations	Children, Young people ²⁰⁶	Children, Young people ⁹³	Children, Young people ⁹⁰	Children (Younger) ²¹⁸	Children (Older), Young people ¹⁹⁰	Children, Young people ²⁰²	Children, young people ^{219 210 220}
Health conditions	Complex PD,CP, Spina bifida, ABI injury & musculo	ABI, TBI ^{103 126}	ABI, TBI ³⁷	CP ⁸⁹ ABI ³⁷	PD ^{92 223} CP ²⁰⁹	CP ^{217 224}	CP ^{210 220}

	skeletal disorders 221 SCI 222 211						
Evaluation context (Setting)	Home, school & community 221 225	Home, community, & school 201	Home, school, & community 90	Home & community 226	Home, school & community 190 227	Home, school, & community 217	Rehabilitation 228
Clarity of instructions	Excellent Manual 212	Excellent Website https://www.canchild.ca/en/resources/#?type=35#\$	Excellent 90	Adequate 229	Adequate On form only	Adequate http://www.ncl.ac.uk/sparcle	Excellent 230
Format	Questionnaire 212 Activity card sort - pictures 212	Parent report survey as part of CFFS 103	Self or interviewer administered	Questionnaire, parent or caregiver 208	Questionnaire, Task performance 209 227	Questionnaire parent & therapist 217 Physical inspection of home 125	Individual interview with client, parent, caregiver 219
Digitised	Paper based 231	Paper based Attached to email 93	Paper based 103	No information	Paper based 227	No information	GOALed GAS App 232
Time to completion	40-60 Minutes for self-report 39	5 Minutes when separate from CFFS 103	10 Minutes 90	10 Minutes 233	Unknown 37	10 to 20 Minutes 234	45 Minutes 210
Administration Scoring	Complex-to-use 235 Diversity Yes/No Intensity 7 point scale 37 Manual scoring 235	Easy-to-use 90 Administration & Scoring Guidelines 201	Easy-to-use 90 Administration and scoring Four point ordinal scale. 10380	Easy-to-use 208 Frequency & performance 5-point scales 37	Easy-to-use 92 236 236 Performance Yes/No Assistance 6 point scale 37	Complex-to-use 202 Needed and not available = 0 needed and available = 1. 217	Complex-to-use Need skills to establish goals
Interpretability	Easy with pictures 45	Easy 90	Easy for parents 90	Easy to understand 17	Easy for parents to understand 236	Acceptable to parents	Easy to understand Positive face value from the viewpoint of the patient or carer. 210

							GAS App improves interpretability ²³²
Examiner Qualifications	Not required (Pearson Assessment CAPE, 2021)	Not required, however administrator should be aware of WHO ICF ^{56 103}	Not required, however, administrator should be aware of WHO ICF ^{56 103}	Not required Parent administered ²³³	No information	Required ¹²⁵	Recommended ²²⁰ https://eatspeakth.ink.com/goal-attainment-scaling-tutorial/#define-gas
Costs - Payment	Required http://www.pearsonassess.ca/en/programs/00/62/97/p006297.html	Not required	Not required	Not required ^{233 89}	No information	No information	No payment required ¹³⁸
SCALE CONSTRUCTION							
Item selection	Excellent The CAPE/ PAC dimensions of participation: diversity, intensity, with whom, where, enjoyment, and preference ²¹² Includes organised activities, a specific setting and a larger meaningful goal ¹⁹⁸	Excellent Literature review Feedback from clients ²⁰¹ Based on CHIEF ²³⁷	Excellent Favourable hypothesis testing ⁷⁹ Construct validity was available for all measures ²³⁸ Feedback from parents ⁹⁰ Includes organised activities, a specific setting and a larger meaningful goal ¹⁹⁸	Adequate Framework not stated however equates to 'Client and Family-Centred Care'. ⁶⁶ and <i>WHO ICF</i> Usability – easy Does not include home environment	Excellent/adequate Adequate Hypothesis testing ¹⁹⁰ Items fit model and order of difficulty ²⁰⁹ Strong internal consistency ²⁰⁹ Home-based participation ⁹²	Excellent Literature review Factor analysis Focus groups parents Random selection of participants Large numbers Established CP registers. SR and RCTs Actual inspection of physical environment Hypothesis testing ¹²⁵	Excellent Literature review. Used initially in mental health Client family and therapist select Individual goals items not provided ⁹⁸
Level of measurement	Ordinal ⁴³	Ordinal/Rasch ²⁰¹	Ordinal/Rasch ⁷⁹	Ordinal ^{218 116} Rasch	Ordinal/Rasch ^{209 37}	Nominal ²³⁹	Ordinal transformed into T scores ²⁴⁰
Number of items	55 Items ³⁹	18 Items ¹⁰³	20 Items ¹³⁷	18 Items ²⁰⁸	33 Items ¹³⁷	51 ²⁴² 60 ²⁴³ Items	Goals 2-5 ⁹⁸
Sub-scales	5 Sub-scales ²⁴¹	Sub-scale of CFFS ¹⁰³	4 Sub-scales ⁹⁰	2 Sub-scales ²⁰⁸	2 Sub-scales ²⁰⁹	4 Sub-scales ²⁴²	Not applicable

Manual/website	Excellent Manual with standardised instructions ²¹²	Adequate https://www.canc hild.ca/en/resources/?type=35#\$	Excellent CASP-Youth-Version ¹²⁷	Adequate Instructions on form ²²⁶	Poor No website or manual identified	Adequate https://research.ncl.ac.uk/spa rcle/protocol.htm	Excellent Manual ²¹⁹
Norms available	Norm-referenced ^{241 244}	None identified ²¹³	Norm-referenced ⁸⁰	None identified	None identified	Not applicable	Not applicable
RELIABILITY# Rigour of studies	Adequate ^{245 244 37}	Adequate ^{103 142}	Excellent ¹²⁷	Adequate Test-retest reliability. ³⁷ Excellent test-retest for self-care ²¹⁸	Excellent ^{209 92} Adequate ³⁷	Excellent Can be used as a reliable and valid measure to assess environmental factors. ²⁴⁶	Adequate ²²⁰
VALIDITY# Rigour of studies	Adequate Validity construct, ABI ³⁷	Excellent ^{103 126 216 186}	Excellent ^{216 247 186 103 126 190} Moderate ^{247 216 79 248}	Adequate ^{214 226}	Adequate ¹⁹⁰ Poor Structural ¹⁹⁰	Excellent Construct validity ²⁴⁶	Adequate Some question of setting easy goals that may not be clinically relevant. ^{219 240}
Responsiveness	Not established ¹⁹⁴	Not established	Moderate ^{247 216} particularly for severe TBI. ²³⁸	Adequate ³⁷ Excellent ²⁴⁷ For children and youth with TBI over 3 years ²⁴⁷	Not established	Not appropriate as reported in cross sectional study	Moderate ^{249 138}
OVERALL QUALITY & UTILITY - FOR HOME USE							
	Adequate Valid CAPE includes the important attribute of enjoyment but this measure is focused on leisure and recreation not self-care etc	Adequate Valid, including moderately responsiveness, reliable Usability- brief, easy, not digitised	Excellent/adequate Valid, including moderately responsiveness, reliable	Adequate Valid, reliable Responsiveness ³⁷ Framework not stated however equates to 'Client and Family-Centred	Adequate Valid, reliable No information on responsiveness to change Usability - No website	Adequate Even though home-based, probably more suitable for population studies not clinical practice	Excellent/adequate Well established, valid and reliable, good usability

		Combined participation and home environment	<p>Clinical utility - short, easy, not digitised</p> <p>Combined participation and home environment</p> <p>In ABI, for participation only one available with preliminary evidence of satisfactory measurement properties Resch ³⁷</p>	<p>Care' ⁶⁶ and WHO ICF</p> <p>Does not include organised activities and a larger meaningful goal nor purposeful activity ^{198 137}</p> <p>Usability</p> <p>Does not include home environment</p>	<p>Very relevant to participation in household task in the home environment</p> <p>Specific task associated with older children and young people ⁹²</p>		<p>May be used in home environment</p> <p>May be used with COPM ¹³⁸</p>
Linking measures to OT in previous systematic review ³³	Novak, 2008 ¹³⁰	Alghamdi , 2017 ¹¹⁶	Galvin, 2010 ¹²⁶	Alghamdi, 2017 ¹¹⁶	Amaral, 2014 ¹²⁰	Colver, 2010 ⁹⁴	<p>Novak, 2009 ¹³⁰</p> <p>Angsupaisal, 2015 ²⁵⁰</p> <p>Huang, 2013 ²⁵¹</p>

ABI= Acquired brain Injury; CP= Cerebral Palsy; CFFS=Child and Family Follow-up Survey; CHIEF= Craig Hospital Inventory Environmental Factors; ICF=International Classification of Functioning; PAC= Preference for Activities of Children; PD= Physical Disabilities; UN=United Nations;

RCT= Randomised Controlled Trial; SPARCLE= Study of PARTICipation of Children with Cerebral Palsy Living in Europe; SR=Systematic Review

TBI=Traumatic Brain Injury; WHO =World Health Organisation.

Table 6. Critical Appraisal of Measures for Home Application IMP-YC:PEM

GENERAL INFORMATION							
Acronym Original author Version	Infant Motor Profile (IMP) ¹⁰¹	Participation & Environment Measure for Children and Youth (PEM-CY) ²¹³	Peabody Developmental Motor Scale (PDMS-2) ¹⁰⁵	Pediatric Evaluation of Disability Inventory (PEDI-CAT) ⁷² Speedy and Content balanced PEDI-CAT https://www.pedicat.com/coming-soon-pedi-cat-online/	25. Quality of Upper Extremity Skills Test (QUEST) ¹⁰²	School, Home & Neighbourhood Accessibility: Physically Disabled Children's Assessments (ScHaN©) ⁹⁶	Young Children's Participation and Environment Measure (YC-PEM) ⁹⁷ Based on PEM ²¹³
FOCUS							
Focus of measure	Neuro-muscular and movement related functions ^{56 101}	Participation & Environment simultaneously ⁵⁶	Neuro-muscular and movement related functions Developmental delay ^{56 105}	Activity and participation ⁵⁶	Neuro-muscular and movement related functions ⁵⁶ Impairment and function ²⁵²	Environment-home. UN Convention Rights of Persons with Disabilities ²⁰³ Client & family centered care ⁶⁶	Participation Environment ^{56 97}
Attribute being measured	Motor development & behaviour ¹⁰¹	Eating, dressing, playing, drawing or writing, household tasks ¹⁹⁰	Gross and fine motor proficiency skills Developmental delay ¹⁰⁵	Typical current functional performance in self-care, mobility & responsibility ²⁵³	Quality of upper extremity - impairment and function ²⁵²	Accessibility in home, school & neighbourhood ⁹⁶	Participation - frequency & involvement ²⁵⁴ Environmental support. ⁹⁷
Primary purpose	To discriminate spontaneous motor behaviour & early detection of motor developmental disorders ¹⁰¹	To evaluate ²¹³ To plan therapy PEM+ ²⁵	To describe and discriminate ¹²⁴	To discriminate functional delay To describe following intervention ²⁵³	To describe quality of both upper extremity function in children with neuromotor dysfunction with spasticity ^{139 252}	To describe and discriminate accessibility to physical environments ¹¹⁷	To discriminate environmental factors impacting participation in home school community. Therapeutic goal setting ²⁵⁵

Perspective	Paediatric OT, PT ²⁵⁶	Parent report questionnaire ^{97 137}	Service provider ¹⁰⁵	Care-giver & health professionals ²⁵³ https://www.pedicat.com	Service provider ²⁵²	Child or young person - can ask for assistance ¹¹⁷	Parents, caregivers, service providers ^{97 255}
Populations	Infants (Preterm) Corrected age 4-18 months ¹⁰¹	Children, young people ^{190 28}	Infants, young children ²⁵⁷	Infants, children, young people ²⁵³	Infant, child ¹³⁹	Children, young people ⁹⁶	Infants and young children ^{97 255}
Health Conditions	Neurological dysfunction ¹⁰¹	Developmental disabilities and delays ²⁵⁸ Spina Bifida ²⁵⁹ ABI ²⁶⁰	CP ²⁶¹ Low birth weight ²⁶²	All health conditions ^{253 1}	Neuromotor dysfunction with spasticity ¹³⁹ ABI ²⁶³	Physical disabilities - at least one mobility device ¹¹⁷	Developmental disabilities and delays ⁹⁷ Any health condition ²⁵⁵
Evaluation context (Setting)	Rehabilitation, health care setting ¹⁰¹	Home, school, community settings ^{95 190}	Rehabilitation, Health Care ¹⁰⁵	Home, Community Rehabilitation, Health Care ²⁵³	Clinic and research ¹³⁹	Home, school, neighbourhood ¹¹⁷	Home, pre-school/daycare, community, research, clinical practice ^{97 255}
Clarity of instructions	Excellent Manual ²⁵⁶	Excellent https://canchild.ca/en/resources/248-participation-and-environment-measure-for-children-and-youth-pem-cy	Excellent ²⁶⁴	Excellent ²⁶⁵ http://www.pedicat.com/	Adequate/poor ¹⁰² Needs improvement https://www.sralab.org/rehabilitation-measures/quality-upper-extremity-skills-test	Excellent ¹¹⁷	Excellent https://canchild.ca/en/resources/223-young-children-s-participation-and-environment-measure-ycpem ²⁵⁵
CLINICAL UTILITY (USABILITY)							

Format	Observational Video ²⁶⁶ https://infantmotorprofile.com/auth/dashboard	Parent report Questionnaire ⁹⁷	Observational ¹⁰⁵	Questionnaire Observation of tasks-video Automatic selection of appropriate items ²⁶⁵	Observational Play context ¹³⁹	Questionnaire (McKeever, P. Dunn, J. Yantzi, Aslam, H.Doherty, Ruddick, Young, & Scott, 2015)	Questionnaire parent report ⁹⁷
Digitisation	IMP App https://infantmotorprofile.com	Online, scoring and report function ²⁶⁷ Parent software ²⁶⁸ https://canchild.ca/en/resources/248-participation-and-environment-measure-for-children-and-youth-pem-cy	PDMS-2 Online scoring and reporting system ²⁵⁷	On-line ²⁵³ https://www.pedicat.com/coming-soon-pedi-cat-online/	Pen and paper https://www.sralab.org/rehabilitation-measures/quality-upper-extremity-skills-test	Previously used online www.isr.yorku.ca/survey/schan ¹¹⁷	Available on-line ²⁶⁹
Time to completion	15 Minutes ²⁵⁶	20-25 Minutes ³⁷	45-60 Minutes ²⁵⁷	15 Minutes ^{152 270}	30 to 45 minutes ²⁵²	15-20 Minutes 1 section 45 -60 all 3 sections ⁹⁶	30-40 Minutes ⁹⁷
Administration Scoring/	Complex-to-use Video based ¹⁰¹ so may not be easy in the home https://infantmotorprofile.com/auth/dashboard The IMP App provides automatic calculation of domain and total scores ²⁷¹	Easy-to-use Frequency, involvement 8-point scale - never to daily ³⁷	Complex -to-use Composite score for gross, fine and total. Includes Peabody Motor Activities Program (P-MAP) https://www.pearsclinical.com.au/products/view/475	Easy-to-use Online entry, scoring, reports ⁷² 4 point difficulty and 5 point responsibility scale ²⁶⁵ Not every item needs to be answered to be scored ²⁵³	Complex-to-use 4 point Difficulty Scale with responses ranging from "Unable" to "Easy." ¹³⁹ Scoring QUEST separately is recommended ¹⁴⁰	Easy-to-use (McKeever, P. Dunn, J. Yantzi, Aslam, H.Doherty, Ruddick, Young, & Scott, 2015)	Easy-to-use Tips for Administration ²⁵⁵
Interpretability	Complex Video based ¹⁰¹	Easy Designed for parents to	Difficult to interpret	Interpretation ⁷² Professionals should use PEDI CAT T Scores	Professional need to interpret ¹³⁹	Easy to interpret by clients and their families and developed in co-	PEM+ usability Increases value of measure by

		understand and complete ²⁷²		²⁶⁵		ordination with young people with disabilities. ⁹⁶	linking with OT intervention ²⁵
Examiner Qualifications	Recommended ²⁵⁶	Not required Parent completed Need licence ²⁷²	Recommended Level B Pearson https://www.pears.onclinical.com.au/products/view/475	Recommended ²⁵³ Level B Pearson https://www.pears.onclinical.com.au/products/view/611	Required – licence https://www.canc.hild.ca/en/resources/49-quality-of-upper-extremity-skills-test-quest	Not required	Required licence - Individual or organisational ²⁵⁵
Costs	Payment required ²⁵⁶	Payment required ²⁷²	Payment required ⁴¹	Payment required https://www.pears.onclinical.com.au/products/view/611	Payment required https://www.canc.hild.ca/en/shop/19-quality-of-upper-extremity-skills-test-quest	No payment required	Payment required ²⁵⁵
Item selection	Excellent Applies principles of neuromotor development ²⁷¹ Review of existing instruments ¹⁰¹	Excellent Literature review Interviews with parents and young people Expert review Testing in web-based survey ²⁷² Includes relevant activities, specific setting and a larger meaningful goal. ²⁷³	Excellent Literature review Involvement of expert therapists ^{105 274}	Excellent Dumas et al., 2010) ¹¹⁵ New item bank developed for PEDI CAT in 2013 ²⁷⁶	Excellent Extensive review of literature on development of upper extremity function Consensus meetings with OTs PTs Pilot tested on 10 kids with CP. Based on developmental theory ¹³⁹	Excellent Literature review Case studies Youth consultants Large cross-sectional survey testing content Consultation with experts ⁹⁶	Excellent Based on PEM * ²¹³ Large-sample research ⁹⁷ Fill measurement gap for young children. ²¹³
Level of measurement	Ordinal ¹⁰¹	Nominal Yes/No ²⁷²	Ordinal/Rasch 3 point scale ²⁷⁷	Normative and scaled scores ²⁶⁵	Nominal Yes, No, Not tested ²⁵²	Nominal/ordinal ⁹⁶	Ordinal ⁹⁷
Number of items	80 Items ¹⁰¹	25 Items ⁴⁵	249 Items ²⁶⁴	60 Items ²⁷⁰	36 items refs ¹³⁹	31 Items ⁹⁶	28 items ⁹⁷
Sub-scales	5 Sub-scales ¹⁰¹	3 Sub-scales Including home	6 Sub-scales ²⁶⁴	4 Sub-scales	4 Subscales ¹³⁹	3 Sub-scales including home	4 Sub-scales Including home

		45		May be applied separately ⁷²		96	97
Manual/website	Excellent Manual ²⁵⁶ Website https://infantmotorprofile.com	Excellent ²⁷² On line	Excellent Manual - online ²⁶⁴	Excellent https://www.pedicat.com/coming-soon-pedi-cat-online/	Adequate https://www.canc.hild.ca/en/resources/223-young-children-s-participation-and-environment-measure-ycpem	Not available	Adequate https://www.canc.hild.ca/en/resources/223-young-children-s-participation-and-environment-measure-ycpem
Norms available	Norm-referenced Available on the IMP App ²⁷¹	Not Applicable	Norm-referenced ²⁵⁷ Stratified by age ²⁶⁴ 2003 children USA ²⁷⁴	Norm & criteria referenced Age as a percentile. (M. Fragala-Pinkham et al., 2015)	Available Cerebral Palsy ²⁵²	Not applicable	Unknown
RELIABILITY - Rigour of studies							
	Moderate Test re-test ^{28 114}	Excellent ^{190 28 278 34}	Excellent ²⁷⁴	Excellent Test-retest ^{279 280}	Excellent Good test retest intra-observer Strong reliability ¹⁴⁰ reliability ^{252 39}	Excellent Content Case and large cross sectional studies Test-retest ⁹⁶	Moderate to excellent Large range on test re-test for participation ^{97 97}
VADIDITY - Rigour of studies							
	Excellent Content ¹⁹⁰ Moderate internal consistency ²⁸	Excellent ^{190 267}	Excellent ^{102 274}	Excellent ²⁸⁰	Poor Construct validity ^{139 140}	Excellent Predictive validity ⁹⁶	Moderate to excellent ⁹⁷
Responsiveness	No studies on responsiveness located but demonstrated in Sgandurra, 2017 ²⁸¹	No studies on responsiveness located	Moderate ²⁶¹ Poor ¹⁰² Fair ⁴¹	Moderate For daily activities and mobility ²⁸²	Moderate ^{139 283}	No studies on responsiveness located	No studies on responsiveness located
OVERALL QUALITY & UTILITY – For home use							
	Adequate/unsuitable Valid, moderately reliable	Adequate Valid, including responsiveness, reliable	Unsuitable Requires extensive professional	Excellent Recommended ²⁸⁴	Unsuitable Poor construct validity ¹⁴⁰	Adequate Valid and reliable	Adequate Valid and reliable

	Includes relevant activities, specific settings, and a larger, meaningful goals ⁴⁵ Usability – requires extensive professional development More suited to specialised clinic application	Usability, easy, moderate length, digitised Includes relevant activities, specific settings, and a larger, meaningful goals ⁴⁵ Participation and home environment	development, skills and experience Expensive for infrequent use	Measure of choice in this field as it has excellent utility particularly on digitisation of data entry etc. Precision entry target level saves time and frustration.	Reliable ²⁸⁵ Not functional Costly and time consuming ³⁹	No information on responsiveness Kid and disability friendly, designed for home ⁹⁶	Is useful tool for this age-group ⁹⁷ Yields care plan via PEMS ²⁵ Usability - Web-based mode of administration mode of administration ²⁵
Linking to OT in previous systematic review ³³	Sgandurra, 2017 ²⁷	Albrecht, 2017 ¹¹³ ¹¹⁹	Lin, 2011 ¹²³	Albrecht, 2017 ¹¹³	Novak, 2009 ¹³⁰	Stephens, 2017 ¹¹⁷	Khetani, 2015 ¹¹³

ADL= Activities of Daily Living; CP= Cerebral palsy; DD=Developmental Delay; HOS=How Often Scale (HWS);HWS=How Well Scale :

ICF=International Classification of Functioning; PEM+= Participation and Environment Measure Plus; OT=Occupational Therapist; PT=Physiotherapist; UN=United Nations.

6 Discussion and Conclusion

This review links the components of 'evaluation', 'intervention' and 'outcomes' as described in the Occupational Therapy Practice Framework.⁴⁹ The critically appraised measures were often associated with a specified, usually named invention, such as the 'Occupational Therapy Home Program'.¹³⁰

This linkage approach is in contrast to many other systematic reviews that focus on nominated target populations or health domains, for example, Resch,³⁷ - acquired brain injury and cerebral palsy, and Joshi,³⁹ hand function measures for children with cerebral palsy however, do not connect measures to interventions as in the case with the current review.

In occupational therapy practice the importance of demonstrating an improvement in occupational performance is critical. These changes must be clinically (as opposed to only statistically) significant to provide a high value service to clients, their families and funding bodies.

The improvements in usability provided by digital delivery and advancements such as Computerised-Adaptive Testing (CAT),¹⁰ and the of evaluation and outcome measures also has an important contribution to the efficiency of the Occupational Therapy Practice Framework.⁴⁹

Occupational therapists recognise the importance of measures being based on an appropriate theoretical model.⁵⁸ One of the concepts reinforced in the current review is the value of using measures which evaluate the functioning of individuals with physical disabilities and their families in the **home** environment. This approach is firmly embedded in the WHO ICF⁵⁷ model of the 'person-environment (home)-occupation fit' and the major influence of the child or young person's stage of growth and development. Another aspect is the setting or contextual factor of the environment shown in Law's 2011 'Focus on Function'.¹²¹ Occupational performance and participation is modified by the environment in which it is performed and there is a need to measure this interaction in relation to formulating treatment plans.²⁸⁶ This approach is in contrast to neuromuscular and developmental evaluations that are often administered in isolation from the home and family environment.

One of the distinct advantages of the methodology chosen for this critical appraisal is that the Law and McDermid⁴ approach that is based on a well-recognised and applied model, the WHO ICF.⁵⁷ This approach examines both the psychometric and clinimetric properties of measures and is applied by prominent occupational therapy authors in the field.^{55 194 190 287 177} In particular, the clinimetric characteristics of each measure including clarity of instructions, format (Interview, task performance, naturalistic observation questionnaire and digitisation) time to completion, ease of use (Administration, scoring and interpretation), examiner qualifications, frequency of application, availability, and cost are particularly related to time constraints. Other factors for consideration are; the views of clients and their families particularly in relation to the cost-benefit of evaluation; the applicable target populations and norms, the specific occupational therapy regimes to be applied, the policies of the occupational therapy managers, and the requirements of external funding bodies.

When selecting appropriate measures there are a number of recognised barriers and facilitators that support or hinder the consistent and appropriate use of evaluation and outcomes measures in occupational therapy practice. For the individual therapist these include receiving organisational support and leadership from management;^{288 289 290} having designated research support personnel to drive projects related to evaluation of psychometric properties and provide educational support; the use of standardised templates and procedures; and a clear structured process for the project.²⁹⁰ In conclusion, the most useful measures are those which combine the evaluation of the client's occupational performance within the home environment and focus on the Occupational Therapy Practice Framework process of evaluation, intervention and outcomes.⁴⁹ The usability of measures needs to be considered in addition to validity, particularly responsiveness and reliability.

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Ethical Issues

As this study did not directly involve human participants, no ethical approval was required.

7 References

1. World Health Organisation. International classification of functioning, disability and health: children and youth version: ICF-CY. [Internet]. World Health Organization. 2007.
2. American Journal of Occupational Therapy. Activities of Daily Living. Vol. 68, OT-Practice-Framework-Table-1-Occupations. 2014. p. S19–21.
3. Burls A. What Is Critical Appraisal? [Internet]. Second Edi. Vol. 1, Hayward Medical Communications. Hayward Group Ltd; 2009. p. 1–8.
4. Law M, McDermid J. Evidence-Based Rehabilitation: A Guide to Practice [Internet]. Third Edit. Law M, MacDermid J, editors. New Jersey, USA, Hamilton, Ontario, Canada: Slack Incorporated; 2014. 1–429 p.
5. Tesio L. Functional assessment in rehabilitative medicine: Principles and methods. Vol. 43, Europa Medicophysica. 2007. p. 515–23.
6. Higgins JAD. Assessing risk of bias in included studies. Vol. Chapter 8, Cochrane Statistical Methods Group and the Cochrane Bias Methods Group. 2008. 8.1-8.50.
7. Carrozzino D, Patierno C, Guidi J, Berrocal Montiel C, Cao J. Clinimetric Criteria for Patient-Reported Outcome Measures. *Psychother Psychosom*. 2021;90(4):222–32.
8. Capdevila E, Rodríguez-Bailón M, Kapanadze M, Portell M. Clinical Utility of the Canadian Occupational Performance Measure in Older Adult Rehabilitation and Nursing Homes: Perceptions among Occupational Therapists and Physiotherapists in Spain. *Occup Ther Int*. 2020;Article ID:1–13.
9. Gabel CP, Melloh M, Burkett B, Michener LA. Lower Limb Functional Index: Development and clinimetric properties. *Phys Ther*. 2012;92(1):98–110.
10. Haley, S. Ni, Fragula-Pinkham Skinar A. A computer adaptive testing approach for assessing physical functioning in children and adolescents. *Dev Med Child Neurol*. 2007;47(2):113–20.
11. Corcoran M. Defining and Measuring Constructs. *Am J Occup Ther*. 2007;61(1):7–8.
12. Mokkink, L. Terwee CP. COSMIN Taxonomy Measurement Property Definitions and Criteria. *Bmjopen*. 2019;March(Supplementary File 2):1–4.
13. Bolboacă SD. Medical Diagnostic Tests: A Review of Test Anatomy, Phases, and Statistical Treatment of Data. *Comput Math Methods Med*. 2019;28 May(eCollection):1891569.
14. World Health Organization. International Classification of Functioning, Disability and Health. Children & Youth Version. [Internet]. WHO Press. 2007.
15. Sackett DL. How to practice and teach EBM. *Evid Based Med*. 2000;New York:
16. Farlex. The Free Medical Dictionary [Internet]. Medical Dictionary. 2009.
17. Wikipedia. Home Safety [Internet]. Wikipedia, The Free Encyclopedia. 2020 [cited 2020 Sep 2].
18. Carnemolla P, Bridge C. Systematic Review : Evidence on Home Modifications [Internet]. Vol. March, Home Modification Information Clearing House. 15) 1st ed.

- Sydney: Enabling Built Environment Program, University of New South Wales; 2015. p. 1–53.
19. Mokkink L, Terwee C, Patrick D, Alonso, J. Stratford, P. Knol D, Bouter L, de Vet H, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol*. 2010 Jul;63(7):737–45.
 20. Scutchfield F, Howard A, Shapiro R. Health Measurement Scales [Internet]. Oxford Bibliography. 2015.
 21. World Federation of Occupational Therapists. About Occupational Therapy. 2012.
 22. Ranka J, Chapparo C (Editors). Definition of terms: Occupational Performance Model (Australia) [Internet]. Vol. Monograph, Occupational Performance Network. Sydney, Australia; 1997. p. 58–60.
 23. Finch E, Brooks D, Stratford P, Mayo N. Physical Rehabilitation Outcome Measures. 2nd Ed. Lippincott Williams & Wilkins. London, United Kingdom; 2002. 320 p.
 24. Moher D, Hopewell S, Schulz K, Montori, V. Gøtzsche, PDevereaux P, Elbourne, D. Egger M, Altman D. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. *BMJ*. 2010;340(c869):1–28.
 25. Jarvis JM, Gurga A, Greif A, Lim H, Anaby D, Teplicky R, et al. Usability of the Participation and Environment. *Am J Occup Ther* [Internet]. 2019;73(4):1–8.
 26. WHO, World Health Organization. The ICF: An Overview. World Heal Organ. 2001;1–10.
 27. Imms C, Adair B, Keen D, Ullenhag, A. Rosenbaum P, Granlund M. “Participation”: A systematic review of language, definitions, and constructs used in intervention research with children with disabilities. *Dev Med Child Neurol*. 2016;58(1):29–38.
 28. Coster W, Law M, Bedell G, Khetani M, Anaby D, Teplicky R, et al. The Participation and Environment Measure for Children and Youth (PEM--CY): An innovative measure for home, school and community. 2012;
 29. Boone W. Rasch analysis for instrument development: Why,when,and how? *CBE Life Sci Educ*. 2016;15(4):m4.
 30. Foti M, Beohmer K. Quick Reference Dictionary For Occupational Therapy: Sixth Edition (2015). *Occup Ther Heal Care* [Internet]. 2016;30(3):724.
 31. Laver-Fawcett A, Laver Fawcett A. Routine standardised outcome measurement to evaluate the effectiveness of occupational therapy interventions: essential or optional? *Ergoterapeuten*. 2014;4(January 2014):28–37.
 32. Barnsbee L, Barnett AG, Halton K, Nghiem S. Cost-effectiveness. In: *Mechanical Circulatory and Respiratory Support*. 2018. p. 749–72.
 33. Fowler B, Kirwan T. Activities, Participation, Accessibility and Safety in the Home Environment for Children and Young People with Physical Disabilities [Internet]. Home Modification Clearing House. 2021. 1–49 p.
 34. Romli M, Wan Yunus F, Mackenzie L. Overview of reviews of standardised occupation-based instruments for use in occupational therapy practice. Vol. 66,

- Australian Occupational Therapy Journal. 2019. p. 428–45.
35. Bourke-Taylor HM, Brown T, Cordier R. Special Issue: Innovations in occupational therapy measurement [Internet]. Vol. 65, Australian Occupational Therapy Journal. 2018. p. 343–5.
 36. Wagner L, Davids J. Assessment tools and classification systems used for the upper extremity in children with cerebral palsy. *Clin Orthop Relat Res*. 2012;470(5):1257–71.
 37. Resch C, Van Kruijsbergen M, Ketelaar M, Hurks P, Adair B, Imms C, et al. Assessing participation of children with acquired brain injury and cerebral palsy: a systematic review of measurement properties. *Dev Med Child Neurol*. 2020;62(4):434–44.
 38. Strączyńska A. Functional tests assessing manual skills in children with cerebral palsy. *Pedagog Psychol Sport*. 2020;6(3):72.
 39. Joshi D, Kunde D, Ganvir S. Critical analysis of various hand function tools children with cerebral palsy. *VIMS J Phys Th*. 2019;1(2):72–8.
 40. Peters C, Chang A, Morales A, Barnes K, Allegretti A. An integrative review of assessments used in occupational therapy interventions for children with cerebral palsy. *Brazilian J Occup Ther*. 2019;27(1):168–85.
 41. Griffiths. A, Toovey. R, Morgan. P, Spittle. A. Psychometric properties of gross motor assessment tools for children: A systematic review. *BMJ Open*. 2018;8(10):1–14.
 42. Burgess A, Boyd R, Ziviani J, Sakzewski L. A systematic review of upper limb activity measures for 5-18 year old children with bilateral cerebral palsy. *Aust Occup Ther J*. 2019;66(5):552–67.
 43. Cordier R, Chen S, Speyer R, Totino R, Doma K, Leicht A, et al. Child-report measures of occupational performance: A systematic review. *PLoS One*. 2016;11(1):e0147751.
 44. Elvrum A, Sæther R, Riphagen I, Vik T. Outcome measures evaluating hand function in children with bilateral cerebral palsy: a systematic review. *Dev Med Child Neurol*. 2016;58(7):662–71.
 45. Chien C, Rodger S, Copley J, Skorka K. Comparative content review of children's participation measures using the international classification of functioning, disability and health-children and youth. *Arch Phys Med Rehabil*. 2014;95(1):141–52.
 46. James S, Ziviani J, Boyd R. A systematic review of activities of daily living measures for children and adolescents with cerebral palsy. *Dev Med Child Neurol*. 2014;56(3):233–44.
 47. Bialocerkowski A, O'Shea K, Pin T. Psychometric properties of outcome measures for children and adolescents with brachial plexus birth palsy: A systematic review. Vol. 55, *Developmental Medicine and Child Neurology*. 2013. p. 1075–88.
 48. Chang K, Justice D, Chung K, Yang L. A systematic review of evaluation methods for neonatal brachial plexus palsy. *J Neurosurg Pediatr* [Internet]. 2013;12(4):395–405.
 49. Boop C, Cahill S, Davis C, Dorsey, J. Gibbs V, Herr, B. Kearney, K. Griffin Lannigan E, Metzger, L. Miller, J. Owens A, et al. Occupational therapy practice

- framework: Domain and process fourth edition. Vol. 74, American Journal of Occupational Therapy. 2020. 1–87 p.
50. Cummins M. National Disability Insurance Agency Consultation Paper : Access and Eligibility Policy with independent assessments Occupational Therapy Australia submission February 2021. Vol. 1, Occupational Therapy Australia. 2021.
 51. National Disability Insurance Scheme. Independent Assessment of Selection Tool. Vol. September, NDIS. 2020.
 52. Souza A, Alexandre N, Guirardello E. Psychometric properties in instruments evaluation of reliability and validity. *Epidemiol e Serv saude Rev do Sist Unico Saude do Bras.* 2017;26(3):649–59.
 53. Fava, G. Belaise C. A discussion on the role of clinimetrics and the misleading effects of psychometric theory. *J Clin Epidemiol.* 2005;58(8):753–6.
 54. Gorst S, Prinsen C, Salcher-Konrad M, Matvienko-Sikar K, Williamson P, Terwee C. Methods used in the selection of instruments for outcomes included in core outcome sets have improved since the publication of the COSMIN/COMET guideline. *J Clin Epidemiol [Internet].* 2020;125:64–75.
 55. Romli. M, Wan Yunus F. A Systematic Review on Clinimetric Properties of Play Instruments for Occupational Therapy Practice. *Occup Ther Int [Internet].* 2020;4(August):1–19.
 56. World Health Organisation. International Classification of Functioning, Disability and Health. [Internet]. World Health Organization. 2001.
 57. Bickenbach J, Alarcos C, Selb M, Stucki G. ICF Core Sets, Manual for Clinical Practice, 2 ed. ICF Research Branch, Hogrefe Publishing. 2021. p. 2–19.
 58. D'Arcy E, Wallace K, Chamberlain A, Evans, K. Milbourn B, Bölte, S. Whitehouse A, Girdler S. Content validation of common measures of functioning for young children against the International Classification of Functioning, Disability and Health and Code and Core Sets relevant to neurodevelopmental conditions. *Autism.* 2022;26(4):928–39.
 59. Kjekken I. Measurement in occupational therapy. *Scand J Occup Thera.* 2012;19(6):466–7.
 60. Majnemer A. Measures for Children with Developmental Disability: An ICF-CY Approach. Wiley. 2012. 1–552 p.
 61. Miller, L. Ziviani, J. Ware, R. Boyd R. Does Context Matter? Mastery Motivation and Therapy Engagement of Children with Cerebral Palsy. *Phys Occup Ther Pediatr.* 2016;36(2):155–70.
 62. Chapparo C, Ranka J. Towards a model of occupational performance : Model development. *Occup Perform Model [Internet].* 1997;1(July):24–44. 265861552ee9.pdf
 63. Pollock N, Baptiste S, Law M, Mccoll MA, Opzoomer A, Polatajko H. Occupational Performance Measures: A Review Based on the Guidelines for the Client-centred Practice of Occupational Therapy. *Can J Occup Ther.* 1990;57(2):82-7.
 64. Law M, Baptiste S, McColl M, Opzoomer A, Polatajko H, Pollock N, et al. The Canadian Occupational Performance Measure: An outcome measure for occupational therapy. *Can J Occup Ther.* 1990;5(2):82-7.

65. Khayatzadeh-Mahani, M. Mehraban, A. Kamali, M. Parvizy, S. Haghani, H. Amini M. Development and Validation of Occupation Based Practice Measure (OBPM). *Can J Occup Ther.* 2022;89(3):283–93.
66. Mccoll M, Pranger T. Theory and practice in the Occupational Therapy Guidelines for Client-centred Practice. *Can J Occup Ther [Internet]*. 1994;61(5):250–9.
67. Lammi BM, Law M. The effects of Family-Centred Functional Therapy on the occupational performance of children with cerebral palsy. *Can J Occup Ther.* 2003;70(5):285–97.
68. Law M. Outcome measures rating form guidelines. *Can J Occup Ther.* 2004;(August):1–5.
69. Law M, Baptiste S, McColl M, Opzoomer A, Polatajko H, Pollock N. The Canadian Occupational Performance Measure: An Outcome Measure for Occupational Therapy. *Can J Occup Ther.* 1990;57(2):82–7.
70. Ferre C, Brandão M, Surana B, Dew, A. Moreau N, Gordon A, Dew A, et al. Caregiver-directed home-based intensive bimanual training in young children with unilateral spastic cerebral palsy: a randomized trial. *Dev Med Child Neurol.* 2017;59(5):497–504.
71. Smart A. A multi-dimensional model of clinical utility. *Int J Qual Heal Care.* 2006;18(5):377–82.
72. Dumas HM, Fragala-Pinkham MA, Haley SM, Ni P, Coster W, Kramer JM, et al. Computer adaptive test performance in children with and without disabilities: Prospective field study of the PEDI-CAT. *Disabil Rehabil.* 2012;
73. Stasolla F, Ciarmolibrizio D. Telerehabilitation to Improve Clinical and Health Conditions of Children with Cerebral Palsy: A Mini Review. *Clin Res Psychol.* 2020;3(1):1–5.
74. Gershon R. Computer adaptive testing. *J Appl Meas.* 2007;6(1):109–27.
75. Haley SM, Ni P, Fragala-Pinkham MA, Skrinar AM, Corzo D, Skrinar, A. Corzo D, et al. A computer adaptive testing approach for assessing physical functioning in children and adolescents. *Dev Med Child Neurol.* 2005;47(2):113–20.
76. Pearson. Q-global® [Internet]. Pearson Clinical Assessment. 2022.
77. Krumlinde-Sundholm L, Eliasson AAC. Development of the assisting hand assessment: A Rasch-built measure intended for children with unilateral upper limb impairments. *Scand J Occup Ther.* 2003;10(1):16–26.
78. Oña E, Jardón A, Balaguer C. The automated box and blocks test an autonomous assessment method of gross manual dexterity in stroke rehabilitation. Vol. 10454, *Lecture Notes in Computer Science.* 2017. p. 101–14.
79. Bedell G. Further validation of the Child and Adolescent Scale of Participation (CASP). *Dev Neurorehabil [Internet]*. 2009;12(5):342–51.
80. Bedell G. The Child and Adolescent Factors Inventory Scoring Guidelines. CanChild Centre for Childhood Disability Research, McMaster University. 2011. p. 1–14.
81. Law M. Measurement in Occupational Therapy: Scientific Criteria for Evaluation. *Can J Occup Ther.* 1987;54(3):133–8.
82. Greaves. S, Imms. C, Dodd. K, Krumlinde-Sundholm. L. Development of the

- Mini-Assisting Hand Assessment: Evidence for Content and Internal Scale Validity. *Dev Med Child Neurol*. 2013;55(11):1030–7.
83. Altman D. Consolidated Standards of Reporting Trials and encompasses various initiatives developed by the CONSORT 6a Outcomes - CONSORT Statement [Internet]. 2010.
 84. Romli. M, Wan Yunus F, Romli MH, Wan Yunus F. A Systematic Review on Clinimetric Properties of Play Instruments for Occupational Therapy Practice. *Occup Ther Int* [Internet]. 2020;4(August):9475025.
 85. Mokkink LB, Terwee CB, Patrick DL. COSMIN checklist manual. null, editor. 2012.
 86. Shea B, Reeves B, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2: A critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*. 2017;358:1–9.
 87. Haley S. Pediatric evaluation of disability inventory (PEDI). Development, standardization and administration manual. PEDI Research Group. New England Medical Center Hospital. Boston, Massachusetts, USA. PEDI Research Group.; 1992.
 88. Young N, Williams J, Yoshida K, Wright J. Measurement properties of the Activities Scale for Kids. *J Clin Epidemiol*. 2000;53(2):125–37.
 89. Chiarello L, Palisano R, McCoy S, Bartlett D, Wood A, Chang HJ, et al. Child engagement in daily life: A measure of participation for young children with cerebral palsy. *Disabil Rehabil*. 2014;36(21).
 90. Bedell G. The Child and Adolescent Scale of Participation Scoring Guidelines. CanChild Centre for Childhood Disability Research, McMaster University. 2011. p. 1–21.
 91. King, G., Law, M., King, S., Hurley, P., Hanna, S., Kertoy, M., Rosenbaum, P., & Young N. Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC). Harcourt Assessment, Inc. San Antonio, Texas, USA; 2004.
 92. Dunn M. Validation of the CHORES: A measure of school-aged children's participation in household tasks. *Scand J Occup Ther*. 2004;11:179–90.
 93. Bedell G. The Child and Adolescent Scale of Environment (CASE) Administration and Scoring Guidelines. 2011.
 94. Colver A, Dickinson H, Parkinson, K, Arnaud C, Beckung, E, Fauconnier, J, Marcelli M, McManus, V, Michelsen S, Parkes J, et al. Access of children with cerebral palsy to the physical, social and attitudinal environment they need: A cross-sectional European study. *Disabil Rehabil*. 2010;33(1):28–35.
 95. Coster W, Law M, Bedell G, Khetani M, Cousins M, Teplicky R. Development of the participation and environment measure for children and youth: Conceptual basis. *Disabil Rehabil*. 2012;
 96. McKeever P, Dunn, J, Yantzi N, Aslam, H, Doherty S, Ruddick S, Young N, Scott H. Developing an ethnography-based accessibility survey with and for disabled children. *J Ethnogr Qual Res* [Internet]. 2015;10:69–86.
 97. Khetani. M, Graham JE, Davies PL, Law MC, Simeonsson RJ, Khetani MA, et al. Psychometric properties of the young children's participation and environment measure. *Arch Phys Med Rehabil* [Internet]. 2015;96(2):307–16.

98. Kiresuk TJ, Sherman RE. Goal attainment scaling: A general method for evaluating comprehensive community mental health programs. *Community Ment Health J.* 1968;4(6):443–53.
99. Mathiowetz V, Federman S, & Wiemer D. Box and Block Test of manual dexterity: Norms for 6-19 year olds. *Can J Occup Ther.* 1985;52:241–5.
100. Bruininks R. Bruininks-Oseretsky Test of Motor Proficiency: Examiner's Manual. American Guidance Service, Circle Pines, MN. 1978.
101. Heineman KR, Bos AF, Hadders-Algra M. The infant motor profile: A standardized and qualitative method to assess motor behaviour in infancy. *Dev Med Child Neurol.* 2008;50(4):275–82.
102. DeMatteo C, Law M, Russell D, Pollock N, Rosenbaum P, P., & Walter S. QUEST Quality of Upper Extremity Skills Test Manual. CanChild Centre for Childhood Disability, Hamilton. 1992. p. 1–80.
103. Bedell G. Developing a follow-up survey focused on participation of children and youth with acquired brain injuries after inpatient rehabilitation. *NeuroRehabilitation.* 2004;19(3):191–20.
104. Bayley N. Bayley scales of infant and toddler development, third edition. 2006. *J Psychoeduc Assess.* 2007;25(2):180–98.
105. Folio MR, Fewell RR. Peabody Developmental Motor Scales Examiner's Manual, 2nd ed. Austin, TX: Pro-Ed. 2000.
106. Sgandurra G, Beani E, Inguaggiato E, Lorentzen, J, Nielsen J, Cioni G. Effects on parental stress of early home-based caretoy intervention in low-risk preterm infants. *Neural Plast.* 2019;Jan:8p.
107. Pritchard-Wiart L, Bragg E, Thompson-Hodgetts S. The Young Movers Project: A Case Series Describing Modified Toy Car Use as an Early Movement Option for Young Children With Mobility Limitations. *Phys Occup Ther Pediatr.* 2019;39(6):598–613.
108. Chamudot R, Parush S, Rigbi A, Horovitz R, Gross-Tsur V. Effectiveness of Modified Constraint-Induced Movement Therapy Compared With Bimanual Therapy Home Programs for Infants With Hemiplegia: A Randomized Controlled Trial. *Am J Occup Ther [Internet].* 2018;72(6):7206205010.
109. Anaby D, Law M, Feldman D, Majnemer A, Avery L. The effectiveness of the Pathways and Resources for Engagement and Participation (PREP) intervention: improving participation of adolescents with physical disabilities. *Dev Med Child Neurol.* 2018;60(5):513–9.
110. Plint AC, Gaboury I, Owen J, Young NL. Activities Scale for Kids: An Analysis of Normals. *J Pediatr Orthop.* 2003;23(6):788–90.
111. Huang HWHH, Chen YYM, Huang HWHH, Shih MK, Hsieh YH, Chen CL. Modified ride-on cars and young children with disabilities: Effects of combining mobility and social training. *Front Pediatr.* 2018;5(January):1–9.
112. Chen K, Hsieh C, Sheu C, Hu F, Tseng M. Reliability and validity of a Chinese version of the pediatric evaluation of disability inventory in children with cerebral palsy. *J Rehabil Med.* 2009;41(4):273–8.
113. Albrecht E, Khetani M. Environmental impact on young children's participation in home-based activities. *Dev Med Child Neurol.* 2017;59(4):388–94.

114. Coster W, Law M, Bedell G, Khetani M, Cousins M, Teplicky R, et al. Development of the participation and environment measure for children and youth: Conceptual basis. *Disabil Rehabil*. 2012;34(3):238–46.
115. Haley S, Coster W, Dumas H, Fragala-Pinkham, M.Kramer, J.Ni PT. Accuracy and precision of the Pediatric Evaluation of Disability Inventory Computer-Adaptive Tests (PEDI-CAT). *Dev Med Child Neurol* 2011;53:1100-6. *Dev Med Child Neurol*. 2011;
116. Alghamdi M, Chiarello L, Palisano R, McCoy S. Understanding participation of children with cerebral palsy in family and recreational activities. *Res Dev Disabil*. 2017;69(Oct):96–104.
117. Stephens L, Spalding K, Aslam H, Scott H, Ruddick S, Young N, et al. Inaccessible childhoods: evaluating accessibility in homes, schools and neighbourhoods with disabled children. *Child Geogr [Internet]*. 2017;15(5):583–99.
118. Johari S, Rassafiani M, Dalvand H, Kahjoogh M, Daemi M, Ahmadi Kahjoogh M, et al. Effects of maternal handling training at home, on development of fine motor skills in the children with cerebral palsy: A randomized clinical trial. *J Occup Ther Sch Early Interv [Internet]*. 2016;9(4):321–31.
119. Anaby D, Law M, Coster W, Bedell G, Khetani M, Avery L, et al. The mediating role of the environment in explaining participation of children and youth with and without disabilities across home, school, and community. *Arch Phys Med Rehabil [Internet]*. 2014;95(5):908–17.
120. Amaral M, Drummond A, Coster W, Mancini M. Household task participation of children and adolescents with cerebral palsy, Down syndrome and typical development. *Res Dev Disabil*. 2014 Feb;35(2):414–22.
121. Law M, Darrah J, Pollock N, Wilson B, Russell D, Walter S., et al. Focus on function: A cluster, randomized controlled trial comparing child- versus context-focused intervention for young children with cerebral palsy. *Dev Med Child Neurol*. 2011;53:621–9.
122. Haley S. Development, Standards and Administration Manual, Pediatric Evaluation of Disability Inventory (PEDI). PEDI Research Group, Boston, MA : New England Medical Center Hospital. Boston MA: Boston University; 1992.
123. Lin K chung, Wang T ni, Wu C yi, Chen C ling, Chang K chieh, Lin YY chan Y chan, et al. Effects of home-based constraint-induced therapy versus dose-matched control intervention on functional outcomes and caregiver well-being in children with cerebral palsy. *Res Dev Disabil [Internet]*. 2011;32(5):1483–91.
124. Maddox T. Peabody Developmental Motor Scales. In: *Encyclopedia of Special Education*. 2008.
125. Colver A. Study protocol: SPARCLE - A multi-centre European study of the relationship of environment to participation and quality of life in children with cerebral palsy. *BMC Public Health*. 2006;6(105):1–10.
126. Galvin J, Froude E, McAleer J. Children's participation in home, school and community life after acquired brain injury. *Aust Occup Ther J*. 2010;57(2):118–26.
127. Bedell G. Adolescent Scale of Participation (CASP-Youth Version) [Internet]. Center for Rehabilitation Effectiveness Sargent College of Health and

- Rehabilitation Sciences at Boston University. 2011. p. 1–5.
128. Engel-Yeger B, Jarus T, Anaby D, Law M. Differences in patterns of participation between youths with cerebral palsy and typically developing peers. *Am J Occup Ther*. 2009;63(1):96–104.
 129. King. G, King. S, Rosenbaum. P, Kertoy. M, Law. M, Hurley. P, et al. Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC). PsychCorp; San Antonio, Texas: San Antonio,; 2004.
 130. Novak I, Cusick A, Lannin N. Occupational therapy home programs for cerebral palsy: Double-blind, randomized, controlled trial. *Pediatrics*. 2009;129:e606–14.
 131. Rigby P, Ryan S, Campbell K. Effect of Adaptive Seating Devices on the Activity Performance of Children With Cerebral Palsy. *Arch Phys Med Rehabil* [Internet]. 2009;90(8):1389–95.
 132. Novak I, Cusick A, Lowe K. A pilot study on the impact of occupational therapy home programming for young children with cerebral palsy. *Am J Occup Ther*. 2007;61(4):463–8.
 133. Prellwitz M, Skär L. How children with restricted mobility perceive the accessibility and usability of their home environment. *Occup Ther Int*. 2006;13(4):193–206.
 134. Østensjø S, Carlberg E, Vøllestad N. The use and impact of assistive devices and other environmental modifications on everyday activities and care in young children with cerebral palsy. *Disabil Rehabil*. 2005;27(14):849–61.
 135. Australian Commission on Safety and Quality in Health Care. Clinical governance for allied health practitioners. Australian Commission on Safety and Quality in Health Care. 2020. p. 1–3.
 136. Hoffmann, T., Bennett, S., & Del Mar C. Evidence-Based Practice Across the Health Professions-E-pub. 3rd ed. Elsevier Health Sciences - E-pub. 2017. 1–428 p.
 137. Chien. C, Rodger S, Copley J, McLaren C. Measures of participation outcomes related to hand use for 2- to 12-year-old children with disabilities: A systematic review. *Child Care Health Dev*. 2014;40(4):458–71.
 138. Cusick A, McIntyre S, Novak I, Lannin N, Lowe K. A comparison of goal attainment scaling and the Canadian occupational performance measure for paediatric rehabilitation research. *Pediatr Rehabil*. 2006;9(2):149–57.
 139. Dematteo C, Law M, Russell D, Pollock N, Rosenbaum P, Walter S. The Reliability and Validity of the Quality of Upper Extremity Skills Test. *Phys Occup Ther Pediatr* [Internet]. 1993 Jan 1;13(2):1–18.
 140. Thorley M, Lannin N, Cusick A, Novak I, Boyd R. Construct validity of the Quality of Upper Extremity Skills Test for children with cerebral palsy. *Dev Med Child Neurol*. 2012;54(11):1037–45.
 141. Liang K, Chen H, Shieh J, Wang T. Measurement properties of the box and block test in children with unilateral cerebral palsy. *Sci Rep*. 2021;11(1):20955.
 142. Bedell G. Child & Family Follow-up Survey (CFFS) [Internet]. Vol. 19, NeuroRehabilitation. 2004.
 143. Young N, Williams J, Yoshida K, Bombardier C, Wright J. The context of

- measuring disability: Does it matter whether capability or performance is measured? *J Clin Epidemiol*. 1996;49(10):1097–101.
144. Selves C. Reliability and Concurrent Validity of the Bruininks-Oseretsky Test in Children with Cerebral Palsy. *Biomed J Sci Tech Res*. 2019;18(5):13961–7.
 145. Rosenbaum P SD. The World Health Organization International Classification of Functioning, Disability, and Health: a model to guide clinical thinking, practice and research in the field of cerebral palsy. *Semin Pediatr Neurol*. 2004;11(1):5–10.
 146. Jongbloed-Pereboom M, Nijhuis-Van Der Sanden M, Steenbergen B. Norm scores of the box and block test for children ages 3-10 years. *Am J Occup Ther*. 2013;67(3):312–8.
 147. McColl M, Law, M. Baptiste S, Pollock, N. Carswell A, Polatajko H. Targeted applications of the Canadian Occupational Performance Measure. *Can J Occup Ther*. 2005;72(5):298–300.
 148. Maritz R, Baptiste S, Darzins SW, Magasi S, Weleschuk C, Prodinger B. Linking occupational therapy models and assessments to the ICF to enable standardized documentation of functioning. *Can J Occup Ther*. 2018;85(4):330–41.
 149. Law M, Teplicky R, King S, King G, Kertoy M, Moning T, et al. Family-centered service: Moving ideas into practice. *Child Care Health Dev*. 2005;31(6):633–42.
 150. Bagley A, Gorton G, Bjornson K, Bevans K, Stout J, Narayanan U, et al. Factor- and item-level analyses of the 38-item Activities Scale for Kids-performance. *Dev Med Child Neurol*. 2011;53(2):161–6.
 151. Wilson B, Kaplan, B. Crawford S, Dewey D, Dadkhah A, Aksay E, Bruininks R, et al. Bruininks-Oseretsky Test of Motor proficiency, second edition. Sports biomechanics / International Society of Biomechanics in Sports. 2013.
 152. Hilton C, Goloff S, Altaras O, Josman N. Review of instrument development and testing studies for children and youth [Internet]. Vol. 67, *American Journal of Occupational Therapy*. 2013. p. e30–54.
 153. Krumlinde-Sundholm L. Reporting outcomes of the Assisting Hand Assessment: What scale should be used? Vol. 54, *Developmental Medicine and Child Neurology*. 2012. p. 807–8.
 154. Ryll U, Bastiaenen C, Eliasson A-C. Assisting Hand Assessment and Children's Hand-Use Experience Questionnaire –Observed Versus Perceived Bimanual Performance in Children with Unilateral Cerebral Palsy. *Phys Occup Ther Pediatr*. 2017;37(2):199–209.
 155. Deitz J, Kartin D, Kopp K. Review of the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). *Phys Occup Ther Pediatr*. 2007;27(4):87–102.
 156. Law M, Baptiste S, Carswell A, Mccoll M, Polatajko H, Pollock N. Canadian occupational performance measure. 2005.
 157. Carswell, A. McColl M, Baptiste S, Law, M. Polatajko H, Pollock N. The Canadian Occupational Performance Measure: a research and clinical literature review. *Can J Occup Ther*. 2004;71(4):210–22.
 158. Young N, Yoshida K, Williams J, Bombardier C, Wright J. The role of children in reporting their physical disability. *Arch Phys Med Rehabil*. 1995;76(10):913–8.
-

159. Krumlinde-Sundholm L, Holmefur M, Kottorp A, Eliasson AC. The Assisting Hand Assessment: Current evidence of validity, reliability, and responsiveness to change. *Dev Med Child Neurol*. 2007;49(4):259–64.
160. Law M. Canadian Occupational Performance Measure (COPM) [Internet]. Cerebral Palsy Alliance. 2016.
161. Young N, Varni J, Snider L, McCormick A, Sawatzky B, Scott M, et al. The Internet is valid and reliable for child-report: An example using the Activities Scale for Kids (ASK) and the Pediatric Quality of Life Inventory (PedsQL). *J Clin Epidemiol* [Internet]. 2009;62(3):314–20.
162. Greaves S, Imms C, Krumlinde-Sundholm L, Dodd K, Eliasson A. Bimanual behaviours in children aged 8-18 months: A literature review to select toys that elicit the use of two hands. *Res Dev Disabil*. 2012;33(1):240–50.
163. Araneda R, Ebner-Karestinos D, Paradis J, Saussez G, Friel K, Gordon A, et al. Reliability and responsiveness of the Jebsen-Taylor Test of Hand Function and the Box and Block Test for children with cerebral palsy. *Dev Med Child Neurol*. 2019;61(10):1182–8.
164. Bruininks, R. Bruininks B. Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) [Internet]. Pearson Clinical. 2021.
165. Costi S, Mecugni, D. Beccani L, Alboresi, S. Bressi, B. Paltrinieri S, Ferrari, A. Pelosin E. Construct Validity of the Activities Scale for Kids Performance in Children with Cerebral Palsy: Brief Report. *Dev Neurorehabil*. 2020;23(7):474–7.
166. Kontson K, Marcus I, Myklebust B, Civillico E. Targeted box and blocks test: Normative data and comparison to standard tests. *PLoS One*. 2017;12(5):1–15.
167. Cusick A, Lannin NA, Lowe K. Adapting the Canadian Occupational Performance Measure for use in a paediatric clinical trial. *Disabil Rehabil*. 2007;29(10):761–6.
168. PEARSON. Telepractice and the BOT-2 [Internet]. 2021. p. 1–15.
169. Toomey M, Nicholson D, Carswell A. The Clinical Utility of the Canadian Occupational Performance Measure. *Can J Occup Ther*. 1995;62(5):242–9.
170. Tanner L, Grinde K, McCormick C. The Canadian Occupational Performance Measure: A Feasible Multidisciplinary Outcome Measure for Pediatric Telerehabilitation. *Int J Telerehabilitation*. 2021;13(1):1–10.
171. Koolen E, Spruit M, de Man, M. Antons J, Nijhuis, E. Nakken, N. Janssen D, van 't Hul A. Effectiveness of Home-Based Occupational Therapy on COPM Performance and Satisfaction Scores in Patients with COPD. *Can J Occup Ther*. 2021;88(1):26–37.
172. Baptise S. Canadian Occupational Performance Measure. *Acedemia*. 2008. p. 1–3.
173. Verkerk G, Van Der Molen-Meulmeester L, Alsem M. How children and their parents value using the Canadian Occupational Performance Measure (COPM) with children themselves. *J Pediatr Rehabil Med*. 2021;14(1):7–17.
174. Bruininks R BB. Bruininks-Oseretsky Test of Motor Proficiency–2nd Edition (BOT-2): Manual. Circle Pines: MN: AGS Publishing,. 2005.
175. Law M, Polatajko H, Pollock N, McColl MA, Carswell A, Baptiste S. Pilot testing of the Canadian Occupational Performance Measure: clinical and measurement

- issues. *Can J Occup Ther Rev Can d'ergothérapie*. 1994;61(4):191–7.
176. Bedell G, Bedell GM, Bedell G. Developing a follow-up survey focused on participation of children and youth with acquired brain injuries after inpatient rehabilitation. *NeuroRehabilitation*. 2004;19(3):191–20.
177. Greaves S, Imms C, Dodd K, Krumlinde-Sundholm L. Assessing bimanual performance in young children with hemiplegic cerebral palsy: a systematic review. *Dev Med Child Neurol*. 2010;52(5):413–21.
178. Tuersley L, Bray N, Tudor Edwards R. Development of the wheelchair outcomes assessment tool for children (watch): A patient-centred outcome measure for young wheelchair users. *PLoS One*. 2018;13(12):1–16.
179. Okuda PMM, Pangelinan M, Capellini SA, Cogo-Moreira H. Motor skills assessments: Support for a general motor factor for the movement assessment battery for children-2 and the Bruininks-Oseretsky test of motor proficiency-2. *Trends Psychiatry Psychother* [Internet]. 2019;41(1):51–9.
180. Brown T. Structural Validity of the Bruininks-Oseretsky Test of Motor Proficiency–Second Edition (BOT-2) Subscales and Composite Scales. *J Occup Ther Sch Early Interv* [Internet]. 2019;12(3):323–53.
181. Doric J., Cornwall R. A psychometric comparison of patient-reported outcome measures used in pediatric hand therapy. *J hand Ther*. 2021;477–83.
182. Ek L, Eliasson A, Sicola E, Sjöstrand L, Guzzetta A, Sgandurra G, et al. Hand Assessment for Infants: Normative Reference Values. *Dev Med Child Neurol*. 2019;61(9):1087–92.
183. McIntyre F, Parker H, Thornton A, Licari M, Piek J, Rigoli D, et al. Assessing motor proficiency in young adults: The Bruininks Oseretsky Test-2 Short Form and the McCarron Assessment of Neuromuscular Development - ScienceDirect. *Hum Mov Sci* [Internet]. 2017 Jun 1 [cited 2021 Jul 29];53:55–62.
184. Holmefur M, Krumlinde-Sundholm L, Eliasson AC. Interrater and intrarater reliability of the assisting hand assessment. *Am J Occup Ther*. 2007;61(1):79–8.
185. Holmefur M, Krumlinde-Sundholm L. Psychometric properties of a revised version of the Assisting Hand Assessment (Kids-AHA 5.0). *Dev Med Child Neurol*. 2015;58(6):618–24.
186. McDougall J, Bedell G, Wright V. The youth report version of the Child and Adolescent Scale of Participation (CASP): Assessment of psychometric properties and comparison with parent report. *Child Care Health Dev*. 2013;39(4):512–22.
187. Brown T. Structural validity of the Bruininks-Oseretsky test of motor proficiency – Second edition brief form (BOT-2-BF). *Res Dev Disabil* [Internet]. 2019 Feb 1 [cited 2021 Jul 29];85(February):92–103.
188. Jírovec J, Musálek M, Mess F. Test of motor proficiency second edition (BOT-2): Compatibility of the complete and short form and its usefulness for middle-age school children. *Front Pediatr*. 2019;7(APR):1–7.
189. Venetsanou F, Kambas A. Motor Proficiency in Young Children: A Closer Look at Potential Gender Differences. *SAGE Open*. 2016;6(1):1–10.
190. Field D, Miller W, Ryan S, Jarus T, Abundo A. Measuring Participation for Children and Youth With Power Mobility Needs: A Systematic Review of Potential Health Measurement Tools. *Arch Phys Med Rehabil* [Internet].

- 2016;97(3):462-477.e40.
191. Kaiser ML, Braun M RC. Utilization of the Canadian Occupational Performance Measure (COPM) among children and their parents: a Swiss experience. 2005 Feb;72(1):30-. Can J Occup Ther. 2005;72(1):30–6.
 192. McColl MA, Paterson M, Davies D, Doubt L, Law M, Paterson M, et al. Validity and Community Utility of the Canadian Occupational Performance Measure. Can J Occup Ther [Internet]. 2000;67(1):22–9.
 193. Bedell G, Khetani M, Cousins M, Coster W, Law M. Parent perspectives to inform development of measures of children's participation and environment. Arch Phys Med Rehabil. 2011;92(May):765–73.
 194. Sakzewski L, Boyd R, Ziviani J. Clinimetric properties of participation measures for 5- to 13-year-old children with cerebral palsy: A systematic review. Dev Med Child Neurol. 2007;49(3):232–40.
 195. Kang L-J, Hwang A-W, Chen C-H. Participation and Environmental Factors for Children with Physical Disabilities in Taiwan. In: Physical Disabilities - Therapeutic implications [Internet]. 2017. p. 2–15.
 196. Eliasson AC, Krumlinde-Sundholm L, Shaw K, Wang C. Effects of constraint-induced movement therapy in young children with hemiplegic cerebral palsy: An adapted model. Dev Med Child Neurol. 2005;47(4):266–75.
 197. Di Rezze B, Wright V, Curran C, Campbell K, MacArthur C. Individualized outcome measures for evaluating life skill groups for children with disabilities. Can J Occup Ther. 2008;75(5):282–7.
 198. Brown T, Chien CW. Occupation-Centred Assessment With Children. In: Rodger S, editor. Occupation-Centred Practice with Children: A Practical Guide for Occupational Therapists. Chichester, West Sussex, United Kingdom: Wiley-Blackwell; 2010. p. 135–56.
 199. Angsupaisal M, Maathuis C, Hadders-Algra M. Adaptive seating systems in children with severe cerebral palsy across International Classification of Functioning, Disability and Health for Children and Youth version domains: A systematic review. Dev Med Child Neurol. 2015;57(10):919–31.
 200. Adair B, Ullenhag A, Keen D, Granlund M, Imms C. The effect of interventions aimed at improving participation outcomes for children with disabilities: A systematic review. Dev Med Child Neurol. 2015;57(12):1093–104.
 201. Bedell G, McDougall J. The Child and Adolescent Scale of Environment (CASE): Further validation with youth who have chronic conditions. Dev Neurorehabil. 2015;18(6):375–82.
 202. Forsyth R, Colver A, Alvanides S, Woolley M, Lowe M. Participation of young severely disabled children is influenced by their intrinsic impairments and environment. Dev Med Child Neurol. 2007;49:345–9.
 203. Quinlivan S. The United Nations Convention on the Rights of Persons with Disabilities: An introduction [Internet]. ERA Forum. 2012.
 204. Mihaylov S, Jarvis S, Colver A, Beresford B. Identification and description of environmental factors that influence participation of children with cerebral palsy. Dev Med Child Neurol. 2004;46(5):299–304.
 205. Turner-Stokes L, Williams H, Johnson J. Goal attainment scaling: Does it provide added value as a person-centred measure for evaluation of outcome in
-

- neurorehabilitation following acquired brain injury? *J Rehabil Med*. 2009;41(7):528–35.
206. King. G, King. S, Rosenbaum. P, Kertoy. M, Law. M, Hurley. P. *Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC)*. San Antonio, TX: PsychCorp; 2004.
 207. King, G., Law, M., King, S., Hurley, P., Hanna, S., Kertoy, M., Rosenbaum, P., & Young N, King. G, King. S, Rosenbaum. P, Kertoy. M, Law. M, et al. *Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC)*. Harcourt Assessment, Inc. San Antonio, TX: PsychCorp; 2004.
 208. Chiarello L, Palisano R, Mccoy S, Bartlett D. *Child Engagement in Daily Life Measure I nstructions for Parents : Part One : Participation in Family and Recreational Activities*. *Can Child*. 2017;2(March):1–7.
 209. Dunn. L, Magalhaes L, Mancini M. Internal structure of the Children Helping Out: Responsibilities, Expectations, and Supports (CHORES) Measure. *Am J Occup Ther*. 2014;68(3):286–95.
 210. Steenbeek D, Ketelaar M, Galama K, Gorter J. Goal attainment scaling in paediatric rehabilitation: A critical review of the literature. Vol. 49, *Developmental Medicine and Child Neurology*. 2007. p. 550–6.
 211. Klaas SJ, Kelly EH, Gorzkowski J, Homko E, Vogel LC. Assessing patterns of participation and enjoyment in children with spinal cord injury. *Dev Med Child Neurol*. 2010;52(5):468–74.
 212. King GA, King S, Rosenbaum P, Kertoy M, Law M HP. *Children's Assessment of Participation and Enjoyment (CAPE) and Preferences for Activities of Children (PAC)*. San Antonio, TX: Harcourt Assessment, Inc. PsychCorp; San Antonio, Texas: San Antonio,; 2004.
 213. Coster W, Bedell G, Law M, Khetani, M. Teplicky, R. Liljenquist K, Gleason, K. Kao Y. Psychometric evaluation of the Participation and Environment Measure for Children and Youth. *Dev Med Child Neurol*. 2011;53(11):1030–7.
 214. Palisano R, Chiarello L, McCoy S, Bartlett D, An M. Use of the Child Engagement in Daily Life and Ease of Caregiving for Children to Evaluate Change in Young Children with Cerebral Palsy. *Phys Occup Ther Pediatr*. 2015;5(3):280–95.
 215. Colver A. Study protocol: SPARCLE - A multi-centre European study of the relationship of environment to participation and quality of life in children with cerebral palsy. *BMC Public Health*. 2006;6:1–10.
 216. Allonsius F, de Kloet A, Bedell G, van Markus-Doornbosch F, Rosema S, Meesters J, et al. Participation restrictions among children and young adults with acquired brain injury in a pediatric outpatient rehabilitation cohort: The patients' and parents' perspective. *Int J Environ Res Public Health*. 2021;18(4):1–22.
 217. Colver A, Thyen U, Arnaud C, Beckung E. Association between participation in life situations of children with cerebral palsy and their physical, social, and attitudinal environment: A cross-sectional multicenter European study. *Arch Phys Med Rehabil*. 2012;93(12):2154–64.
 218. Chiarello L, Palisano R, McCoy S, Bartlett D, Wood A, Chang HJ, et al. *Child engagement in daily life: A measure of participation for young children with*

- cerebral palsy. *Disabil Rehabil*. 2014;36(21):1804–16.
219. McDougall J, King G. *Goal Attainment Scaling: Description, Utility, and Applications in Pediatric Therapy Services* (2nd edition). 2007;1–36.
 220. Steenbeek D, Ketelaar M, Lindeman E, Galama K, Gorter J. Interrater Reliability of Goal Attainment Scaling in Rehabilitation of Children With Cerebral Palsy. *Arch Phys Med Rehabil*. 2010;91(3):429–35.
 221. Law M, King G, King S, Kertoy M, Hurley P, Rosenbaum P, et al. Patterns of participation in recreational and leisure activities among children with complex physical disabilities. *Dev Med Child Neurol*. 2006;
 222. Klaas S, Kelly E, Gorzkowski J, Homko E, Vogel L. Assessing patterns of participation and enjoyment in children with spinal cord injury. *Dev Med Child Neurol*. 2010;52(5):468–74.
 223. Dunn L, Gardner J. Household task participation of children with and without physical disability. *Am J Occup Ther [Internet]*. 2013;67(5):e100–5.
 224. Salavati M, Vameghi R, Hosseini S, Saeedi A, Gharib M. Reliability and validity of the european child environment questionnaire (ECEQ) in children and adolescents with cerebral palsy: Persian version. *Children*. 2018;5(48):1–10.
 225. Orlin MN, Palisano RJ, Chiarello LA, Kang LJ, Polansky M, Almasri J, et al. Participation in home, extracurricular, and community activities among children and young people with cerebral palsy. *Dev Med Child Neurol*. 2010;52(2):160–6.
 226. Lisa A. Chiarello, Robert J. Palisano, Sally Westcott McCoy, and Doreen J. Bartlett C. *Child Engagement in Daily Life Measure (Version 2) [Internet]*. Patient-Centered Outcomes Research Institute. 2017. p. 1–10.
 227. Phillips R, Olds T, Boshoff K, Lane A. Measuring activity and participation in children and adolescents with disabilities: A literature review of available instruments. *Aust Occup Ther J*. 2013;60(4):288–300.
 228. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: A practical guide. *Clin Rehabil*. 2009;23(4):362–70.
 229. Mobbs C, Spittle A, Johnston L. Participation Measures for Infants and Toddlers Aged Birth to 23 Months: A Systematic Review. *Phys Occup Ther Pediatr [Internet]*. 2021 Mar 26;41(6):567–89.
 230. Turner-Stokes L. GAS - Goal Attainment Scaling in Rehabilitation. A practical guide [Internet]. Vol. 44, Kings College London. University of London, UK; 2015. p. 1–14.
 231. Hanna S, Hurley P, Kertoy M, King G, King S, Law M, et al. *Children's Assessment of Participation and Enjoyment and Preferences for Activities of Children; CAPE/PAC*. Pearson Clinical.
 232. Gaffney E, Gaffney K, Bartleson L, Dodds C. Goal Attainment Scaling Made Easy with an App: GOALed. *Pediatr Phys Ther*. 2019;31(2):225–30.
 233. Fogleman S. *Child Engagement in Daily Life Measure for children with CP. Tests & Measures : A Resource for Pediatric Physical Therapy Practitioners*. 2015. p. 1.
 234. Arnaud C, Duffaut C, Fauconnier J, Schmidt S, Himmelmann K, Marcelli M, et al. Determinants of participation and quality of life of young adults with cerebral palsy: longitudinal approach and comparison with the general population -

- SPARCLE 3 study protocol. *BMC Neurol*. 2021;21(254):1–10.
235. Pearson Assessment CAPE. Children’s Assessment of Participation and Enjoyment and Preferences for Activities of Children (CAPE/PAC) [Internet]. Pearson Clinical. 2021.
236. Dunn L, Coster WJ, Orsmond GI, Cohn ES. Household task participation of children with and without attentional problems. *Phys Occup Ther Pediatr*. 2009;29(3):258–73.
237. Whiteneck G, Harrison-Felix C. Quantifying Environmental Factors: A Measure of Physical, Attitudinal, Service, Productivity, and Policy Barriers. *Arch Phys Med Rehabil*. 2004;85:1324–35.
238. Bull K, Hornsey S, Kennedy C, Darlington A, Grootenhuis M, Hargrave D, et al. Systematic review : measurement properties of patient- reported outcome measures evaluated with childhood brain tumor survivors or other acquired brain injury. *Neuro-Oncology Pract*. 2020;102(3):277–87.
239. Colver A, Thyen U, Arnaud C, Beckung E, Fauconnier J, Marcelli M, et al. Association between participation in life situations of children with cerebral palsy and their physical, social, and attitudinal environment: A cross-sectional multicenter European study. *Arch Phys Med Rehabil* [Internet]. 2012;93(12):2154–64.
240. Krasny-Pacini A, Evans J, Sohlberg M, Chevignard M. Proposed criteria for appraising goal attainment scales used as outcome measures in rehabilitation research. *Arch Phys Med Rehabil*. 2016;97(1):157–70.
241. Imms C, Froude E, Adair B, Shields N. A descriptive study of the participation of children and adolescents in activities outside school. *BMC Pediatr*. 2016;16(84):1–11.
242. Dickinson H, Colver A. Quantifying the physical, social and attitudinal environment of children with cerebral palsy. *Disabil Rehabil*. 2011;33(2):36–50.
243. Espín-Tello S, Colver A. How available to European children and young people with cerebral palsy are features of their environment that they need? *Res Dev Disabil*. 2017;71(Dec):1–10.
244. Potvin MC, Snider L, Prelock P, Kehayia E, Wood-Dauphinee S. Children’s assessment of participation and enjoyment/preference for activities of children: Psychometric properties in a population with high-functioning autism. *Am J Occup Ther*. 2013;67(2):209–17.
245. Imms C. Review of the children’s assessment of participation and enjoyment and the preferences for activity of children. *Phys Occup Ther Pediatr*. 2008;28(4):389–404.
246. Çankaya Ö, & MKG, Özdemir P. Construct-concurrent validity and reliability of the European Child Environment Questionnaire (ECEQ) in a sample of Turkish children with cerebral palsy. *Disabil Rehabil* [Internet]. 2020;29(Sept):1–9.
247. Golos A, Bedell G. Responsiveness and discriminant validity of the Child and Adolescent Scale of Participation across three years for children and youth with traumatic brain injury. *Dev Neurorehabil*. 2018;21(7):431–8.
248. Golos A, Bedell G. Psychometric properties of the Child and Adolescent Scale of Participation (CASP) across a 3-year period for children and youth with traumatic brain injury. *NeuroRehabilitation*. 2016;6(38):311–9.

249. Steenbeek D, Gorter JW, Ketelaar M, Galama K, Lindeman E. Responsiveness of Goal Attainment Scaling in comparison to two standardized measures in outcome evaluation of children with cerebral palsy. *Clin Rehabil*. 2011;25(12):1128–39.
250. Angsupaisal M, Maathuis CGBB, Hadders-Algra M. Adaptive seating systems in children with severe cerebral palsy across International Classification of Functioning, Disability and Health for Children and Youth version domains: A systematic review. *Dev Med Child Neurol*. 2015;57(10):919–31.
251. Hwang A, Chao M, Liu S. A randomized controlled trial of routines-based early intervention for children with or at risk for developmental delay. *Res Dev Disabil*. 2013;34(10):3112–23.
252. Haga N, van der Heijden-Maessen H, van Hoorn J, Boonstra A, Hadders-Algra M. Test-Retest and Inter- and Intrareliability of the Quality of the Upper-Extremity Skills Test in Preschool-Age Children With Cerebral Palsy. *Arch Phys Med Rehabil*. 2007;88(12):1686–9.
253. Fragala-Pinkham M, Shore B, Kramer J. Introduction to the Pediatric Evaluation of Disability Inventory Computerized Adaptive Test (PEDI-CAT) for Children with Cerebral Palsy. In: AACPDM 69th Annual Meeting, October 21-24 [Internet]. 2015. p. 1–81.
254. Williams, U. Law, M. Hanna, S. Gorter J. Using the Young Children's Participation and Environment Measure (YC-PEM) to Describe Young Children's Participation and Relationship to Disability and Complexity. *J Dev Phys Disabil*. 2019;31:135–48.
255. Salgado Z, Villegas V, Khetani M. YC-PEM 101 -Tips for navigating the Young Children's Participation and Environment Measure (YC-PEM). Vol. 1, CanChild. 2021. p. 1–2.
256. Hadders-Algra M, Heineman K. The Infant Motor Profile. Routledge Taylor and Francis Group London and New York. United Kingdom; 2021. 174 p.
257. Glovasky S. Peabody Developmental Motor Scale - Second Edition (PMDS-2) [Internet]. Therapro. 2022. p. 1–2.
258. Law M, Anaby D, Teplicky R, Khetani, M. Coster W, Bedell G. Participation in the home environment among children and youth with and without disabilities. *Br J Occup Ther*. 2013;76(2):1–9.
259. Bakaniene I, Prasauskiene A. Patterns and predictors of participation in children and adolescents with spina bifida. *Disabil Rehabil*. 2019;42(26):3771–9.
260. Baque E, Barber L, Sakzewski L, Boyd RN. Randomized controlled trial of web-based multimodal therapy for children with acquired brain injury to improve gross motor capacity and performance. *Clin Rehabil*. 2017;31(6):722–32.
261. Wang HH, Liao HF, Hsieh CL. Reliability, sensitivity to change, and responsiveness of the Peabody Developmental Motor Scales-Second Edition for children with cerebral palsy. *Phys Ther* [Internet]. 2006 [cited 2022 Jan 19];86(10):1351–9.
262. Tavasoli, A. Azimi, P. Montazari A. Reliability and validity of the Peabody Developmental Motor Scales-second edition for assessing motor development of low birth weight preterm infants. *Pediatr Neurol*. 2014;51(4):522–6.
263. Sakzewski L, Ziviani J, Boyd R. Systematic review and meta-analysis of

- therapeutic management of upper-limb dysfunction in children with congenital hemiplegia. *Pediatrics*. 2009;123(6):e1111–22.
264. Folio, M. Fewell R. Peabody Developmental Motor Scale - PDMS-2 Guide to Item Administration [Internet]. Pro-Ed. 2022. 1–2 p.
 265. Haley S, Coster W, Dumas H, Frangala-Pinkham M, Moed R. Development, Standardization and Administration Manual. Vol. October, Pediatric Evaluation of Disability Inventory Computer Adaptive Test. Boston, U: Boston University, School of Public Health; 2012. p. 1–37.
 266. Tveten KM, Hadders-Algra M, Strand LI, Van Iersel PAM, Rieber J, Dragesund T. Intra- and Inter-Rater Reliability of the Infant Motor Profile in Infants in Primary Health Care. *Phys Occup Ther Pediatr* [Internet]. 2020;40(5):571–81.
 267. Khetani. M, Marley J, Baker M, Albrecht E, Bedell G, Coster W, et al. Validity of the Participation and Environment Measure for Children and Youth (PEM-CY) for Health Impact Assessment (HIA) in sustainable development projects. *Disabil Health J*. 2014;7(2):226–35.
 268. CanChild. Participation and Environment Measure for Children and Youth (PEM-CY). 2021. p. 1–4.
 269. Kaelin V, Albrecht E, Rigau B, Dooling-Litfin J, Scully E, Murphy N, et al. Pilot Implementation of an Electronic Participation and Environment Measure for Family-Centered and Participation-Focused Early Intervention. *Am J Occup Ther*. 2020;74(4_Supplement_1):7411520510.
 270. Dumas H, Frangala-Pinkham M, Haley S, Ni P, Coster W, Kramer J, et al. Computer adaptive test performance in children with and without disabilities: Prospective field study of the PEDI-CAT. *Disabil Rehabil* [Internet]. 2012;34(5):392–401. f
 271. Hadders-Algra M, Heineman K. The Infant Motor Profile. Routledge Taylor and Francis Group Lond and New York. United Kingdom; 2021. 174 p.
 272. Coster, W. Law, M. Bedell, G. Khetani, M. Anaby, D. Teplicky, R, Lin C-Y. The Participation and Environment Measure for Children and Youth (PEM-CY): An innovative measure for home, school and community [Internet]. CanChild. 2013.
 273. Pan CY. Motor proficiency and physical fitness in adolescent males with and without autism spectrum disorders. *Austism*. 2014;18(2):156–65.
 274. Griffiths. A, Toovey. R, Morgan. P, Spittle. A, Griffiths A, Toovey R, et al. Psychometric properties of gross motor assessment tools for children: A systematic review. *BMJ Open*. 2018;8(10):1–14.
 275. Dumas H, Frangala-Pinkham M, Haley S, Coster W, Kramer J, Kao Y, et al. Item bank development for a revised pediatric evaluation of disability inventory (PEDI). *Phys Occup Ther Pediatr*. 2010;30(3):168–84.
 276. Dumas H, Fragal-Pinkham M. Item Bank Development for a Revised Pediatric Evaluation of Disability Inventory (PEDI). *Pediatr, Phys Occup Ther*. 2013;23(1):1–7.
 277. Chien C-W. Using the Rasch model to validate the Peabody Developmental Motor Scales– second edition in infants and pre-school children. [Internet]. James Cook University; 2007.
 278. Khetani M. Reliability of the Young Children’s Participation and Environment Measure (YC-PEM) for Pediatric Research and Practice. *Arch Phys Med Rehabil*

- [Internet]. 2014;95(10):e91.
279. Shore BJ, Allar BG, Miller PE, Matheney TH, Snyder BD, Fragala-Pinkham M. Measuring the Reliability and Construct Validity of the Pediatric Evaluation of Disability Inventory–Computer Adaptive Test (PEDI-CAT) in Children With Cerebral Palsy. *Arch Phys Med Rehabil*. 2019;100(1):45–51.
 280. Dumas HM, Fragala-Pinkham MA. Concurrent validity and reliability of the pediatric evaluation of disability inventory-computer adaptive test mobility domain. *Pediatr Phys Ther*. 2012;24(2):171–6.
 281. Sgandurra G, Lorentzen J, Inguaggiato E, Bartalena L, Beani E, Cecchi F, et al. A randomized clinical trial in preterm infants on the effects of a home-based early intervention with the “CareToy System.” *PLoS One*. 2017;12(3):1–13.
 282. Fragala-Pinkham MA, Dumas HM, Lombard KA, O’Brien JE. Responsiveness of the Pediatric Evaluation of Disability Inventory-Computer Adaptive Test in measuring functional outcomes for inpatient pediatric rehabilitation. *J Pediatr Rehabil Med*. 2016;9(3):215–22.
 283. Law M, Cadman D, Rosenbaum P, Walter S, Russell D DC. Neurodevelopmental therapy and upper-extremity inhibitive casting for children with cerebral palsy. *Dev Med Child Neurol*. 1991;33(5):379–87.
 284. James S, Ziviani J. Delivering online home-based rehabilitation: Insights from children with cerebral palsy and their caregivers. *Dev Med Child Neurol* [Internet]. 2014;56:15–6.
 285. Thorley M, Lannin N, Cusick A, Novak I, Boyd R, Thorley M, Lannin N, Cusick A, Novak I BR. Reliability of the quality of upper extremity skills test for children with cerebral palsy aged 2 to 12 years. *Phys Occup Ther Pediatr* [Internet]. 2012 Jan 12;32(1):4–21.
 286. Di Marino E, Tremblay S, Khetani M, Anaby D. The effect of child, family and environmental factors on the participation of young children with disabilities. *Disabil Health J*. 2018 Jan 1;11(1):36–42.
 287. James S, Ziviani J, Boyd R. A systematic review of activities of daily living measures for children and adolescents with cerebral palsy. *Dev Med Child Neurol*. 2014;56(3):233–44.
 288. Bennett S, Allen S, Caldwell E, Whitehead M, Turpin M, Fleming J, et al. Organisational support for evidence-based practice: Occupational therapists perceptions. *Aust Occup Ther J*. 2016;63(1):9–18.
 289. Duncan E, Murray J. The barriers and facilitators to routine outcome measurement by allied health professionals in practice: A systematic review. Vol. 12, *BMC Health Services Research*. 2012. p. 1–9.
 290. Taylor S, Fowler B, Watters S, Edwards S, Pickering Y, Sidhu R, et al. Promoting the Use of Quality Assessments in a Paediatric Occupational Therapy Department : A Quality Improvement Initiative. *New Zeal J Occup Ther*. 2020;67(1):31–7.

Appendices

- Appendix 1. Expression of Interest
- Appendix 2. List of Excluded Measures
- Appendix 3. Legend for Quality Appraisal - Categories and Grades
- Appendix 4. Quality Appraisal of Single Studies
- Appendix 5. Quality Appraisal of Systematic Review
- Appendix 6. Other Sources