Research Report

Association Between Characteristics of Locomotion and Accomplishment of Life Habits in Children With Cerebral Palsy

Background and Purpose. "Handicap situation" is defined in the literature as "a disruption in the accomplishment of a person's life habits (activities of daily living and social roles)." The purpose of this study was to determine the strength of association between various types of locomotion and the accomplishment of life habits, which is an indicator of the occurrence of handicap situations in children with cerebral palsy. **Subjects.** Ninety-eight children with cerebral palsy, aged 5 to 17.8 years ($\bar{X}$=10.5, SD=3.5), were recruited. **Methods.** The Life Habits Assessment was used to evaluate handicap situations in activities of daily living and social roles. Types of locomotion, the Pediatric Functional Independence Measure (locomotion section), and 2 tests representing functional activities (walking speed and stair climbing) were used as characteristics of locomotion. **Results.** Locomotion capabilities were associated with the accomplishment of activities of daily living and social roles. Performance in variables related to locomotion, number of associated problems, and type of cerebral palsy explained 17% to 74% of the total variance in accomplishment of life habits in children who walked without technical aids. **Conclusion and Discussion.** The results suggest that locomotion might influence the accomplishment of life habits. Other factors, however—such as environmental barriers—should also be examined to determine their impact on the occurrence of handicap situations. [Lepage C, Noreau L, Bernard P-M. Association between characteristics of locomotion and accomplishment of life habits in children with cerebral palsy. *Phys Ther.* 1998;78:458–469.]

Key Words: *Cerebral palsy, Handicap, Locomotion, Social integration.*

Céline Lepage

Luc Noreau

Paul-Marie Bernard

Cerebral palsy (CP) is the most frequent cause of severe physical disabilities in children.[1] Defined as a permanent disorder of movement and posture, it is caused by a defect or a nonprogressive lesion in the immature brain.[2] Children with CP can show a delay in the acquisition of various motor skills such as gross and fine motor functions or speech. This delay may produce functional limitations and bring about disturbance in societal functioning.[3] In 1980, the World Health Organization introduced a model of disablement (the ICDIH conceptual framework) that defined *handicap* as "a disadvantage for a given individual resulting from an impairment or disability that limits or prevents the fulfillment of a role that is normal for that individual."[4] Over the last decade, a conceptual evolution has led to the introduction of the concept of *handicap situations*, which are defined as "disruptions in the accomplishment of a person's life habits (activities of daily living and social roles), taking into account his age, sex and socio-cultural identity, resulting on the one hand from impairments or disabilities and, on the other hand, from environmental factors."[5] This concept illustrates the interaction between (1) the individual characteristics linked to organic and functional consequences of diseases or trauma and (2) the environmental attributes appearing in the person's life context. This interaction is summarized in a conceptual framework: The Handicap Creation Process (Fig. 1).[5]

To our knowledge, only two studies[6,7] have addressed the issue of handicap or the quality of social life in children with CP. Jarvis and Hey[6] evaluated the level of handicap by a questionnaire on various aspects of daily living such as mobility, dependence, school integration, and social resources (71 items). A three-level ordinal scale was used for the quantification of handicap. This study suggested that CP affects the child's ability to participate in normal everyday activities and that children with quadriplegia or diplegia are generally more handicapped than children with hemiplegia.[6] The total handicap score was highly correlated with measures of physical disability and with limited mobility ($r>.70$). In a more general manner, Hirst[7] measured the quality of social life in 89 children with CP and reported that 40% of these children experienced a very restricted social life. Moreover, various combinations of severe functional limitations were associated with a poor quality of social life, and about two thirds of children with walking problems encountered a restricted social life.[7] The results of these two studies suggest that a low level of locomotor capabilities for walking or using a wheelchair will affect mobility and may interfere with activities of

C Lepage, MSc(PT), is Physical Therapist, Rehabilitation Institute of Quebec City, 2975 Chemin St-Louis, Sainte-Foy, Quebec, Canada G1W 1P9 (clepage@craph.org). Address all correspondence to Ms Lepage.

L Noreau, PhD, is Assistant Professor, Department of Rehabilitation, Laval University, Quebec, Canada, and Research Associate, Rehabilitation Institute of Quebec City, Quebec, Canada.

P-M Bernard, MSc, is Professor, Department of Social and Preventive Medicine, Laval University.

This study was approved by the Centre Cardinal-Villeneuve Human Subjects Ethics Committee.

We acknowledge support from The Quebec Health Research Funds, The Rehabilitation Research Consortium of Eastern Quebec, The Cerebral Palsy Research Chair of Laval University, and the Centre Cardinal-Villeneuve (Quebec City).

This article was submitted January 6, 1997, and was accepted October 1, 1997.

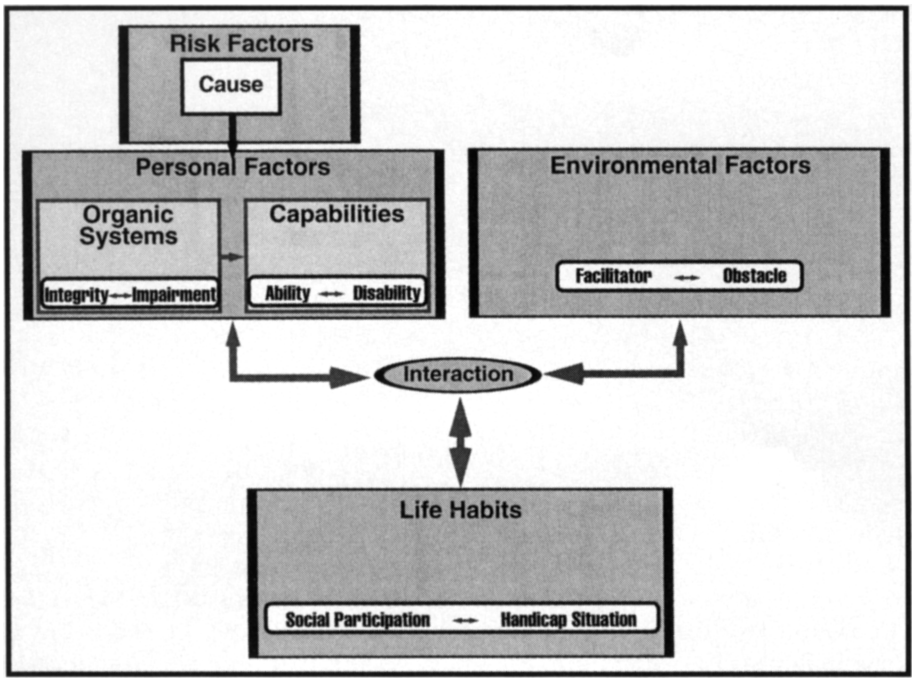

Figure 1.
The Handicap Creation Process: explanatory model of the causes and consequences of disease, trauma, and other health disorders. (Reprinted with permission from Fougeyrollas P, St-Michel G, Bergeron H, et al. *Revision of the Quebec Classification: Handicap Creation Process*. Quebec City, Quebec, Canada: The Quebec Committee on the ICIDH; 1997.)

daily living (ADL), community activities, recreation, or work-related tasks. For example, a child who has reduced locomotion could have difficulties in performing activities related to personal care, gaining access to public buildings (eg, school, post office, community center) on his or her own, or regularly participating in recreational activities. Walking disabilities in combination with other functional limitations would be associated with reduced social contact.[7]

In our study, locomotion consisted of walking with or without technical aids and moving with a manual or a motorized wheelchair. Rehabilitation of children with CP usually includes enhancement of locomotion through gait and mobility training and prescription of assistive aids (eg, orthoses, gait aids, wheelchairs). The development of improved locomotion is often a priority even for people with a severe motor disability.[8] For example, adults with CP have expressed the desire for better locomotion.[9] Among locomotion variables, gait speed is a good indicator of overall function (the ability to ambulate during ADL) and ability to perform functional gait-related activities.[10,11]

We hypothesized that a low level of locomotor capabilities may cause the occurrence of handicap situations. As a first step, we believed the association between characteristics of locomotion and the occurrence of handicap situations should be carefully assessed. Better knowledge of this association could assist clinicians in clarifying the objectives of interventions designed to prevent handicap situations.[12] The main objective of our study, therefore, was to determine the strength of association among different types of locomotion in children with CP and the accomplishment of life habits, which is an indicator of the occurrence of handicap situations (ADL and social roles). Our secondary objective was to identify variables related to the occurrence of handicap situations among children with CP who walk without technical aids.

Method

Recruitment and Subjects

Ninety-eight children, aged 5 to 17.8 years ($\bar{X}$=10.5, SD=3.5), were recruited on a voluntary basis from a potential population of 265 children with CP (residence in Quebec City, Quebec, Canada, metropolitan area) who were admitted into the CP program and the rehabilitation service of the Centre Cardinal-Villeneuve (CCV) (Quebec City, Quebec, Canada). A first contact was initiated by mail to the parents of all potential subjects. The letter described the nature of the study and encouraged the parents and children to participate. The sample was made up of the parents and children who returned a reply coupon.

Data Collection

Characteristics of the children who participated in the study were obtained from the CCV's main and physical therapy files and included type of CP (quadriplegia, diplegia, or hemiplegia), motor dysfunction (spastic, dyskinetic, ataxic, or mixed), and severity (mild, moderate, or severe). This information was verified by the attending physical therapists. The general criteria used to classify the children regarding the impairment type were as follows. In quadriplegia, the whole body is affected.[13] The upper limbs and the trunk are usually more affected than the lower limbs, and head control is poor.[13] In diplegia, the lower limbs are more affected than the upper limbs, and head control is good.[13] In hemiplegia, one side of the body shows some dysfunctions.[13] The degree of severity corresponds to impairment in muscle tone; it is evaluated by experienced physical therapists and based on clinical judgment. Associated problems such as auditory or visual deficits, epilepsy, and speech or language disorders were documented from a questionnaire filled out by the parents and reviewed with the main evaluator (CL). Comprehen-

sion difficulties were noted by the second evaluator (SR) when the child had difficulties understanding simple instructions given during a test of locomotion. Prior to data collection, a pilot test was carried out with 5 children to examine the study procedures.

Each parent was met by the main evaluator. During an evaluation session of approximately 90 minutes in length, the degree of handicap situations was assessed. The parents signed an informed consent statement approved by the CCV Human Subjects Ethics Committee. In order to evaluate the potential association with the occurrence of handicap situations, sociodemographic variables (age, sex, order and number of children in the family, education, type of school attended, place of residence, parents' education and occupation, and annual family income) were documented. The assessment of locomotor variables for each child was done by a second evaluator who had not been informed about the purpose of the study in order to allow blind assessment.

Handicap situations were assessed with the Life Habits Assessment (Life-H, Version 1.0).[5] This tool was developed from the model of disablement proposed by the Quebec Committee of the International Classification of Impairments, Disabilities, and Handicaps.[14] This model is a conceptual evolution of the World Health Organization's model of disablement.[4] Life-H is a global, non–age-specific instrument for determining disruptions in the accomplishment of life habits in persons with disabilities. Life habit is a key concept underlying the comprehension of handicap situations. *Life habits* are defined as "those habits that ensure the survival and development of a person in society throughout his or her life."[5] Specifically, these are ADL and social roles recognized by the sociocultural milieu and normally attributed to the person in his or her life context (Appendix 1). Taking the form of a questionnaire, Life-H measures the level of accomplishment of 248 life habits (or life situations) regrouped in 13 major categories. The level of accomplishment is based on the degree of difficulty and the types of assistance required (technical aids, adaptation, and human assistance) to accomplish the life habit. More than 200 items are applicable to the context of a child's life.

An accomplishment scale (Appendix 2) was developed by the combination of the two concepts (degree of difficulty and required assistance).[5] A raw score was obtained for each life habit category by adding the accomplishment score for each applicable item. Because the children were at different stages of development, all life habits were not applicable to everyone. A life habit that did not make up part of a child's daily life, as reported by the parent, was considered as nonapplicable and consequently did not count in the raw accomplishment score. We obtained the total Life-H score by adding up the raw scores of the 13 categories. The raw score of each category and the total score were expressed on a continuous scale from 0 to 10 in order to take into account variations in the number of applicable items for each child. A simple computer program was developed to obtain the different scores.

This is the first experimentation using Life-H in children with CP. The content validity of Life-H has been established with a group of rehabilitation experts (researchers, clinicians, and consumers).[5] A study with children having myelodysplasia showed a good level of test-retest reliability over 2 weeks ($.45 \leq$ intraclass correlation coefficients $\leq .77$) for most life habit categories.[5] Data were collected by the main evaluator, who participated in the design of the instrument and who has many years of clinical experience with children who have CP. This helped ensure the accuracy of the measure over the data collection period (2 months). For the purpose of our study, the accomplishment scale was slightly adapted to quantify the degree of human assistance in order to increase the sensitivity of the scale (from 0.5 to 1). This modification allowed us to take into account the marked differences observed between children as to the level of human assistance required to accomplish the life habits. Human assistance was noted on 4 levels: (1) minimal assistance, (2) 25% to 49% assistance, (3) 50% to 74% assistance, and (4) maximum assistance. The percentage corresponds to the assistant's average participation in the accomplishment of life habits.

The most frequent type of locomotion used by the children was noted: walking with or without technical aids (tibial orthoses, walkers, or crutches), using a manual or motorized wheelchair, or crawling. In children walking without aids or orthoses, the locomotion section of the Pediatric Functional Independence Measure (WeeFIM) was used to determine locomotor capabilities.[15] The WeeFIM measures the disability level of different areas in children from 6 months to 7 years of age.[15] This instrument can also be used for older children ($\geq$7 years of age) when they show a deficit of motor development. The content validity of WeeFIM was rated by a panel of interdisciplinary experts.[16,17] The test-retest reliability ($.83 \leq r \leq .99$) and interrater reliability ($.74 \leq r \leq .96$) have been established in school-aged children with motor impairments.[18] The WeeFIM locomotion section consists of 2 items: (1) locomotion (walking, using a wheelchair, or crawling) and (2) stair climbing. Each task was evaluated on a 7-point ordinal scale ranging from complete dependence (1) to complete independence (7), taking into account the type and amount of assistance (human assistance and technical aids) required to perform ADL (Appendix 3). In order

Table 1.
Distribution of Subjects According to Type and Severity of Cerebral Palsy (CP) and the Type of Locomotion Used

		Type of Locomotion					
		Walking		Wheelchair			
Type of CP	Severity	No Technical Aids	Technical Aids	Manual	Motorized	Crawling	Total
Hemiplegia	Mild	20					20
	Moderate	10	2				12
Diplegia	Mild	8					8
	Moderate	4	7	2		1	14
	Severe		1				1
Quadriplegia	Mild	6	1	2			9
	Moderate	2	1	8	4	1	16
	Severe			10	8		18
Total		50	12	22	12	2	98

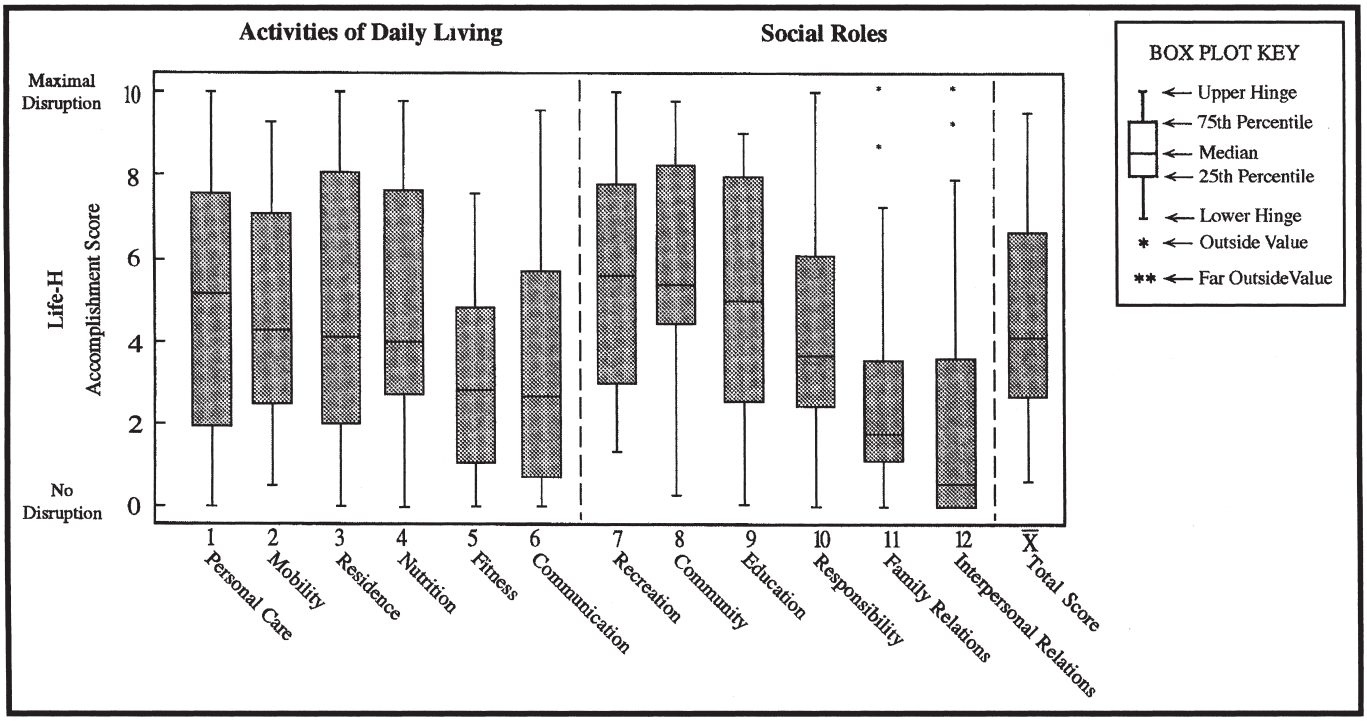

Figure 2.
Disruptions in accomplishment of life habits according to activities of daily living (1–6) and social roles (7–12). Life-H = Life Habits Assessment (Version 1.0).[5]

to attain the secondary objective of our study, 2 additional tests were used to measure locomotor performance. Walking speed was recorded with a stopwatch as children started at a line and then accelerated over 45 m on a marked walkway. If a child adopted a running mode instead of walking mode, the test was repeated. The time necessary to ascend and descend a flight of stairs (12 steps) was measured. Such tests are commonly used in clinical settings.

Data Analysis

Variation in the degree of accomplishment in 12 categories of ADL and social roles was illustrated using box plots. The employment category was not considered because only 5 subjects were in a situation of gainful employment. An analysis of variance (ANOVA) and tests of multiple comparisons (Tukey) were used to identify differences in the Life-H scores according to the types of locomotion (walking with or without technical aids, using a manual or motorized wheelchair). Two children who moved by crawling were excluded from the analysis. The Life-H scores of children who walked and of children who used a wheelchair were compared with *t* tests. In children who were able to walk without technical aids, a correlation analysis was used to determine the strength of association between Life-H item scores and walking

Table 2.
Differences Between the Life-H Scores ($\bar{X}\pm SD$) According to the Types of Locomotion

	Type of Locomotion				*Post Hoc* Tests (Tukey)[a]					
	Walking		Wheelchair							
Life Habit	(a) No Technical Aids (n=50)	(b) Technical Aids (n=12)	(c) Motorized (n=12)	(d) Manual (n=22)	a vs b	a vs c	a vs d	b vs c	b vs d	c vs d
Nutrition	2.9±1.7	3.6±2.4	7.5±1.8	7.7±2.5		*	*	*	*	
Fitness	1.6±1.2	2.5±1.8	5.3±1.1	5.3±1.9		*	*	*	*	
Personal care	3.1±1.9	4.2±2.6	7.8±0.8	8.2±1.2		*	*	*	*	
Communication	1.8±1.9	2.3±2.6	4.7±2.0	7.0±3.0		*	*	+	*	+
Residence	2.3±1.4	4.9±1.6	8.7±1.4	8.6±1.8	*	*	*	*	*	
Mobility	2.6±1.3	5.0±1.7	6.4±1.7	8.1±1.3	*	*	*		*	*
Responsibility	2.9±2.1	3.1±3.1	4.6±2.0	7.5±2.9			*		*	*
Family relations	1.5±1.4	2.0±1.1	3.4±1.9	4.9±2.3		*	*		*	
Interpersonal relations	1.2±1.8	1.7±2.0	1.1±1.5	4.1±3.6			*		+	*
Community	4.1±1.5	5.5±1.9	7.8±1.0	8.4±1.6	+	*	*	*	*	
Education	2.9±2.3	3.6±2.8	6.7±1.7	8.7±1.3		*	*	*	*	+
Recreation	3.6±1.7	5.6±1.6	7.3±1.1	8.5±1.3	*	*	*	+	*	
Total score	2.7±1.2	4.2±1.7	6.6±1.2	7.8±1.4	*	*	*	*	*	

[a] Asterisk (*) signifies $P<.01$; plus sign (+) signifies $.01<P\leq.05$.

speed and between Life-H item scores and stair-climbing performance. A multiple linear regression analysis allowed the determination of association between Life-H scores (dependent variables) and a set of independent variables (walking speed, stair-climbing performance, WeeFIM locomotion score, number of associated problems, type of CP). Correlational and regression analyses were not performed for children walking with technical aids or using a wheelchair because of the small number of children in these categories. Potentially confounding variables such as age, sex, and life milieu (urban or rural) were considered. To prevent alpha level inflation due to multiple analyses, significance of statistical analyses was fixed at the .01 level.

Results

The sample and base population did not differ for age ($\bar{X}=10.5$, SD=3.5, range=5–17.8 years versus $\bar{X}=11.1$, SD=3.6, range=5–17.8 years; $t=-1.64$, $P=.10$), sex (female=52% versus 48%, $\chi^2=.65$, $P=.46$), and type of CP ($\chi^2=.40$, $P=.86$). Subjects of the sample presented some associated problems: visual problems (n=43), auditory problems (n=8), epilepsy (n=27), speech or language disorders (n=57), and comprehension difficulties (n=15).

Examination of the type and severity of CP revealed that severe impairment was found exclusively in individuals with quadriplegia (except for 1 participant with diplegia), whereas mild and moderate impairments were more equally distributed within the three types (Tab. 1). Most participants (n=90) used the same means of locomotion inside and outside their residence ($\chi^2=.23$, $P=.59$). The children who moved around by creeping or crawling in the house (n=8) used a wheelchair for outdoor mobility. The locomotion type was associated with type and severity of CP (Tab. 1). All children with hemiplegia or mild diplegia were able to walk. Conversely, 88% of children with moderate or severe quadriplegia used a wheelchair.

In a previous report,[19] we noted disruptions in the accomplishment of all life habit categories (Fig. 2). There is large variability in each category of life habits. The level of disruption was particularly high except for two categories related to social roles (family and interpersonal relations, $P<.01$). Among the most disrupted categories, 3 social roles (recreation, community, and education) had a direct link with school and social integration. Moreover, we noted that the type of CP and its severity were related to the accomplishment of life habits. Generally, children with hemiplegia were less disturbed in their life habits than children with moderate or severe quadriplegia were. Children with moderate or severe quadriplegia showed large disruptions in life habits.

Locomotion Types and Disruptions in Life Habits

In the main analysis, the mean Life-H scores were compared with the type of locomotion (walking without technical aids, n=50; walking with technical aids, n=12; use of a manual wheelchair, n=22; use of a motorized wheelchair, n=12) (Tab. 2). Differences between children who walked (n=62) and children who used a wheelchair (n=34) were noted for the total Life-H score and for the scores for each life habit category ($3.36\leq t\leq 14.02$, $P<.001$). The ANOVA showed differences in the total Life-H score and all life habit category scores among the 4 types of locomotion ($8.75\leq F\leq 112.44$, $P<.001$). Differences related to Life-H scores

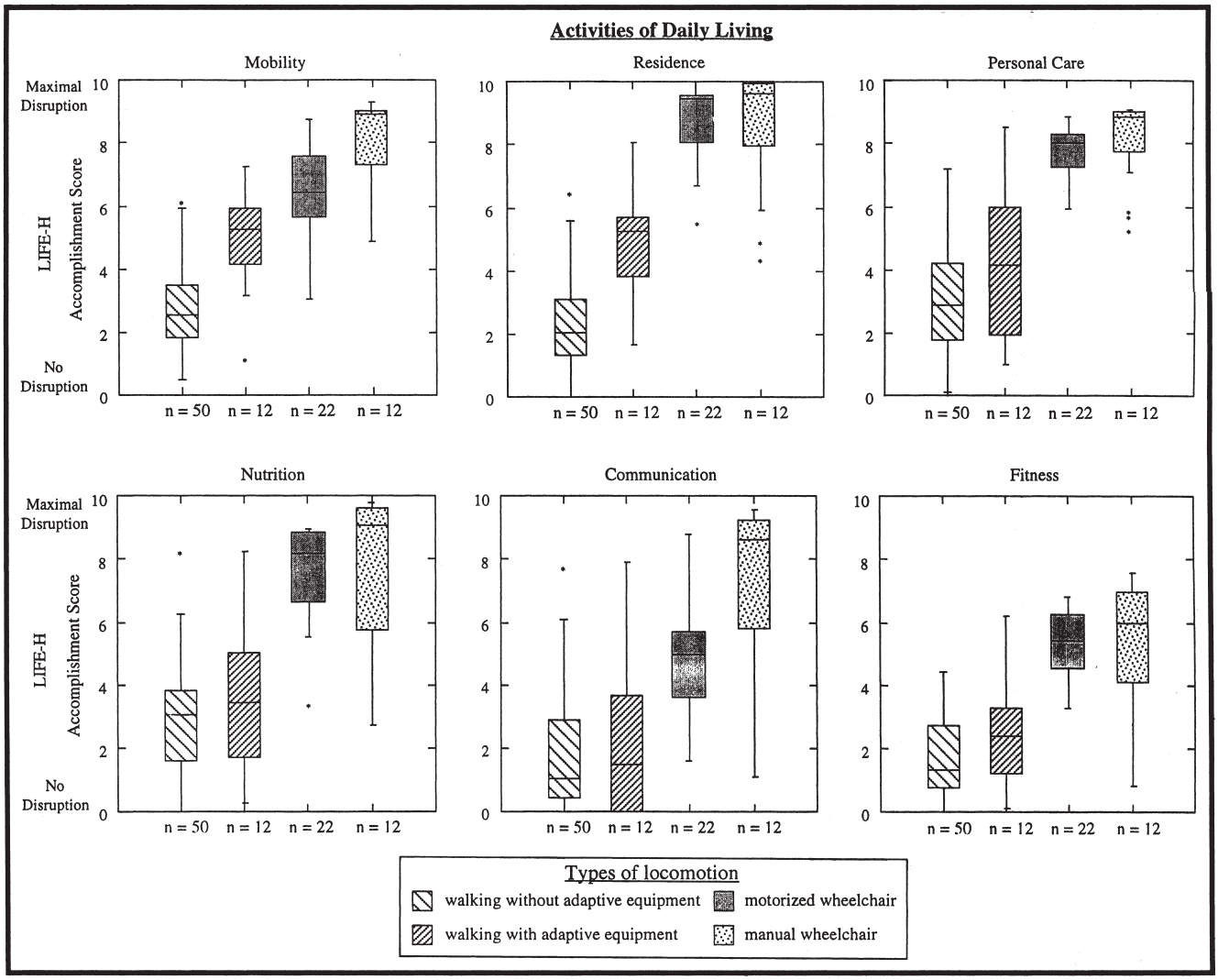

Figure 3.
Disruptions in accomplishment of life habits (activities of daily living) according to the type of locomotion (n=96). Two children who moved by crawling were excluded from the analysis. Asterisk (*) indicates outlier; double asterisk (**) indicates extreme outlier. F values obtained from analysis of variance comparing means of accomplishment scores. Life-H=Life Habits Assessment (version 1.0).[5]

are illustrated by box plots for ADL (Fig. 3) and social roles (Fig. 4).

Tests of multiple comparisons (Tukey) indicated that differences in Life-H scores were particularly marked between children who walked without technical aids (n=50) and children who moved around in a manual wheelchair (n=22) (Tab. 2). Although somewhat lower, differences were noted between children who walked with technical aids (n=12) and children who used a motorized wheelchair (n=12) for the total Life-H score and the scores for 8 life habit categories. Differences in Life-H scores were also observed between children who walked without technical aids (n=50) and children who walked with technical aids (n=12) for the total Life-H score and scores for 4 life habit categories (ie, residence, mobility, community, and recreation).

Furthermore, differences in Life-H scores were noted between children who used a motorized wheelchair (n=12) and children who used a manual wheelchair (n=22) in 5 life habit categories. Although all children who moved around in a wheelchair (manual or motorized) showed approximately the same type of motor impairment, a larger proportion of children who used a manual wheelchair showed associated problems compared with children who used a motorized wheelchair: visual problems, 59% versus 33% (P=.15); auditory problems, 23% versus 0% (P=.14); epilepsy, 55% versus 17% (P=.07); and comprehension difficulties, 50% versus 0% (P=.003).

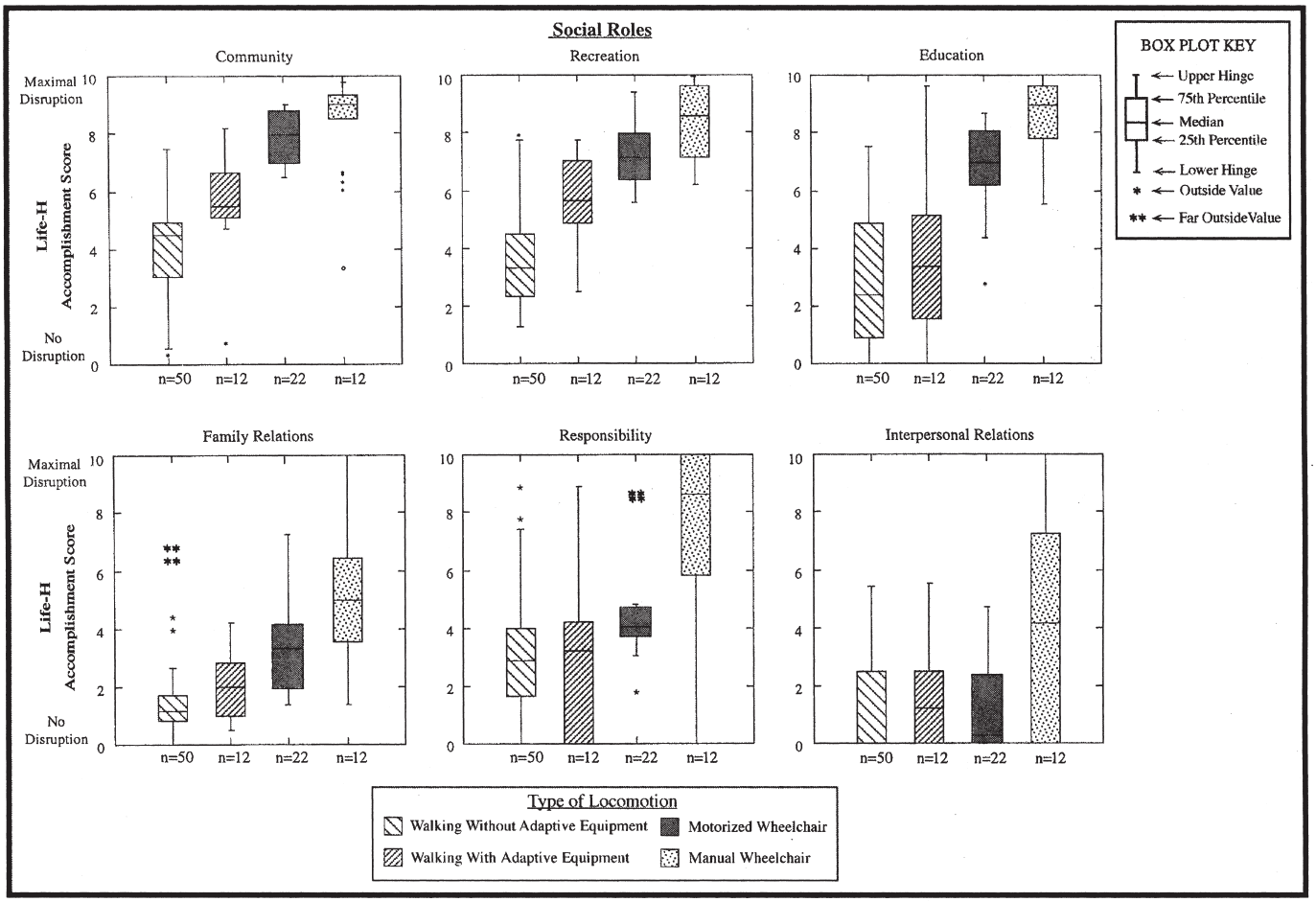

Figure 4.
Disruptions in accomplishment of life habits (social roles) according to the type of locomotion (n=96). Two children who moved by crawling were excluded from the analysis. Asterisk (*) indicates outlier; double asterisk (**) indicates extreme outlier. F values obtained from analysis of variance comparing means of accomplishment scores. Life-H=Life Habits Assessment (version 1.0).[5]

Disruptions in Life Habits Among Children Walking Without Technical Aids

Correlational and multiple regression analyses were performed for children without comprehension difficulty who walked with no technical aids (n=47). In order to obtain a homogeneous group, 3 children were excluded because of "comprehension difficulties." Significant correlations were observed between disruption in the accomplishment of 6 life habits and locomotion variables (walking speed and stair-climbing performance). The disruptions in life habits were slightly more correlated with stair-climbing performance ($.38 \leq r \leq .82$, $P \leq .015$) than with walking speed ($-.29 \leq r \leq -.60$, $P \leq .05$) (Tab. 3).

Regression analysis showed that some variables (timed stair-climbing performance, number of associated problems, walking speed, WeeFIM locomotion score, and type of CP) explained from 17% to 74% of the total variance in the disruption of 6 life habit categories and in the total Life-H score (Tab. 4). The results of the stair-climbing test explained the largest percentage of the variance (22%–66%) in the disruption in 4 life habit categories (mobility, community, recreation, and residence). In the models tested, the variables (age, sex, life milieu [urban or rural]) did not contribute to the explained variance.

Discussion

Improvement of mobility and locomotion is an important objective of the rehabilitation of children with CP. Despite a great concern of rehabilitation professionals for the development of motor capabilities, the potential influence of motor function on social integration of children with CP remains to be carefully examined. In our study, characteristics of locomotion in children with CP were evaluated and the association with the accomplishment of life habits (occurrence of handicap situations) was analyzed. To our knowledge, our study is the first to attempt to document the relationship between locomotion (walking and wheelchair) and handicap situations in these children.

Table 4.
Percentage of Partial and Total Variance in Disruption in Accomplishment of Life Habits (Dependent Variables) Explained by the Independent Variables in Subjects Who Walked Without Technical Aids (n=47)[a]

	Independent Variable						
Dependent Variable	Stair-Climbing Test (%)	+	No. of Associated Problems (%)[b]	+	Others (%)	=	Total Variance (%)
Total score	47		7		4[d]		58
Mobility	66		2		6[d]		74
Community	37		7				44
Recreation	33		5				38
Education	3[c]		19		6[e]		29
Residence	22						22
Fitness	11				6[f]		17

[a] Three children were excluded because of comprehension difficulties.
[b] Associated problems: visual, auditory, epilepsy, and speech and language disorders.
[c] $P=.12$.
[d] Type of cerebral palsy.
[e] WeeFIM locomotion score.
[f] Walking speed.

As previously reported for this group of children,[19] the type and severity of CP was associated with the disruption in accomplishment of life habits and thus potentially contributed to the occurrence of handicap situations. We believe that this finding confirms observations that there is a trend toward a more restricted social life in the presence of severe functional limitations.[7] In agreement with previous reports,[6,7] our results suggest that motor disabilities, and more specifically locomotor capabilities, are related to disruptions in life habits. One of the most important findings of our study was that locomotor variables explained a larger percentage of variance in disruptions of life habits than did some of the impairments (eg, type of CP) in children who walked without technical aids. According to Hirst,[7] when indexes of impairments and disabilities are combined, a stronger association with the quality of social life can be observed. Consequently, evaluation of locomotor and other motor capabilities is important for establishing a prognosis regarding independence in ADL and social roles.

Table 3.
Correlations[a] Between the Disruption in the Accomplishment of Life Habits and Locomotion Variables (Walking Speed and Stair-Climbing Performance)

	Locomotion Variable			
	Walking Speed		Stair-Climbing Performance	
Life Habit	*r*	*P*	*r*	*P*
Personal care	−.340	.021	.550	.000
Residence	−.345	.018	.483	.001
Mobility	−.601	.000	.817	.001
Community	−.487	.001	.620	.001
Education	−.290	.050	.378	.010
Recreation	−.358	.014	.588	.001
Total score	−.423	.003	.694	.003

[a] Pearson product-moment correlation coefficients (r).

Types of locomotion were associated with the accomplishment of life habits in children with CP. This finding suggests that a higher level of locomotor capability might favor the accomplishment of life habits and might limit the occurrence of handicap situations. Children who walked accomplished several life habits more easily compared with children who used a wheelchair. This result is in agreement with clinical observations that suggest that independent walking facilitates participation in some life habits (recreational and educational activities). For example, children with CP who have better locomotor skills can get to their local school independently instead of depending on special transportation. Other factors, however, might influence the strength of this association. One of these factors is the associated problems encountered in these children, as shown by the variance in the category "education" that was explained by this factor. Moreover, we have observed that a larger proportion of children using a wheelchair presented associated problems and comprehension difficulties compared with children who walked. Consequently, the presence of these characteristics in children with CP would entail a higher level of disruptions in accomplishment of life habits and, as previously observed,[7] may lead to a very restricted quality of life.

Differences in the Life-H scores among the locomotion types were found in 3 categories of ADL (ie, residence, mobility, and personal care) and 3 categories of social roles (ie, recreation, community, and education). Accomplishment of life habits related to ADL necessitate an appropriate level of motor and locomotor capabilities in order to overcome architectural barriers. Further-

more, in several situations, the use of a wheelchair may elicit negative attitudes from the people around the child and produce a reaction of withdrawal from activities favoring social integration. Hirst[7] reported that extreme social isolation is not a direct consequence of impairment or disability, but that it might arise from severe functional loss and other factors such as dependency on others, restricted choices, physical barriers, lack of self-confidence in social skills, or previous experience of rejection. Actually, both ADL and social roles have to be carried out in different environments, and we can estimate that school and social environments are those presenting the most severe environmental barriers of various origins (architectural, physical, attitudinal, and other societal barriers).

Another finding of our study was the association among walking speed, stair-climbing performance, and the accomplishment of life habits in children who walked without technical aids. The stair-climbing test seems highly associated with the disruptions in the accomplishment of life habits related to school and social participation. This test is probably a better indicator of motor capabilities of a child than walking speed is. We hypothesize that stair climbing demands more balance, coordination, strength, and muscle control than walking demands. Thus, these results suggest that a higher level of motor capabilities could facilitate the accomplishment of some life habits, especially in the presence of architectural barriers. For example, in children who are unable to climb stairs, participation in leisure activities held in nonaccessible buildings can be compromised.

This study has some limitations related to the sample and the measures used. First, the small number of children recruited in specific subgroups (ie, children using a motorized wheelchair and children walking with technical aids) did not allow us to perform some statistical analyses. This difficulty is frequently mentioned in reports of studies of children with CP.[20] Second, a misclassification error may be a factor in the measure of severity of CP. Indeed, there are difficulties in establishing objective criteria for the severity of CP.[6,21] This bias could bring an underestimation of disruptions even though the assessment of severity was performed by experienced therapists. A bias could also have been introduced into our study through the parents' responses to Life-H. According to Young et al,[22] however, there would be no difference between the responses of parents and children regarding their physical disabilities.

We did not measure the impact of environmental barriers, which limits the analysis of the influence of these factors on the occurrence of handicap situations. As previously discussed,[19] a new tool has been used to assess the concept of handicap situations in persons with disabilities. Currently, there is no standard or profile of accomplishment of life habits in individuals without disabilities. Further research should provide data that will allow the establishment of such a profile and the comparison of various groups of persons with disabilities. Finally, because the children were from the same rehabilitation center, the results cannot be generalized for all children with CP.

Conclusion

This study provides evidence that locomotor capabilities are associated with the accomplishment of ADL and social roles and, therefore, may be causally implicated in the occurrence of handicap situations. Nonetheless, the presence of associated problems and comprehension difficulties might also be related to handicap situations encountered by children with CP. Given that social integration remains a major goal in rehabilitation, research on this issue should be encouraged in order to clarify the real impact of rehabilitation interventions focusing on impairments and disabilities and those aiming at modifying some aspects of the person's life milieu (environmental factors). Future studies are needed to design and test a model incorporating the complex interactions between impairment and disability in combination with the full scope of environmental and societal constraints.

Acknowledgments

We acknowledge the contributions of Sophie Roy (the second evaluator), Gilles-Pierre Drapeau, and Lucie Boudreault for their technical and clinical support. We also acknowledge all parents and their children who participated in this study. We are indebted to Dr Carol L Richards for her valuable comments on the manuscript.

References

1 Hutton JL, Cooke T, Pharoah PO. Life expectancy in children with cerebral palsy. *BMJ.* 1994;13:431–435.

2 Bax MCO. Terminology and classification of cerebral palsy. *Dev Med Child Neurol.* 1964;6:295–297.

3 Campbell SK. Framework for the measurement of neurologic impairment and disability. In: Lister MJ, ed. *Contemporary Management of Motor Control Problems: Proceedings of the II Step Conference.* Alexandria, Va: Foundation for Physical Therapy Inc; 1991:143–153.

4 *International Classification of Impairments, Disabilities, and Handicaps.* Geneva, Switzerland: World Health Organization; 1980.

5 Fougeyrollas P, Noreau L, Bergeron H, et al. Social consequences of long-term impairments and disabilities: conceptual approach and assessment of handicap. *Int J Rehabil Res.* In press.

6 Jarvis S, Hey E. Measuring disability and handicap due to cerebral palsy. *Clinics in Developmental Medicine.* 1984;87:35–45.

7 Hirst M. Patterns of impairment and disability related to social handicap in young people with cerebral palsy and spina bifida. *J Biosoc Sci.* 1989;21:1–12.

8 Perry J. *Gait Analysis: Normal and Pathological Function.* Thorofare, NJ: Slack Inc; 1992:179–181, 485–487.

9 Goldberg MJ. Measuring outcomes in cerebral palsy. *J Pediatr Orthop.* 1991;11:682–685.

10 Rose SA, Ounpuu S, DeLuca PA. Strategies for the assessment of pediatric gait in the clinical setting. *Phys Ther.* 1991;71:961–980.

11 Drouin LM, Malouin F, Richards CL, Marcoux S. Correlation between the Gross Motor Function Measure scores and gait spatio-temporal measures in children with neurological impairments. *Dev Med Child Neurol.* 1996;38:1007–1019.

12 Wood-Dauphinee S, Arsenault B, Richards CL. Outcome assessment in rehabilitation: overview of the 2nd National Rehabilitation Research Conference. *Canadian Journal of Rehabilitation.* 1994;7:171–184.

13 Bobath B, Bobath K. *Motor Development in the Different Types of Cerebral Palsy.* London, England: William Heinemann Medical Books Ltd; 1982.

14 Fougeyrollas P, St-Michel G, Bergeron H, Cloutier R. The Handicap Creation Process: new full proposals. *ICIDH International Network.* 1991;4(1–2):18–37.

15 Granger CV, Braun S, Grisworld K, et al; Gautheron V, Minaire P, trans. *Guide Pour l'Utilisation du Système Uniforme de Données Pour la Médecine de Rééducation et Réadaptation: Incluant la Mesure de l'Indépendance Fonctionnelle Pour Enfants.* New York, NY: Research Foundation, State University of New York; 1991.

16 McCabe MA, Granger CV. Content validity of a pediatric functional independence measure. *Appl Nurs Res.* 1990;3:120–122.

17 McCabe MA. *Evaluating the Validity and Reliability of the Pediatric Functional Independence Measure.* Chicago, Ill: Rush University, College of Nursing; 1991.

18 Msall ME, DiGaudio KM, Duffy LC. Use of functional assessment in children with developmental disabilities. *Physical Medicine and Rehabilitation Clinics of North America.* 1993;4:517–527.

19 Lepage C, Noreau L, Bernard P-M, Fougeyrollas P. Profile of handicap situations in children with cerebral palsy. *Scand J Rehabil Med.* In press.

20 Boyce WF, Gowland C, Rosenbaum PL, et al. The Gross Motor Performance Measure: validity and responsiveness of a measure of quality of movement. *Phys Ther.* 1995;75:603–613.

21 Palisano R, Rosenbaum P, Walter S, et al. Development and reliability of a system to classify gross motor function in children with cerebral palsy. *Dev Med Child Neurol.* 1997;39:214–223.

22 Young NL, Yoshida KK, Williams JI, et al. The role of children in reporting their physical disability. *Arch Phys Med Rehabil.* 1995;76:913–918.

Appendix 1.

Examples of Items Applicable to Children Used in the Long Form of the Life Habits Assessment (Version 1.0)[5]

Category	No. of Items	Examples of Life Habits
Nutrition	19	Reheating a meal that is already prepared Setting and clearing table
Fitness	5	Doing indoor fitness activities to maintain or improve physical fitness Carrying out relaxation activities
Personal care	33	Taking bath or shower Donning and doffing orthoses and protheses
Communication	11	Keeping up a conversation Using a phone at home
Residence	24	Keeping room in order Taking care of personal belongings (books, equipment of leisure)
Mobility	43	Moving from one room to another in home Getting to and entering area recreation centers
Responsibility	9	Respecting others' rights Recognizing the value of money
Family relations	9	Having an emotional relationship with parents Taking part in social activities with parents
Interpersonal relations	5	Having friendly relationship Having social contacts with those around you (people with whom you study or share recreational activities)
Community	12	Taking part in activities of social groups (eg, Scouts) Using a vending machine
Education	11	Doing practical coursework (eg, laboratories, science, computer) Taking part in activities organized by the school (extracurricular, special days)
Employment	2	Looking for temporary employment (eg, seasonal, student employment) Carrying out specific tasks relating to work
Recreation	27	Taking part in group outdoor play Taking part in artistic activities (music, painting, dance, theater)
Total	210	

Appendix 2.

Scoring of the Modified Scale of Accomplishment of Life Habits Adapted From the Life Habits Assessment (Version 1.0)[5]

Score	Description
0	Performed without difficulty
1	Performed without difficulty (technical aid or adaptation)
2	Performed with difficulty (no help)
3	Performed with difficulty (technical aid or adaptation)
4	Performed without difficulty (minimal human assistance)[a]
5	Performed without difficulty (technical aid or adaptation, and minimal human assistance)[a]
6	Performed with difficulty (minimal human assistance)[a]
7	Performed with difficulty (technical aid or adaptation, and minimal human assistance)[a]
8	Performed by substitution (maximal human assistance)[b]
9	Not performed
N/A	Not applicable

[a] 25%–74% human assistance increases the score of 0.5.

[b] "By substitution" means that the person does not actively participate in the accomplishment of the life habit. This activity is entirely performed through human assistance.

Appendix 3.

Scoring Scale of the Pediatric Functional Independence Measure (WeeFIM)[15]

Level	Scoring Scale (WeeFIM Score)
	No helper
7	Complete independence (timely, safely)
6	Modified independence (device needed)
	Helper
	Modified dependence
5	Supervision[a]
4	Minimal assistance (child=75%–99%)
3	Moderate assistance (child=50%–74%)
	Complete dependence
2	Maximal assistance (child=25%–49%)
1	Total assistance (child=0%–25%)

[a] Presence without physical contact or need to place adaptive equipment.