

Difficulties in Predicting Developmental Change: A Challenge for Service Providers



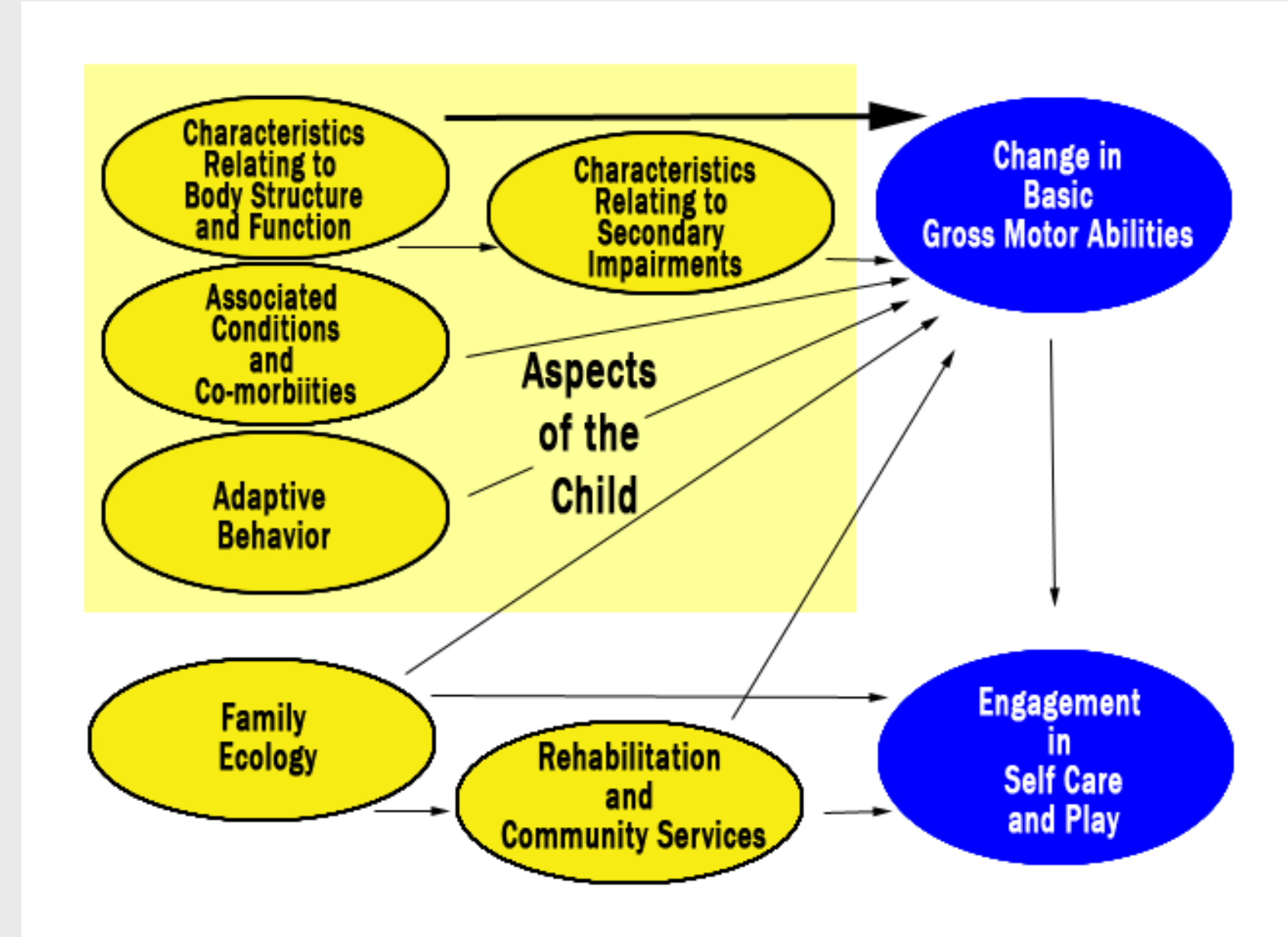
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PURPOSE

- One goal of pediatric physical therapy is to optimize outcomes of a condition through effective interventions
- Identification of determinants of change over time (i.e. prognostic factors), if modifiable, provide foundational knowledge to inform the focus of therapy¹
- We share our experiences about conceptualizing and testing determinants of change in gross motor abilities of young children with cerebral palsy (CP)

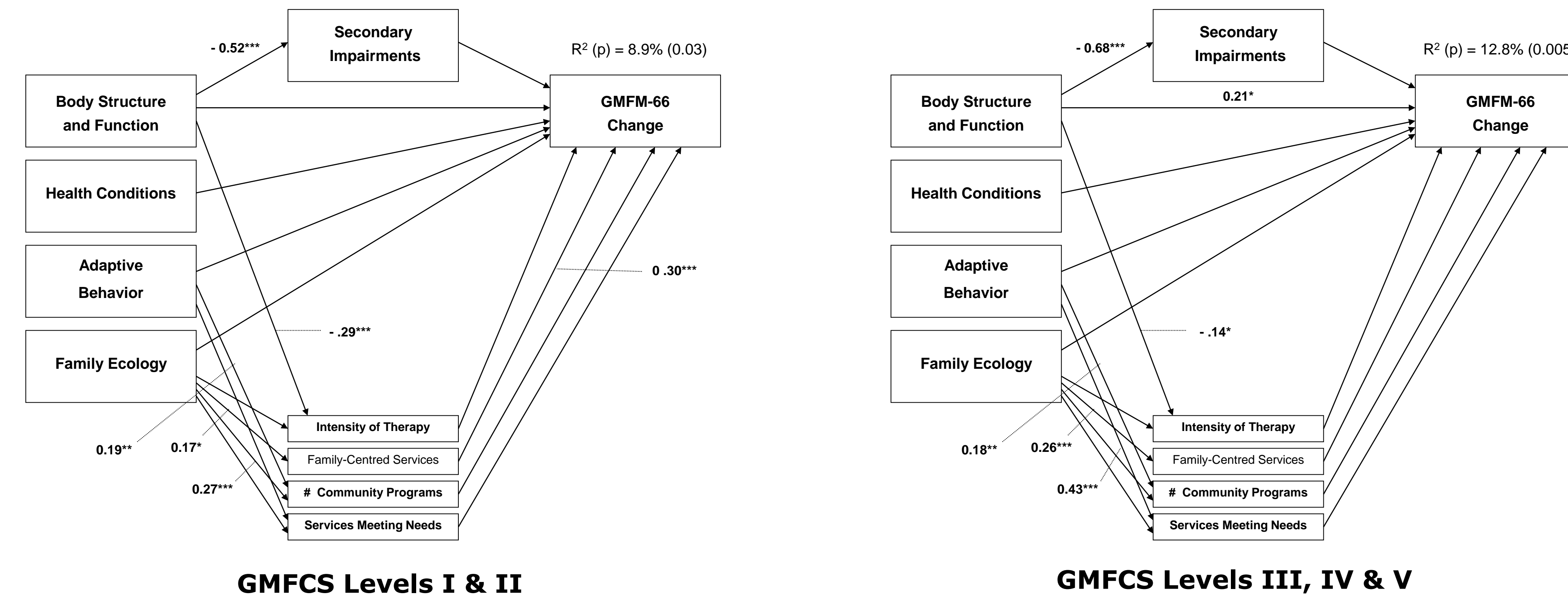
DESCRIPTION

- Our team has described the development² and testing³ of a conceptual model of determinants of gross motor function, and participation in self-care, recreation and leisure, and play of young children with CP



- The model is compatible with current conceptualizations of functioning, disability and health, systems theory, theories of human ecology, and an approach incorporating family-centred care, as well as being based on research literature, clinical expertise, and input from parent collaborators²
- The model emphasizes the multisystem complexity of a child with CP and the dynamic interaction between the child and his or her environment
- To test this model, a sample of 429 children with CP, across all GMFCS levels, aged 18 to 60 months (242 boys and 187 girls) was recruited from multiple sites across Canada and the US
- Data were collected on selected primary and secondary impairments, associated health conditions, adaptability, and gross motor function at the beginning of a one-year study
- Data on family ecology and community programs and rehabilitation services were collected 7 months later, and gross motor function was measured again at the end of the year

RESULTS



When tested, although the data were a good fit with the model, it explained only 9 to 13% of the variance in *change* of motor function over the period of 1 year, in contrast to 58 to 75% of the variance in motor function when the outcome was conceptualized as simply motor function at the end of the year⁴

INTERPRETATION AND SUMMARY OF USE

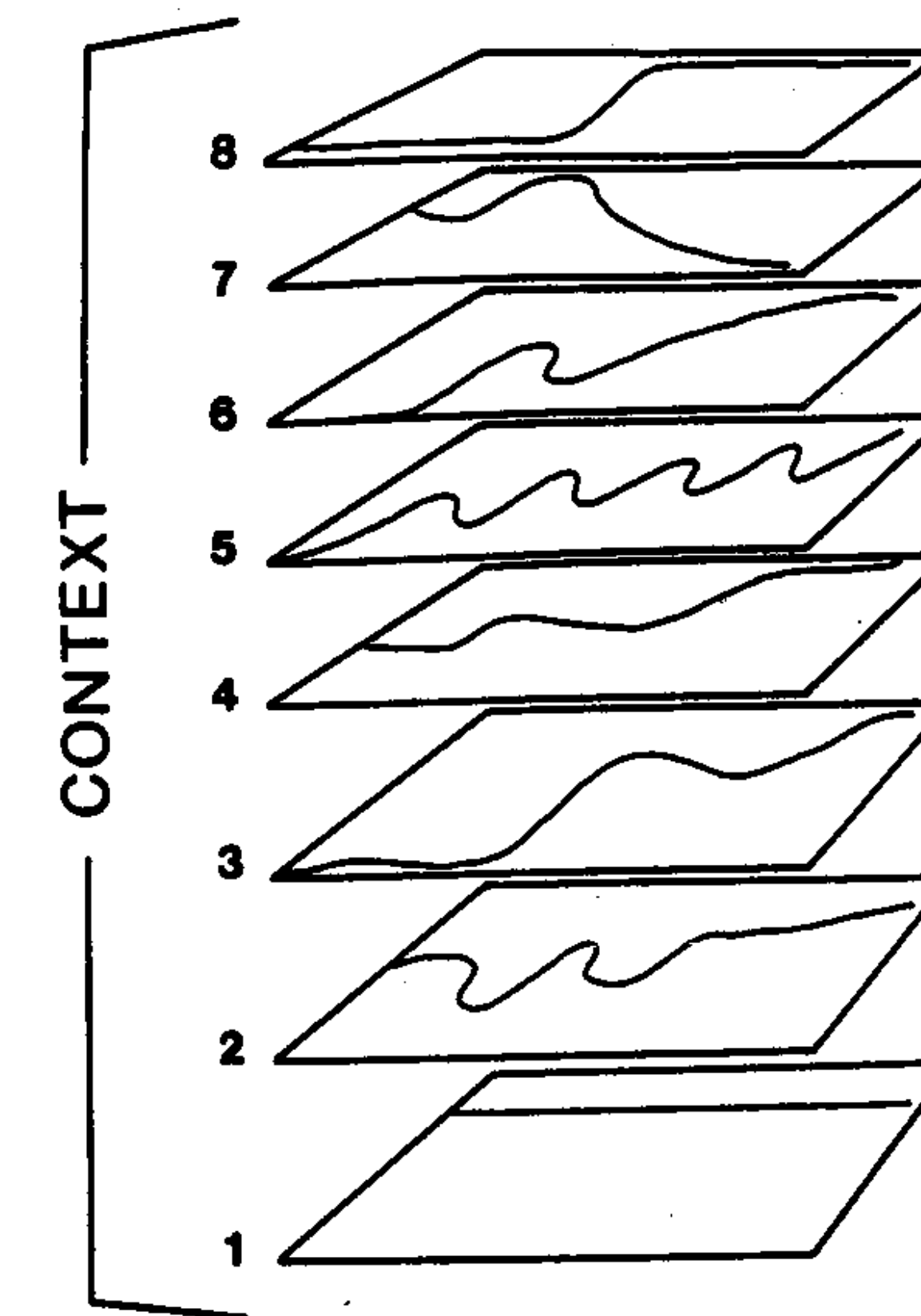
This surprising finding was not explained by lack of variability in the change scores, averaging 5 points with an interquartile range of 8 points

We speculate that this result is attributable to the complexity, uniqueness and non-linearity of developmental phenomena⁵

Predicting developmental change is difficult; across a range of developmental domains, child development does not occur at a steady pace, but instead progresses in spurts and plateaus over time,^{6,7} with a lack of correspondence in rate of development among trajectories of various domains⁸

Furthermore, a unit of change in a determinant is not necessarily associated with a unit change in outcome. A small incremental change in a determinant, such as muscle strength, can lead to significant motor function advances⁵ and vice versa

It is also possible that developmental change is not a generalizable phenomenon,⁵ especially for children with CP who demonstrate wide inter-individual variation



Depicting development as parallel developing subsystems, each with its own trajectory. Time is on the x-axis; a 'quantity' of a contributing subsystem in on the y-axis. Motor function at any time is assemblable from these subsystems within a task and environmental context⁵ adapted from 5, Figure 4.3, page 85

IMPORTANCE TO MEMBERS

- As have others,⁹ we conclude that it is more realistic to pursue investigation of prediction of future function, rather than change in function
- Only family-centred services and body structure and function were associated with change in motor function for children in GMFCS level I & II and III, IV and V, respectively
- Therapists are encouraged to consider children from a holistic perspective, recognizing unique features of each child in his or her social context
- The complexities of children with CP suggest that expertise,¹⁰ in addition to evidence, is required to optimize intervention outcomes

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REFERENCES

1. Fletcher RH, Fletcher SW. *Clinical Epidemiology. The Essentials*. 5th Edition. Philadelphia PA: Wolters Kluwer Health / Lippincott, Williams and Wilkins; 2014.
2. Chiarello LA, Palisano RJP, Bartlett DJ, McCoy SW. A multivariate model of determinants of changes in motor abilities and engagement in self-care and play of young children with cerebral palsy. *Physical and Occupational Therapy in Pediatrics*. 2011;31:150-168.
3. Bartlett DJ, Chiarello LA, McCoy SW, Palisano RJ, Rosenbaum PL, Jeffries L, LaForme Fiss A, Stoskopf B. The Move & PLAY study: An example of Comprehensive Rehabilitation Outcomes Research. *Physical Therapy*, 2010; 90:1660-1672.
4. Bartlett D, Chiarello L, McCoy S, Palisano R, Jeffries L, Fiss A, Rosenbaum P, Wilk P. Determinants of gross motor function of young children with cerebral palsy: A prospective cohort study. *Developmental Medicine and Child Neurology*, 2014;56:275-282.
5. Thelen E, Smith LB. *A Dynamic Systems Approach to the Development of Cognition and Action*. Cambridge, Mass: Massachusetts Institute of Technology, 1994.
6. Darrah J, Magill-Evans J, Volden J, Hodge M, Kembhavi G. Scores of typically developing children on the Peabody Developmental Motor Scales: Infancy to preschool. *Physical and Occupational Therapy in Pediatrics*. 2007; 27:5-19.
7. Darrah J, Senthilselvan A, Magill-Evans J. Trajectories of serial motor scores of typically developing children: Implications for clinical decision-making. *Infant Behavior and Development*. 2009;32:72-78.
8. Darrah J, Hodge M, Magill-Evans J, Kembhavi G. Stability of serial assessments of motor and communication abilities in typically developing infants: Implications for screening. *Early Human Development*. 2003;72:97-110.
9. Wright FV, Rosenbaum PL, Goldsmith CH, Law M, Fehlings DL. How do changes in body functions and structure, activity, and participation relate in children with cerebral palsy? *Developmental Medicine and Child Neurology*. 2008;50:283-289.
10. King, G, Currie, M, Bartlett, D, Gilpin, M, Willoughby, C, Tucker, MA, Strachan, D, Baxter, D. The development of expertise in pediatric rehabilitation therapists: Changes in approach, self-knowledge, and use of enabling and customizing strategies. *Developmental Neurorehabilitation*. 2007; 10:223-240.

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