2-1-2019

Developmental Trajectories for the Early Clinical Assessment of Balance by Gross Motor Function Classification System Level for Children With Cerebral Palsy.

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Title: Developmental Trajectories for the Early Clinical Assessment of Balance by Gross Motor Function Classification System Level for Children With Cerebral Palsy

Running Title: Development Trajectories for the ECAB

Article Type: Original Research

TOC CATEGORY: Pediatrics

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Keywords: Balance, Cerebral Palsy, Early Clinical Assessment of Balance, Development, Children

Accepted: June 18, 2018

Submitted: September 18, 2017

Background. Children with cerebral palsy (CP) characteristically present with impairments in balance. Currently, the pattern and timing of the development balance ability have not been described for children with CP of varying Gross Motor Function Classification System (GMFCS) levels.

Objective. The purpose of this study was to document longitudinal developmental trajectories in a measure of balance, the Early Clinical Assessment of Balance (ECAB) scores, along with age-specific reference percentiles and the amount of change typical over a one-year period, for children within different GMFCS levels.

Design. The design was a longitudinal cohort study.

Methods. Participants included 708 children with CP aged 18 months through their 12th birthday and their families. Children participated in 2 to 5 assessments using the GMFCS and ECAB.

Results. Longitudinal trajectories describing the average change in the ECAB score with respect to age were created by fitting separate nonlinear mixed-effect models for children in each GMFCS level. Reference percentiles were constructed using quantile regression of ECAB data from the first visit (baseline) and 12-month and 24-month visits. Using these reference points, the amount of change in percentiles was calculated for all children by subtracting the baseline percentile score from the 12-month percentile score. Children whose percentile changes are within the 80% limits can usually be described as 'developing as expected' for their age and GMFCS levels.

Limitations. Limitations of this study include use of a convenience sample, a ceiling effect of the ECAB for some children in GMFCS levels I and II, and the use of both a 12-month and 24-month study protocol that impacted the number of children available for each assessment session.

Conclusions. When used appropriately to monitor development and change over time for children with CP, the ECAB longitudinal trajectories, reference percentiles, and the associated change scores presented in this paper should assist therapists and families in collaborative interaction to proactively plan services and intervention relative to balance ability.

Children with cerebral palsy (CP) characteristically present with impairments in postural stability, evident in both static and dynamic activities.[1-5] Postural stability, or balance, is defined as the ability to maintain the center of mass over the base of support.[1,6] Decreased balance may limit a child's ability to move purposely through the environment[1, 6-9] and participate in activities of daily life.[10,11] From our previous work with children with CP, better balance was found to be related to higher motor abilities for children across all Gross Motor Function Classification (GMFCS) Levels,[9] and better balance was also related to higher performance in self-care skills for children GMFCS Levels III, IV, and V.[11] Evidence-based interventions to improve balance have been reported in the literature,[12] suggesting that when properly identified, balance impairments may be lessened. Therefore, assessment of balance of children with CP in the home, school, or clinic setting should be an important component of the physical therapy examination to determine if impairments of postural stability are present, to intervene if appropriate, and to track changes in stability over time.

The Early Clinical Assessment of Balance (ECAB)[13] was developed based on selected items from the Automatic Reactions section of the Movement Assessment of Infants (MAI-AR)[14] and the Pediatric Balance Scale (PBS).[10] Items from the PBS on the ECAB were rescaled based on weighting for difficulty, allowing for a total scaled score of 100.[13] The ECAB addresses several dimensions of balance across the developmental sequence: 1) head and trunk balance; 2) protective responses for balance in sitting, 3) maintaining upright postures in sitting and standing, and 4) making appropriate adjustments for voluntary movements in standing. The ECAB consists of 13-items; 7-items from the MAI-AR (5 of which are bilateral) and 6-items from the PBS and covers balance development from head control through movement in standing.

Because the ECAB's average score differs between groups defined by age and by GMFCS level, it demonstrates known-groups validity for testing the construct of balance in children with CP under five years of age.[13] In addition, internal consistency has been shown to be high (Cronbach's alpha = 0.92),[13] as well as inter-rater (ICC = 0.99, 95%CI = 0.976-0.995) and test-retest (ICC = 0.99, 95%CI=0.971-0.994) reliability, with both the same and different raters over time.[15] The standard error of measurement is 3.6 and the minimal detectable change (at 95% confidence intervals) is 10 for children age 2 to 8 years.[15] Using data from the current study participants, known-groups validity was confirmed for children 1.5-12 years age, showing similar results as found with the younger sample of children with CP. Significant differences in ECAB score (all $p < .001$) were found between all GMFCS levels. In addition, children under five years of age demonstrated lower ECAB scores than children 5 to 9 years ($p < .001$) and children 9 to 12 years ($p < .001$). No differences were noted between the two older groups of children. No differences in ECAB scores were noted between boys and girls in the sample ($p = .52$). The aim of the ECAB is to provide therapists with a valid, reliable, and clinically feasible measure of balance across all GMFCS levels for children with CP. The ECAB form and a training protocol (voice-over power point presentation) are available on the CanChild website at: http://www.canchild.ca under the On Track study webpage.

Currently, the pattern and timing of the development of balance have not been described for children with CP of varying GMFCS levels, and knowledge of this clinical course of development is needed. This information would allow therapists to complete periodic 'check-ups' and developmental monitoring with children with CP, and in collaboration with families, to develop efficient and effective plans for intervention. Therefore, the purpose of this study was to document longitudinal developmental trajectories in ECAB scores, along with age-specific

distributions and reference percentiles including the amount of change that is typical over one year in the ECAB score, for children with different GMFCS levels. Similar longitudinal trajectories[16] and reference percentiles[17] for the Gross Motor Function Measure have provided useful data for clinicians for prediction and prognosis of gross motor development, and have allowed for more efficient intervention planning. The GMFCS was selected because it is more reliable than either type of motor disorder or distribution of involvement[18] and from a philosophical standpoint, we believe in categorizing children by their motor function classification, building on 20-years of research around the GMFCS.

Methods

This study is part of a multisite, prospective cohort study entitled 'On Track: Monitoring Development of Children with Cerebral Palsy and Gross Motor Delay,' which aimed to develop longitudinal trajectories and reference percentiles for impairments, health conditions, and participation variables for children with cerebral palsy.[19] The full study protocol has been reported elsewhere.[19] Institutional Review Boards at all participating institutions and recruitment sites with IRBs reviewed and provided ethics approval. All parents or guardians provided informed consent and children, as appropriate and in compliance with the specific IRB, provided assent.

Role of Funding Source

Funding from both the Canadian Institutes of Health Research and the Patient Centered Outcomes Research Institute supported all aspects of this study.

Participants

A convenience sample of 708 children with CP ages 18-months through 11-years of age, GMFCS Levels I-V participated in this study. Children were recruited from six sites across Canada, including British Columbia, Saskatchewan, Manitoba, Ontario, Nova Scotia, and Newfoundland, and four sites of the United States, including areas within and surrounding Georgia, Oklahoma, Pennsylvania, and Washington states. Participating children had a diagnosis of CP by a physician or demonstrated delay in gross motor development in addition to impairments in: muscle tone, righting and equilibrium reactions, anticipatory postural movements of the head, trunk, or legs during movement, and active range of motion during movements. The distribution of GMFCS level in this large prospective cohort sample of 708 participants is comparable to incidence data reported in the literature. Reid and colleagues reported mean proportions (SD) in each GMFCS level in nine international CP registries: GMFCS I - 34.2% (13.1); GMFCS II – 25.6% (11.6); GMFCS III – 11.5% (2.5); GMFCS IV – 13.6% (4.3); GMFCS V - 15.6% (4.3).[20] The proportion of children in each GMFCS level in our sample is: GMFCS I – 32.1%; GMFCS II – 22.7%; GMFCS III – 11.2; GMFCS IV – 18.2%; GMFCS V – 15.7%.

Continued eligibility to participate was confirmed throughout the study so that the final sample represented children with CP. Therapist assessors provided detailed information regarding eligibility of seventy-one children either before or during recruitment. A physiatrist (JWG) reviewed and made recommendations to the team regarding the eligibility of each of these children, and 11 children were excluded from the final sample as a result of this review. Children were excluded if their parents were unable to speak and understand English, French or Spanish. Attrition was tracked across all study visits and is documented in Figure 1. (Replicated

from McCoy et al, 2017). Demographic information of the children and their families is included in Table 1. (Replicated from McCoy et al., 2017).[19]

Procedures

Children participated in two (n = 656) to five (n = 424) assessment sessions with a physical or occupational therapist in their home or clinic settings. The therapist completed the GMFCS via consensus with parents.[21] The GMFCS is a five-point classification system used to describe gross motor function ability in children with cerebral palsy with distinctions between levels made based on functional abilities, use of assistive technology, and quality of movement.[22] The GMFCS was independently completed by both the assessor and the parent, and then the child's classification was discussed in attempt to reach consensus. Consensus was reached 97.8% of the time, and all disagreements were within one level.[21] Based on study protocol, the final classification used was the parent rating with specific rules applied to determine if the assessor classification should be used instead. Reasons to accept the assessor classification included: compelling written descriptions of the child's capability by the assessor that was lower than the parent-reported performance, use of the incorrect age band for the GMFCS, or assessor providing information that the parent was not ready to discuss reconciliation of disagreements when the therapist classified the child at a less functional level than the parent.[21]

The therapist then completed several assessments, including the ECAB, using study provided standardized equipment. Overall assessment time was 60 minutes or less. The ECAB equipment included: an adjustable height bench (which also included the original 6" high step stool), mat, and stopwatch. Optional provided items included: 2 child size footprints for visual cuing, blindfold to simulate eyes closed, flashcards for distraction, and stickers. The therapist

followed standardized instructions for completion of the ECAB, available at: https://vimeo.com/131890924. For children in GMFCS Levels, III, IV, and V, the assessor began testing in Part I, Item 1, and for children in GMFCS Levels I and II, assessors began testing in Part II, Item 8 and gave full points for Part I. For children with hemiplegia, assessors began testing with Part I, Item 4, and gave full points for Items 1-3. Assessors then continued testing a child until it was apparent that the child was not able to complete further items.

For ECAB Part I, the assessor was instructed to position the child in prone, supine, or sitting, and to tilt the child, as noted on the score form. Then the assessor made a judgment about the child's head righting, sitting balance responses, and protective reactions. For ECAB Part II, the guidelines described by Franjoine and colleagues[10] were modified. The assessor demonstrated each task and provided standardized instructions. The child was allowed up to two practice trials, and the child's best attempt of up to three trials was recorded. Guidelines were provided in the scoring instructions to clarify scoring for partial completion of the test items. If there was any question about scoring a child's behavior, the lower, less mature, less functional score was to be selected, following a conservative scoring rule. Issues with behavior interfering with performance were documented at the bottom of the assessment score sheet.

Prior to data collection, all study therapists obtained greater than or equal to 80% item agreement on videotaped criterion tests, with the study investigators providing 'gold standard' responses.

Data Analysis

Longitudinal Developmental Trajectories

To create development trajectories describing the average change in the ECAB score with respect to age, separate nonlinear mixed-effects models[23] were fit for children in each GMFCS level. Based on inspection of the raw data, which included plots of change in the ECAB over time in individuals within each GMFCS level, and which demonstrated early change followed by a leveling off toward a limit of performance, we chose three asymptotic models that shared these features. The three models shared the same functional form but specified different parameter restrictions or centering (see the statistical supplement for details). These asymptotic models have a rate parameter, an asymptote or limit parameter and, if necessary, an offset parameter to improve model fit. The limit parameter was constrained to be less than or equal to 100, the maximum score of the ECAB. For each GMFCS level, the choice of which model to use was based on Akaike's Information Criteria. To facilitate the interpretation of the rate parameter, it was transformed as 'time-90', which estimates the average time taken for children to reach 90% of their individual ECAB limit. Random effects were fit for each parameter to estimate the variability in the true change parameters among children. Models were fit using the nlme package in R [1].

Reference Percentiles

The reference percentiles describe the distribution of balance scores at each age within each GMFCS level. To calculate reference percentiles, the authors used up to three observed ECAB scores from each child, specifically the scores recorded at their first, 12-month, and 24-month visits. Each observation contributed to a cross-sectional (age-specific and GMFCS-specific) sectional reference percentile that was estimated using quantile regression (QR). The quantregGrowth package in R was used, which uses linear combinations of multiple bases

functions to estimate smooth quantiles across the age continuum and constrains the percentiles to be non-crossing.[24]

We determined a child's ECAB centile score based on their age and GMFCS level, using the calculated percentile scores for all children with baseline and 12 month assessments. The amount of change in each child's percentile score over this twelve-month period was calculated by subtracting the baseline centile score from the twelve-month centiles score. The distribution of these 12-month change scores was used to estimate bands that encompass 50% (range 25-75% change scores) and 80% (range 10- 90% change scores) of changes. These bands quantify the amount of change in percentiles that is typical in this clinical population. Following Hanna et al,[17] we recommend that children whose percentile changes are within the 80% limits can usually be described as 'developing as expected' for their age and GMFCS levels. (See statistical supplement for details.)

Results

Descriptive data for the ECAB is presented in Table 1. Longitudinal trajectories for the ECAB by GMFCS level are shown in Figure 2 with the accompanying model parameters in Table 2. Figure 3 shows the estimated reference percentiles for each GMFCS level, plotted at the 3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 97th percentiles. Additional versions of these figures and the tabulated percentiles are available on the On Track study website: https://www.canchild.ca/en/research-in-practice/current-studies/on-track. Table 3 provides the mean and standard deviation of the change in percentile score over a one-year period by GMFCS level, along with the range of the central 50% and 80% of change scores.

Discussion

Longitudinal trajectories provide useful tools for therapists and families to discuss questions about how well children are doing on the ECAB in relationship to the average values of other children with CP of similar functional ability levels. In general, the ECAB scores follow an asymptotic curve, with a period of change in young children followed by a tapering as children approach their limit on the ECAB. The limits on the ECAB show a clear trend across GMFCS levels; estimated ECAB score (95% CI) at age 12 years was the largest for children at GMFCS Level I and decreased for each GMFCS level. There was no overlap of 95% CIs, indicating clear delineations in average ECAB between levels. This is also reflected in the estimates of the limit parameter across levels (Tab. 2).

We expected that the rate at which children would arrive at their limit on the ECAB would be in accordance with GMFCS level with children with lower functional ability reaching their limit before those with higher functional ability. We found some support for this result. Referring to Table 2 we can observe that the time-90 parameter, the length of time in months required to achieve 90% of ability, generally increases from level V to Level III (children in Level V 34 months, Level IV 45 months, Level III 71 months, Level II 71 months, and Level I 35 months). This difference in the rate of development for children in Level I and for some children in Level II, may be due to a ceiling effect noted for individual children in these levels as early as 3 to 5 years of age. This ceiling effect does not allow us to know the children's true plateau.

Overall, children with CP showed variable responses on the ECAB, even when categorized by GMFCS, which underscores that children with CP have variable development. Of note, the data suggest that children in GMFCS Level II appear to demonstrate highly variable

balance (random effects residual SD = 16.7). The longitudinal trajectories yield information about the course of development for children within a level including variability in their individual ECAB limit and in the number of months it takes to reach 90% of their individual ECAB limit. Because longitudinal trajectories are highly variable, therapists should use them as a prognostic guide for children's current balance development and to predict change in balance, and not to evaluate an individual child's progress over time.

Tracking children's change across time with the reference percentiles indicates how a child is progressing relative to peers of the same ability level and of a similar age. A single assessment permits for an understanding of a child's individual strengths and limitations related to balance. Specifically, the reference percentiles might be useful in flagging balance as a potential area for intervention or, conversely, maybe to indicate that, relative to peers, balance is a strength and thus not an area of for intervention focus. Interventions may be designed to leverage this relative strength in balance so that the child can attempt more challenging balance related tasks for participation or can focus on other areas of need such as strength, coordination, or endurance.

Completing a second ECAB assessment later in time provides an understanding of change in balance abilities over time. This comparison of percentiles allows therapists and families to determine if an individual child with CP is demonstrating ECAB balance scores that are progressing 'as expected,' 'more than expected,' or 'less than expected' over time, depending on their functional ability levels. Relative percentile standing can be much more variable than the measured changes in ability that underlie them, and it is generally true that large changes in percentiles can occur over 12 months, but still be categorized as progressing 'as expected.' Because percentiles represent a relative standing at a moment in time, decisions about services

should be supplemented with an analysis of the child's function via examination of ECAB's raw scores and the context of the testing sessions (i.e. child's cooperation with testing, environmental distractions, etc.).

To illustrate the application of these data to practice, consider Caden (pseudonym), a child tested within the study, who was classified as GMFCS Level III and tested at age 8 years 9 months and then again at age 9 years 6 months. At the first assessment he scored 52 on the ECAB, which for his age and GMFCS level was slightly above the average on the longitudinal trajectory. From a prognostic perspective, balance may begin to plateau as he ages. Using the percentile graphs, his score was at the 65th percentile. At his second visit his ECAB score was 47, which equaled a percentile of 50. Therefore, a 5-point drop in ECAB translated to a 15-percentile point drop between the assessments. This percentile drop places him just lower than within the middle 80% of children at his age and GMFCS (-14 to +22; Table 3), suggesting that he is progressing less than expected. Examination of the actual ECAB test data show that he scored lower at the second test time on several early head and trunk balance and protective response items on the right side and a little higher on several standing items (sit-to-stand, stand with eyes closed and turning 360 degrees). Using all this information can spark a rich discussion among the family, Caden, and the therapist to determine what is occurring and guide potential change in the intervention plan. Perhaps when he was tested at the second time, he was tired and the changes on the earlier test items are erroneous, or perhaps an asymmetry is becoming more apparent. The fact that he has improved on some standing balance activities is positive. Whatever the details are, using the ECAB to track his balance ability across time can inform and assist collaborative interaction between the therapist and family and assist with decision making related to services.

Limitations

The convenience sample used in this study presents a potential limitation; however, the GMFCS distribution of this cohort sample is comparable to incidence data reported in the literature, supporting the applicability of the findings.[20] Additionally, a ceiling effect was noted on the ECAB for individual children in GMFCS levels I and II as early as 3 to 5 years of age. This limits the interpretation of the children's true plateau and suggests additional higher level balance items need to be incorporated into the ECAB or a different measure should be used for children in Levels I and II to allow for further differentiation of balance abilities for children with higher functional ability levels. Finally, two study protocols (a 2-visit and a 5-visit protocol) were merged for the analysis of this work. This led to variation in the number of children who were available to be assessed at each time point.

Conclusion

When used appropriately to monitor development and change over time for children with CP, the ECAB longitudinal trajectories and reference percentiles should assist therapists and families' collaborative interaction to proactively plan services and intervention relative to balance development. Tracking development and intervening at opportune times should lead to improved balance and may subsequently improve gross motor ability and facilitate performance in self-care for children with CP.

Author Contributions and Acknowledgements

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We acknowledge additional On Track Study Team members including academic researchers: Lisa Chiarello, Robert Palisano, Lynn Jeffries, and Jan Willem Gorter; Canadian project coordinator Barb Galuppi; US project coordinator Monica Smersh; and parent researchers: Lisa Diller, Paula Drew, Nancy Ford, Marquitha Gilbert, Tina Hjorngaard, Kimberly Rayfield, and Barbara Sieck Taylor. We thank the participating children and families, whose continued involvement made this study possible. We also acknowledge the important contributions of the regional coordinators as well as the 90 therapists across North America who assessed children during the course of the study.

Ethics Approval

Institutional Review Boards at all participating institutions and recruitment sites with IRBs reviewed and provided ethics approval. All parents or guardians provided informed consent and children, as appropriate and in compliance with the specific IRB, provided assent.

Funding

The On Track Study was funded by the Canadian Institutes of Health Research (MOP # 119276) and the Patient Centered Outcomes Research Institute (Grant # 5321).

Disclosures

The authors completed the ICJME Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest. The statements presented in this work are solely the responsibility of the authors and do not necessarily represent the views of the Patient-Centered Outcomes Research Institute (PCORI), its Board of Governors or Methodology Committee.

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Figure Captions

Figure 1. On track study participant flow diagram (reprinted from McCoy et al, 2017).[19]

Figure 2. Longitudinal developmental trajectories in ECAB Score by GMFCS Level. Model 1 was fit for Level I & II; model 2 was fit for Level III; and model 3 was fit for Levels IV & V. See statistical supplement for details.

Figure 3. Reference percentiles by GMFCS level.

Table 1.
Child and Parent Demographics[a]

Characteristic	Participants for Whom Assessments Were Completed at:		
	Baseline (n = 708)	12 mo (n = 656)	24 mo (n = 424)
Child sex			
Boy	396 (56)	369 (56)	242 (57)
Girl	312 (44)	287 (44)	182 (43)
Child GMFCS level			
I	227 (32)	217 (33)	135 (32)
II	161 (23)	147 (22)	97 (23)
III	80 (11)	73 (11)	48 (11)
IV	129 (18)	116 (18)	75 (18)
V	111 (16)	103 (16)	69 (16)
Child distribution of involvement[b]			
Monoplegia	8 (1)	8 (1)	6 (1)
Hemiplegia	198 (28)	184 (28)	114 (27)
Diplegia	184 (26)	172 (26)	114 (27)
Triplegia	39 (6)	38 (6)	20 (5)
Quadriplegia	278 (39)	253 (39)	170 (40)
Child race[b]			
American Indian/Alaska Native	15 (2)	11 (2)	3 (1)
Asian	40 (6)	37 (6)	18 (4)
Black/African American	60 (8)	56 (8)	45 (11)
White	503 (72)	472 (73)	310 (74)
Multirace	81 (12)	73 (11)	43 (10)
Child ethnicity[b]			
Hispanic	49 (7)	43 (7)	32 (8)
Not Hispanic	654 (93)	610 (93)	390 (92)
Aboriginal	31 (4)	26 (4)	9 (2)
Not Aboriginal	672 (96)	627 (96)	413 (98)
Parent respondent race[b]			
American Indian/Alaska Native	15 (2)	12 (2)	4 (1)
Asian	51 (7)	45 (7)	22 (5)
Black/African American	56 (8)	52 (8)	42 (10)
White	550 (79)	517 (80)	339 (81)
Multirace	26 (4)	22 (3)	12 (3)

Parent respondent ethnicity[b]			
Hispanic	32 (5)	30 (5)	20 (5)
Not Hispanic	669 (95)	621 (95)	400 (95)
Aboriginal	20 (3)	16 (3)	5 (1)
Not Aboriginal	681 (97)	635 (97)	416 (99)
Parent respondent age, y,[b] mean (SD)	37.8 (7.9)	37.9 (8.0)	37.4 (7.1)
Parent respondent relationship to child[b,c]			
Mother	628 (89)	578 (88)	382 (90)
Father	51 (7)	51 (8)	26 (6)
Other	25 (4)	25 (4)	15 (4)
Parent respondent education[b]			
High school or less	160 (23)	147 (23)	92 (22)
Community college/associate's degree	212 (30)	196 (30)	114 (27)
University	328 (47)	307 (47)	214 (51)
Family income[b]			
≥$75,000	306 (52)	293 (53)	190 (52)
$60,000–$74,999	78 (13)	72 (13)	43 (12)
$45,000–$59,999	50 (8)	47 (8)	34 (9)
$30,000–$44,999	58 (10)	49 (9)	35 (10)
≤$30,000	102 (17)	92 (17)	61 (17)
Family composition			
Adults, mean (SD)	2.1 (0.7)	2.1 (0.7)	2.1 (0.7)
Children, mean (SD)	2.3 (1.1)	2.3 (1.1)	2.3 (1.1)
Country			
Canada	347 (49)	330 (50)	137 (32)
United States	361 (51)	326 (50)	287 (68)

[a]Reprinted with permission from McCoy et al.[19]Data are reported as number (percentage) of participants unless otherwise indicated. GMFCS = Gross Motor Function Classification System

[b]Report was based on the available information

[c]Mother = mother, adoptive mother, foster mother, or custodial mother; father = father, adoptive father, or step father; other = grandparent, nursing supervisor, or aunt.

Table 2.

Longitudinal Developmental Trajectories Model Parameters and Predicted Values[a]

Parameter	Values for GMFCS Level:				
	I	II	III	IV	V
Fitted model	1	1	2	3	3
No. of children	227	161	80	129	111
No. of observations	874	611	298	487	443
Mean no. of observations/child	3.9	3.8	3.7	3.8	4.0
Fixed effects					
Limit	98.3	90.6	50.6	25.30	6.46
95% CI	97.7–98.7	86.3–93.6	45.8–55.4	23.3–27.4	5.5–7.6
Time-90 (mo)	34.6	71.0	70.7	45.0	33.7
95% CI	27.8–43.0	54.8–92.1	54.1–92.3	34.4–58.9	15.0–75.6
Outcome at age	94.5	73.0			
95% CI	93.2–95.5	70.8–75.1			
Random effects					
Residual SD	3.9	16.7	6.0	3.76	2.94
50% range					
Limit	96.6–99.2	90.6–90.6[b]	40.4–60.8	19.0–32.9	3.9–10.5
Time-90 (mo)	19.5–61.3	71.0–71.0[b]	21.3–21.3	45.0–45.0	Not estimated
Outcome at age	90.7–96.8	Not estimated			
Population predicted mean (95% CI) for ECAB score					
2 y	54.1 (27.4–71.6)	34.2 (27.9–39.6)	27.4 (24.5–30.5)	17.8 (16.0–19.7)	5.1 (3.8–6.2)
5 y	94.5 (93.4–95.4)	73.0 (71.3–74.7)	43.3 (40.8–45.9)	24.1 (22.6–25.6)	6.3 (5.5–7.1)
12 y	98.3 (97.8–98.6)	89.1 (86.6–91.1)	50.1 (46.5–53.6)	25.3 (23.7–27.0)	6.5 (5.7–7.4)
Change from 2 to 5 y	40.4 (23.2–66.7)	38.8 (32.7–45.5)	15.9 (13.6–17.7)	6.2 (4.8–7.6)	1.2 (0.3–2.1)
Change from 5 to 12 y	3.8 (2.9–4.9)	16.2 (12.5–19.1)	6.8 (4.0–9.9)	1.2 (0.5–2.2)	0.2 (0.0–0.8)

[a]Definitions of fixed and random effects are provided in the statistical supplement. ECAB = Early Clinical Assessment of Balance; GMFCS = Gross Motor Function Classification System.

[b]Negligible random effects for this parameter.

Table 3.

Change in Percentile Scores Over a One-Year Period by GMFCS Level[a]

Parameter	Values for GMFCS Level:				
	I	II	III	IV	V
No. of children	217	147	73	116	103
Mean centile change	3	0	3	5	4
SD for centile change	17	17	16	17	18
25%–75% range for change scores	−2 to +12	−10 to +9	−4 to +9	−7 to +14	−7 to +13
10%–90% range for change scores	−18 to +25	−23 to +19	−14 to +22	−14 to +29	−15 to +29

[a]GMFCS = Gross Motor Function Classification System.