QUEST
2016, VOL. 68, NO. 4, 521–535
http://dx.doi.org/10.1080/00336297.2016.1145128

Routledge
Taylor & Francis Group

Aligning Physical Activity Measures With the International Classification of Functioning, Disability and Health Framework for Childhood Disability

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ABSTRACT

The introduction of the International Classification of Functioning, Disability and Health has placed emphasis on framing health behavior as a multidimensional construct. In relation to childhood physical activity, this encompasses dimensions of functional performance, activity attendance, and subjective perceptions of involvement and enjoyment within activity settings. Current literature, however, primarily investigates physical activity in terms of performance and activity levels. The resulting misalignment of theory and measurement practice challenges the development of a comprehensive understanding of childhood physical activity behavior. For children with disabilities, who may have nuanced experiences in activity, there may be greater necessity to examine additional dimensions of physical activity (e.g., participation). In an effort to support meaningful interpretations of physical activity behavior measures among children with disabilities, the purposes of this article are to (a) conceptualize childhood physical activity within the International Classification of Functioning, Disability and Health, and (b) provide guidance on aligning measurement tools with physical activity dimensions.

KEYWORDS

Adolescent; assessment; health behavior; International Classification of Functioning, Disability and Health; participation; pediatrics; physical activity; recreation; youth; leisure and recreation

Introduction

Physical activity (PA) is recognized as a critical aspect of childhood for promoting health and development. For children with disabilities, engagement in regular PA has been shown to reduce risk for the development of secondary conditions (Fowler et al., 2007; Johnson, 2009), and positively impact the development of self-efficacy, social identity and peer relationships (Taub & Greer, 2000). Alongside national initiatives to increase childhood PA levels (U.S. Department of Health and Human Services, 2008), parents (e.g., Chiarello et al., 2010; Maggs et al., 2011), and professionals (e.g., Buffart, Westendorp, Van Den Berg-Emons, Stam, & Roebroeck, 2009; Rimmer & Rowland, 2008) are increasingly advocating for targeted promotion of PA among children with disabilities.

PA is understood to be a complex and evolving phenomenon that includes aspects of attendance, physical execution of motor and fitness tasks, and subjective perceptions of being engaged and involved during those tasks or within activity settings (Arim, Findlay, & Kohen,

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2012; Granlund, 2013; Rainey, Van Nispen, Van Der Zee, & Van Rens, 2014). Despite the acknowledged multidimensionality of this construct, PA is predominately defined and measured within literature along a single performance based dimension. The corresponding and widely adopted biomedical perspective defines PA as "bodily movements resulting in energy expenditure" (Caspersen, Powell, & Christenson, 1985, p. 126). From this perspective, PA is described in terms of frequency and diversity of attendance in various activity settings (e.g., formal, informal, recreational, school-based, solitary, etc.) and intensity of performance as it relates to energy expenditure (e.g., time spent in sedentary, light, moderate, or vigorous activity) (e.g., Hinckson & Curtis, 2013). To date, this approach has greatly supported health promotion and disease prevention initiatives by highlighting health outcomes and risk factors associated with childhood PA behaviors (e.g., Fowler et al., 2007; Johnson, 2009). However, the current focus on movement outcomes may not directly align with the conceptualization of PA as a dynamic construct. Furthermore, it may not appropriately capture and describe the unique behavior patterns of children with disabilities, who may have nuanced experiences of PA (Kang, Palisano, King, & Chirarello, 2014).

The conceptualization of PA has evolved in response to this unidimensionality. Researchers from psychosocial perspectives redefine PA as the individual agency of activity related to movement and in relation to energy expenditure (i.e., voluntary, goal-directed, purposeful) (e.g., Malina, 2014; Newell, 1990). This perspective has given rise to the discussion of PA as a person–environment interaction, opposed to a strictly intrinsic, bodily experience (Lobo, Harbourne, Dusing, & Mccoy, 2013; Logan et al., 2015; Mallinson & Hammel, 2010). Further, there is increased interest among child development professionals as to *how* PA facilitates participation, exploration, and engagement of children in their everyday environment, social interactions, and overall development (Lobo et al., 2013; Logan et al., 2015). As the discussion of PA continues to expand and efforts are made to describe its dynamic, complex nature, it is necessary for measurement selection practices to concurrently evolve in order to adequately capture PA behaviors. The adoption of a collaborative PA taxonomy and framework would support the alignment of measurement practice and the comprehensive understanding of PA status and patterns among children with disabilities. It would further support the development of effective intervention and promotion strategies for this at-risk population (McConachie, Clover, Forsyth, Jarvis, & Parkinson, 2006).

The absence of a general classification of PA dimensions in relation to conceptual models of disability and health may explain the limited scope in which measurement tools are utilized. Inconsistencies in the literature may further develop due to the subsequent lack of guidance on the measurement selection process in alignment with a common PA taxonomy. As a result, it is important to develop a general framework that allows for appropriate and comprehensive descriptions of PA experiences of children with disabilities. Furthermore, a parallel guide for selecting measurements that appropriately capture the complex nature of childhood PA is required. Therefore, the purpose of this article is to introduce a conceptual framework to support the process of defining PA, selecting appropriate PA tools for children with disabilities, and discussing research outcomes.

Physical activity taxonomy

To guide the alignment of PA measurement with a conceptual framework for disability in research, this article is organized into three levels: (a) the conceptualization of function,

disability, and health; (b) the definitions and operationalization of specific dimensions and components of PA within this conceptual framework (with disability-specific examples); and (c) the subsequent selection of appropriate measurement tools that align with the preceding levels. Figure 1 presents this three level process and will be continually referred to in support of the discussion below. In brief overview, Level 1 of Figure 1 illustrates a rendition of the International Classification of Functioning, Disability and Health (ICF) framework (World Health Organization [WHO], 2002). Level 2 represents how these theoretical constructs have been defined and operationalized in the context of PA and childhood disability within current literature (e.g., Kang et al., 2014; Rosenbaum & Gorter, 2012). Lastly, Level 3 provides examples of appropriate measurement tools that link to each of the PA definitions and broader ICF health constructs when considered in the context of specific research questions.

Level 1: Conceptual framework of health and disability

The ICF provides a framework within which health and well-being can be discussed in relation to disability, personal, and contextual factors (WHO, 2013). Published in 2002, the ICF challenges the notion that physical performance at the individual level is the primary index of health and full participation in community opportunities (WHO, 2013). Rather, health is emphasized as a multidimensional and dynamic interaction between the

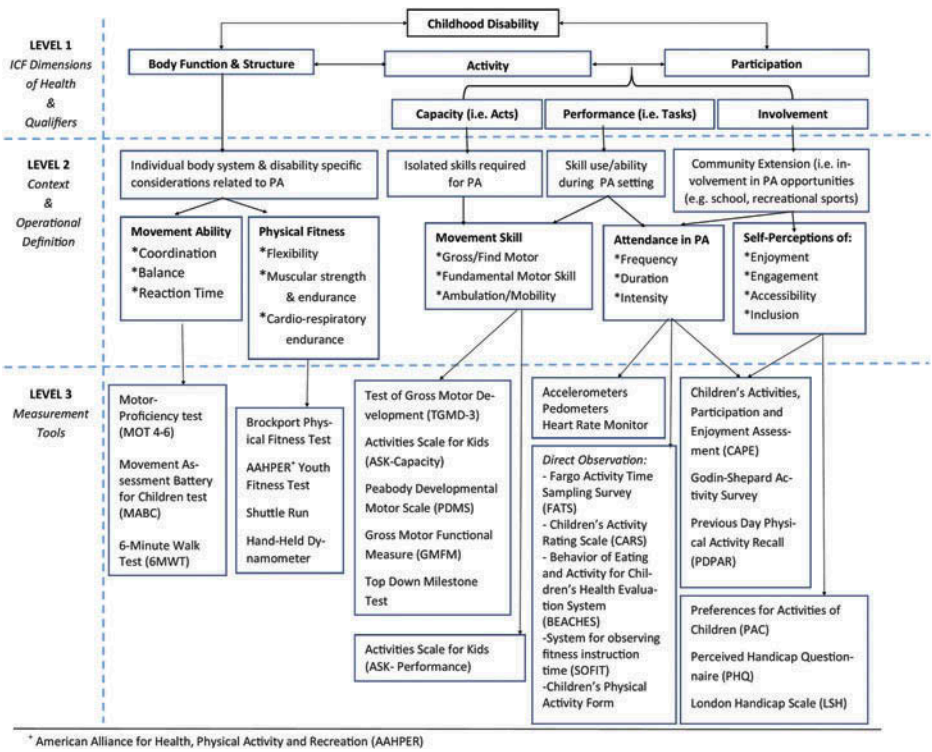

Figure 1. Conceptual Map for linking the health domains of the International Classification of Functioning, Disability and Health (WHO, 2002) to childhood physical activity constructs and appropriate measurement tools. See Appendix for references of specific measurements listed.

person and society. As such, the focus of disability studies has shifted away from identifying and fixing individual impairments (i.e., biomedical perspective) to addressing the impact of disability within the context of daily living (i.e., sociocultural perspective).

Level 1 of Figure 1 models the three central ICF health dimensions: (a) body function and structure, (b) activity, and (c) participation (WHO, 2013). The first dimension, *body function and structure*, describes the physiological function of body structures and anatomical components within an individual (WHO, 2013). *Activity*, in turn, describes the purposeful execution of tasks or actions by an individual (WHO, 2013). The third dimension, *participation*, is defined by the WHO as the ability to engage in or the degree of involvement in meaningful life situations. However, it remains the most elusive dimension within the literature (e.g., Granlund, 2013; Granlund et al., 2012; Heinemann et al., 2010; Mallinson & Hammel, 2010). Coster and Khentani (2008) redefined participation as "organized sequences of activities directed toward personally or socially meaningful goals" (p. 643). This may include experiences such as getting dressed for school and attending a community/school event or play group. Alternatively, Badley (2008) described this construct as "*social involvement*, concerning the individual as a player in socially and culturally recognized areas of human endeavors" (p. 2339). In childhood, this may translate to social roles such as being a child, a student, or a sports player within meaningful and goal-directed peer interactions during leisure and recreational play. Conceptually, participatory profiles of children encompass an interaction of disability, environment, aids/assistance, personal preferences, physical performance, and social engagement within specific, child-relevant activity contexts (Almqvist, Hellnäs, Stefansson, & Granlund, 2006; Forsyth & Jarvis, 2002; Kang et al., 2014; Mallinson & Hammel, 2010).

Capacity and *performance* are qualifiers provided for the ICF to differentiate between what a child can optimally do when conditions are controlled and what a child actually does on a daily basis, respectively (WHO, 2002). To further clarify the distinction between physical outcomes and self-perceptions, Granlund et al. (2012) proposed "involvement" as a third qualifier. *Involvement* describes the degree of perceived engagement in school and community activities, an experience independent of task performance. As illustrated in Level 1 of Figure 1, these three qualifiers overlap and can be used to describe activity and participation dimensions. In attempt to form more distinctive constructs, Badley (2008) redefined this set of qualifiers as *Acts* (general things people do independent of context, relating to physical function as a whole), *Tasks* (purposeful things done within specific contexts of daily living), and *Social Involvement* (the degree to which a person fulfills socially and culturally recognized roles in life). These alternatives differentiate how an activity is performed in the context of daily living and subjectively experienced as a participator, from the execution of isolated movements or functional actions. For example, a child may successfully walk 10 meters at physical therapy but find that using a wheelchair while transitioning between classes at school allows her to socialize with friends, get to class on time, and not become too fatigued to learn. In this manner, her physical *capacity* to execute the walking task is very distinct from her daily *performance* of independent ambulation and *experience* of independence and transportation between classes as a student and peer. The representation of all three aspects of activity and participation are necessary to capture the entirety of her experience, emphasizing the importance of taking a multidimensional perspective to childhood health and activity behavior.

Rosenbaum and Gorter (2012) offered a more whimsical rendition, "The F-words in Childhood Disability," in which the three ICF health dimensions are equated to *Fitness* (i.e., body function and structure), *Function* (i.e., activity), and *Friendship* (i.e., participation). Regardless of the terminology, two central themes arise from these taxonomies. First, health is a complex and dynamic construct that is both an objective and subjective experience. Second, physical or task performance and personal perceptions of involvement are distinct and independent aspects of a child's experiences, which jointly contribute to personal health behavior and well-being. Thus, to comprehensively describe the profiles and health patterns of children with disabilities, it is essential to consider experiences from multiple perspectives (objective and child-centered) and along more than one ICF dimension of health.

Level 2: Applying the ICF to childhood physical activity and disability

For children, a primary context in which the three ICF health dimensions are experienced and developed is PA opportunities. This includes, but is not limited to free time, play, and school and recreational sports and games. As such, all dimensions are important considerations in representing the dynamic and complex nature of childhood PA. Level 2 of Figure 1 represents the application of the ICF health dimensions to the specific context of PA, providing examples of how it has been operationalized within disability literature.

Notably, awareness of *participation* as a health-related PA dimension is rising in the literature (e.g. Goldstein, Cohn, & Coster, 2004; Law, 2002), but remains underrepresented compared to its ICF counterparts. For children with disabilities, engagement in PA fulfills a multitude of personal goals for achievement, interpersonal development, and social relationships (Forsyth & Jarvis, 2002; Taub & Greer, 2000). Children with disabilities have described PA participation first-hand as equating to having fun, feeling successful, doing and being with friends and peers, and feeling independent (Harding et al., 2009; Heath, Case, Mcguire, & Law, 2007). Therefore, discussion of PA participation requires consideration for what children can and want to do, their self-perceived feelings of involvement, enjoyment, and being valued in activity situations by others, and what PA opportunities are accessible, available, and supported within their community (Almqvist et al., 2006; King et al., 2003; Mallinson & Hammel, 2010). A more careful consideration of the various dimensions of participation in life may result in more optimal experiences for children with disabilities. This may lend to a more comprehensive understanding of the associated impacts on these children's quality of life, lifestyle choices, and overall emotion and psychosocial well-being (Kang et al., 2014).

With emphasis on the participation domain, a refined conceptualization of PA is offered as an *experience* that includes components of movement performance, activity attendance and engagement, and social and communal participation. Opposed to viewing this perspective as a new exclusive definition, it is advised that future researchers consider this multidimensional perspective in the development of their project-specific conceptualizations of PA. Special attention should be given to this approach when discussing children with disabilities. Studies continually reveal drastic discrepancies in PA performance patterns between children with disabilities (e.g. Zwier et al., 2010; King, DeWit, McDougall, Hurley, & Law, 2010) and their peers. The next step in research is to explore the associated mechanisms and behavior patterns as they relate to childhood experiences, development, and health. Dr. Malina's "Top 10 Research Questions Related to Growth …

and Physical Activity" (2014) encourages researchers to expand in this direction. At an individual level, Malina's top question is whether PA is essential to childhood development (p. 161), and the degree to which development is impacted when children are not fully participating in PA. This is followed by a question on the existence of critical performance levels required for full PA participation (p. 164). A corollary question regards the extent to which children who have not achieved this critical level are being supported by youth programs and PA promotion interventions to engage in meaningful participation. Furthermore, researchers are challenged to determine the appropriateness of current concepts of health, fitness, PA for children (compared to adults), or for children with disabilities (pp. 165–166). A multidimensional perspective, inclusive of physical performance and subjective perceptions of participation, is required to effectively answer these and related questions. As such, it is advised that childhood PA be discussed and defined as the *subjective experience of meaningful engagement in activity opportunities* (e.g., school/community sports, free/recreational play) *that are shared with others* (e.g., family, peers, and friends).

Nonetheless, it is argued that the issue at large is not current practices for defining and conceptualizing PA. It is widely acknowledged to be a complex and context-dependent construct, and nuanced for children with disabilities (e.g., Kang et al., 2014). Rather, the concern is for the limited scope of operational definitions and measurement tools currently utilized in research practice. The primary use of performance-based measures suggest that the complex nature of PA is not, at present, appropriately being captured. Thus, through this article, further exploration of PA as an experience beyond movement and performance outcomes is supported. Further, more extensive investigations of how these experiences and related behavior patterns exist in children with and without disabilities is prompted. Figure 1 provides a framework for this future development in research. Overlaying the PA taxonomy, the ICF offers researchers a guide for linking PA experiences to physical and perceived health outcomes. Please note that Figure 1 is not offered as a model or an approach with distinct steps to be universally adopted. Instead, the aim is to provide general guidelines for classifying, conceptualizing, and measuring PA.

A critical first step in research on childhood PA is determining which health dimension (Level 1) is of interest to a given researcher. The selected dimension(s) (body function, activity, and/or participation) will influence, and be influenced by, contextual definitions and researcher's specific perspectives on PA and health. This in turn will guide subsequent determination of how PA is operationalized (Level 2), as well as which measurement tools are most appropriate (Level 3). Utilizing the framework illustrated in Figure 1 will support the ensuing interpretations of results in a manner that translates and contributes to the larger discussion of childhood PA *experiences*.

Although primarily for adults, several examples exist within literature for framing PA within the ICF and in relation to specific disability populations (e.g., van der Ploeg, van der Beek, van der Woude, & van Mechelen, 2004; Rimmer, 2006; Temple, 2010). These examples have been integrated into Level 2 of Figure 1. Within these models, *body function and structure* has been considered in relation to underlying mechanisms of movement and function within the individual. Examples include flexibility, muscular strength, coordination, balance, standing posture, gait, and associated physical fitness components (e.g., McBurney, Taylor, Dodd, & Graham, 2003). In adapted PA, additional disability-specific considerations such as incontinence, heat intolerance, and spasticity align with this dimension as well (Rimmer, 2006; Temple, 2010). Factors discussed within

the activity dimension include children's gross movement functional level, degree of independent ambulation and mobility, and competency in fundamental movement skills, such as running, jumping, kicking, and throwing. Both *body function and structure* and *activity* have traditionally been the focus of discussion in disability research, with the examination of fitness and personal capacity to engage at a given activity intensity or accrue recommended time in high intensity activity being a primary research interest (e.g., Cervantes & Porretta, 2010).

In developing a definition of PA, it is important to consider how it serves as an index of health and relates to the specific aim and objectives of a research inquiry. Notably, the definition of PA is dependent on the objectives of a research or program setting. Considerations for what a researcher intends to capture and extrapolate about the experiences, behaviors, and status of children with disabilities in terms of PA behaviors can guide how specific operational definitions of this construct are aligned with the ICF health dimensions.

Level 3: Measurement selection

Traditionally, PA has been operationalized in terms of physical performance at it relates to energy expenditure, which has linked to the predominate use of objective measures of PA (i.e., accelerometers and pedometers)(e.g., Dollman et al., 2009). Underlying this approach is the strong assumption that greater energy expenditure is associated with desired health outcomes. Research supporting this, including Loprinzi and Troust (2010), have found that individuals who have met the recommended guidelines for daily moderate to vigorous activity are at lower risk for obesity and other health concerns. Public health initiatives (U. S. Department of Health and Human Services, 2008) targeting PA levels (intensity and duration) at a national level to reduce health risks in children with disabilities (e.g., Hinckson & Curtis, 2013) further drive the disproportionately high representation of the activity dimension in PA and disability literature. In alignment with this model, PA has been primarily measured in terms of overall levels, intensities, and frequency of engagement/attendance in various activity modalities (Cervantes & Porretta, 2010; Hinckson & Curtis, 2013).

Notably, Cervantes and Poretta (2010) found *activity* performance as the primary concern in PA literature, with self-report and motion monitors the most commonly used measurement tools. Only five of the 28 reviewed studies used multiple or multi-dimensional measures to capture PA behaviors (Cervantes & Poretta, 2010). A later work, Hinckson and Curtis (2013), showed similar trends, with 29 of the 30 studies examining PA among children with intellectual disabilities reviewed utilizing *activity*-oriented measures. This included direct measures such as accelerometers, pedometers, direct observation, heart rate monitors, doubly labeled water; and subjective measures such as parent proxy reports and questionnaires. From these measures, PA was described in terms of frequency, intensity and duration (Hinckson & Curtis, 2013). Of the studies reviewed, *participation* was only included as the primary measure of PA in Wuang and Su (2012), and as a secondary measure in Lin, Yen, Li, and Wu (2005) (as cited in Hinckson & Curtis, 2013).

In an earlier work ("A Hitchhiker's Guide to Assessing Young People's Physical Activity: Deciding What Method to Use"), Dollman et al. (2009) attempted to provide

support for selecting from the multitude of PA measurement tools when investigating the PA profiles of typically developing children. While a significant first step, their guidance was restricted to measures linked to PA performance definitions (i.e., *activity* health dimension). Furthermore, authors neglected to discuss the relationship between their taxonomy and the conceptual aspects of PA (Dollman et al., 2009). Clearly, there is need to increase the inclusion of *participation*-related measures in PA research. This may be especially true for children with disabilities who may not receive meaningful and complete representations of PA experiences and overall health from descriptions of *body function and structure* status or *activity* behaviors alone (Kang et al., 2014).

To support and encourage investigation of the *participation* dimension, Magasi and Post (2010) suggested two key stages of consideration in assessment selection, including clearly defining participation in the context of the research question and identifying the level of detail (specific or global) and breadth (single or multiple aspects) needed to address your research question. In Level 3 of Figure 1, these general steps were integrated into options for PA measures to consider that are relevant in each conceptual ICF dimension. The intention is to expand the work of Dollman et al. (2009) and support the adoption of a general, yet comprehensive, approach to assessing PA in children with disabilities.

Steps for measurement selection

As illustrated in Figure 1, authors offer three general steps for aligning measurement selection with the contemporary ICF framework of disability and health:

Step 1: Determine which health dimension is of interest. It is advised that researchers clearly identify the intended purpose and utility of research in relation to the ICF conceptual framework of health and disability.

Step 2: Define the chosen health dimension(s) within a specific PA context and with consideration for the experiences of children with disabilities and the specific research objectives.

Step 3: Select a measurement tool that aligns with your definition. Please see examples provided in Figure 1. Appendix A includes measurement references and additional resources to support the selection of appropriate assessments of childhood PA.

For example, consider Malina's (2014) primary question posed to researchers on the relationship between routine PA and childhood growth and development (p. 161). If a researcher is interested in the health- and fitness- related benefits, then Step 1 would be aligning this perspective with the body function and structure ICF domain (see Level 1 of Figure 1). Alternatively, interest in how PA facilitates psychosocial development would align with activity or participation domains. Step 2 then requires translating these health domains into operational definitions that appropriately fit with a researcher's specific question. In the first scenario, PA would equate to "bodily movements resulting in energy expenditure" (Caspersen et al., 1985, p. 126) and defined in terms of motor performance or physical fitness and attendance frequency and intensity. A researcher may then select objective measures (Step 3) of physical capacity (e.g., Brockport Physical Fitness Test) and PA intensity (e.g., accelerometers or self-report; see Level 3 of Figure 1). Outcomes from

this type of study could address specific questions regarding type and intensity of PA required for beneficial effects on health and fitness (Malina, 2014, p. 161).

The second scenario can take on several forms. One example comes from pediatric rehabilitation research, where PA is defined as "independent goal-oriented movement" and embedded in a research question regarding the interaction of PA and childhood exploration within their environment and social worlds (e.g., Logan et al., 2015). In this approach, researchers utilize direct observation measures of movement patterns and social interactions. Alternatively, with older children, a self-report questionnaire on participation (e.g., CAPE [Children's Activities Participation and Enjoyment Assessment], see appendix 1 and King et al., 2004) may adequately capture this aspect of children's PA experience. Ultimately, how the framework in Figure 1 is applied in practice will depend on the underlying outcome and related behaviors of interest, the breadth and perspective of health adopted, and the context in which PA is being discussed. It is important to note that there may be a need to select multiple measures or operationalize PA within two or more ICF health constructs. In other words, inclusion of multiple PA dimensions may be necessary to acquire an appropriate and comprehensive picture that aligns with the overarching goal or research inquiry. In the recognition of time and resource limitations, it is recommended, at the very least, that researchers acknowledge the scope of a given study in relation to the ICF health constructs (Jette, 2006; WHO, 2013). Researchers are advised to consider their research inquiries in relation to the bigger picture framework and to address how their findings impact the comprehensive understanding of childhood PA, health, and disability.

Conclusion

Although PA has been thoroughly explored and continuing efforts to further investigate PA in child populations are consistently being made, there is an emerging need to align PA measurement selection with contemporary, multidimensional models of health and disability. The heavy focus of research on objective activity levels for children with disabilities is, in no doubt, informative and essential for the progression of health outcomes. Efforts to date have captured the discrepancies in PA intensity levels between children with and without disabilities (e.g., Law et al., 2004). Given this evidence, there is now substantial need to explore this issue in more depth and examine factors of performance and self-perceived engagement. This requires greater attention to and inclusion of *participation* as an important aspect of PA than is currently represented in childhood PA literature.

Addressing participation and viewing PA as a multidimensional construct will provide a more valuable interpretation of PA experiences, especially for children with disabilities (see Kang et al., 2014). This will further allow for a more thorough understanding of and reasoning for PA discrepancies in disability. For example, low achievement or scoring on performance outcomes, such as activity diversity or intensity, does not necessarily directly translate to poor health, activity experiences, or participatory outcomes (Imms, 2008). Instead, low scoring may be attributed to level of choice, social factors, or specific enjoyment of one activity that is valued by the child. This example highlights the advantage of identifying alternative barriers, explanations, and factors that may explain patterns of PA intensity. These PA components may serve as targets for future interventions and support efforts to increase PA levels and experiences for this population.

Although research efforts on specific, individual aspects of PA are highly useful in terms of a given outcome, there are restrictions and consequences to this unidimensional perspective. Ultimately, more meaningful measurements and interpretations of PA are necessary for children with disabilities. Detailed, comprehensive pictures of PA patterns and experiences will help guide and support subsequent intervention strategies for increasing PA at the individual and population level. This multidimensional approach would serve as a solution to the issue of misalignment between the conceptual ICF framework for health and disability and PA measurement in research practice to date.

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APPENDIX A: Supplementary reference and resource list for measurement selection

Provided below are the references of the specific measures included in Figure 1. This is not an exhaustive list, nor was it systematically constructed or intended to represent the "best" PA measures for children or disability. Rather, it should serve as a tool and starting point for supporting the measurement selection process. Researchers are encouraged to think critically about aligning their measurement tool with their intended purpose within the ICF framework. An additional resource list is provided that includes more comprehensive reviews and synthesis of PA measures and assessments within the literature.

Figure 1 References

Accelerometer and Pedometers and Heart Rate Monitor (*example sources):

*Chen, K. Y., & Bassett, D. R. (2005). The technology of accelerometry-based activity monitors: Current and Future. *Medicine & Science in Sports & Exercise, 37*(Suppl.), 490–500.

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American Alliance for Health, Physical Education, and Recreation (AAPHER) Youth Fitness Test:

American Alliance for Health, Physical Education, and Recreation (AAPHER). (1975). *AAHPER youth fitness test manual* (revised edition). Washington, DC: Author. Retrieved from http://files.eric.ed.gov

Activities Scale for Kids (ASK):

Young, N. L., Williams, J. I., Yoshida, K. K., & Wright, J. G. (2000). Measurement properties of the activities scale for kids. *Journal of Clinical Epidemiology, 53*(2), 125–137.

Behavior of Eating and Activity for Children's Health Evaluation System (BEACHES):

McKenzie, T. L., Sallis, J. F., Nader, P. R., Patterson, T. L., Elder, J. P., Berry, C. C., … Nelson, J. A. (1991). BEACHES: An observational system, for assessing children's eating and physical activity behaviors and associated events. *Journal of Applied Behavior Analysis, 24*(1), 141–151.

Brockport Physical Fitness Test:

Winnick, J. P., & Short, F. X. (2000). The Brockport Physical Fitness Test. *Palaestra, 16*(1), 20–26.

Children's Activities Participation and Enjoyment Assessment (CAPE) & Preferences for Activities of Children (PAC):

King, G. A., Law, M., King, S., Hanna, S., Kertoy, M., & Rosenbaum, P. (2007). Measuring children's participation in recreation and leisure activities: Construct validation of the CAPE and PAC. *Child: Care, Health & Development, 33*(1), 28–39.

Children's Activity Rating Scale (CARS):

Puhl, J., Greaves, K., Hoyt, M., & Baranowski, T. (1990). Children's Activity Rating Scale (CARS): Description and calibration. *Research Quarterly for Exercise and Sport, 61*(1), 26–36.

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Gross Motor Functional Measure (GMFM):
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Hand-held dynamotor:
Dwyer, G. B., Davis, S., & American College of Sports Medicine. (2013). *ACSM's Health-Related Physical Fitness Assessment Manual* (4th ed.). Philadelphia, PA: LWW.
London Handicap Scale (LHS):
Harwood, R. H., Rogers, A., Dickinson, E., & Ebrahim, S. (1994). Measuring handicap: The London Handicap Scale, a new outcome measure for chronic disease. *Quality in Health Care, 3*(1), 11–16.
Mobility Assessment Schedule:
Kvas, Š., Stöppler, R., Haveman, M., & Tillmann, V. (2013). Assessing mobility competences of children with intellectual disabilities: Development and results of the Mobility Assessment Schedule. *Journal of Policy and Practice in Intellectual Disabilities, 10*(4), 300–306.
Motor—Proficiency—Test (MOT 4–6):
Zimmer, V. R., & Volkamer, M. (1987). *Motoriktest für vier- bis sechsjährige Kinder*. Komotini, Greece: Elsevier.
Movement Assessment Battery for Children Test (M-ABC):
Henderson, S. E., Sugden, D. A., & Barnett, A. L. (2007). Movement Assessment Battery for Children (2nd ed.). London, England: Harcourt.
Peabody Developmental Motor Scale (PDMS):
*Folio, M. R., & Fewell, R. R. (1983). Peabody Developmental Motor Scales and activity cards. Dallas, TX: DLM-Teaching Resources.
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Perceived Handicap Questionnaire:
Kuptniratsaikul, V., Smerasuta, O., & Klomjaiyen, P. (2002). The Perceived Handicap Questionnaire: A self perceived handicap measurement in patients with spinal cord injury. *Journal of Medical Association of Thailand, 85*(8), 935–939.
Physical Activity Scale for Individuals with Physical Disabilities (PASIPD):
Washburn, R. A., Zhu, W., McAuley, E., Frogley, M., & Figoni, S. F. (2002). The Physical Activity Scale for Individuals with Physical Disabilities: Development and evaluation. *Archives of Physical Medicine and Rehabilitation, 83*, 193–200.

Previous Day Physical Activity Recall (PDPAR):
Weston, A., Petosa, R., & Pate, R. (1997). Validation of an instrument for measurement of physical activity in youth. *Medicine and Science in Sports and Exercise, 29*(1), 138–143.
System of Observing Instructional Fitness Time (SOFIT) and System for Observing Play and Leisure Activity in Youth (SOPLAY):
*McKenzie, T. L. (2012). *System for Observing Fitness Instructional Time (SOFIT)*. San Diego, CA: San Diego State University.
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Test of Gross Motor Development:
*Ulrich, D. (2000). *Test of Gross Motor Development* (2nd ed.). Austin, TX: Pro-ED.
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Top Down Milestone Test:
Bidabe, L., & Lollar, J. (1995). *MOVE: Mobility opportunities via education* (3rd ed.). Baskersfield, CA: Kern Country Superintendent of Schools.
6-Minute Walk Test (6MWT):
Crapo, R. O., Casaburi, R., Coates, A. L., Enright, P. L., MacIntyre, N. R., McKay, R. T., … Mottram, C. (2002). ATS statement: Guidelines for the Six-Minute Walk Test. *American Journal of Respiratory and Critical Care Medicine, 166*, 111–117.
REVIEWS and GUIDES for Childhood Physical Activity Measurement:
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