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Relationship between Function and Health-Related Quality of Life of School-Aged Children with Cerebral Palsy

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Abstract. [Purpose] To determine the correlation between function, measured by the functional independence measure for children (WeeFIM) and health-related quality of life (HRQOL), measured by the child health questionnaire (CHQ-PF28) for children with cerebral palsy (CP), and to find out which child and parent factors related with each of these measures. [Subjects] One hundred fifty-five school-aged children with CP (89 boys, 66 girls) and their mothers. [Methods] Two physical therapists evaluated function and HRQOL using the WeeFIM and the CHQ-PF28 individually through interviews with the mothers of the subjects. [Results] Severer GMFCS levels were associated with lower functional ability, physical and psychosocial quality of life. The correlation between total WeeFIM score and Physical Summary Score (PHS) was r=0.48. Social cognition correlated fairly well with Psychosocial Summary Score (PSS) (r=0.26). Epilepsy was significantly related with lower PHS, PSS, WeeFIM total score and all the subscale scores. GMFCS was related with all the scales except the PSS. [Conclusion] The WeeFIM and CHQ-PF28 appear to assess related but different constructs, so there is a need to incorporate complementary measures when evaluating function and HRQOL of children with CP. Child factors such as epilepsy and GMFCS were more associated with functional status and well-being of school-aged children with CP than parental factors in Korea.
Key words: Health-related quality of life, Function, Cerebral palsy

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INTRODUCTION

Children with cerebral palsy (CP) develop a spectrum of motor functional outcomes, frequently with a variety of comorbidities. These outcomes potentially affect not only the child's functioning, but also their health-related quality of life (HRQOL). Therefore, function and HRQOL are both considered important as indicators of outcome in the field of physical therapy for children with CP[1)]. Niewczyk and Granger[2)] noted the importance of a clear definition of terms when assessing outcomes, stating that function refers to a person's ability to perform basic daily living skills such as eating, toileting, grooming, walking, and interacting with others, whereas HRQOL refers to an overall assessment of well-being across various domains such as physical and psychosocial well-being[3)].

Most research related to the quality of life or HRQOL, for individuals with CP has shown that physical well-being is positively correlated with mobility and that mobility dose not correlate consistently with psychosocial well-being[4–7)]. Grilli et al.[8)] reported associations between activities of daily living (ADL) and HRQOL using the functional independence measure (WeeFIM) and the pediatric quality of life inventory (PedsQL4,0) individually for children with global developmental delay. In their study, they concluded that the WeeFIM mobility and self-care areas were each fairly well correlated with PedsQL-Physical Health Summary Score. Liu et al.[1)] demonstrated that mobility function may be good indicator of the physical component of HRQOL, but is a poor indicator of the psychosocial component of HRQOL in CP.

The field of pediatric physical therapy needs to perform more outcome research using appropriate measurement tools, to provide valuable information to researchers, therapists, and families. A popular, well-validated and highly reliable pediatric functional outcome measure is the WeeFIM[9)]. Despite numerous newly published instruments for measuring HQOL in children with CP, the Child Health Questionnaire (CHQ) is widely used[10)].

In the qualitative study of the HRQOL of CP, it is another issue to find out factors that affect quality of life of CP. It is reported that the severity of CP has a significant relationship with quality of life of children with CP[7)]. Parental factors, functional status, mental health, age, gender, and type of CP

are regarded as affecting factors11. However, these factors change with cultural background and so far it has not been possible to compare worldwide differences in traits because of the small number of reports from non-diverse nations.

Examining the relationship between function and HRQOL is important to determine the optimal treatment outcome that addresses the highest achievable functional goals[12–17]. To our knowledge, the impact of function on HRQOL of Korean children with CP has never been discussed because there has been no study related to the HRQOL of children with CP in the Korean population. Therefore, the primary objective of this study was to determine whether parent's perception of their child's HQOL is correlated to functional status among school-aged children with cerebral palsy. A second objective was to examine child and parent factors related to each measure.

SUBJECTS AND METHODS

Subjects

The subjects were 155 children with CP (89 boys and 66 girls, mean age, 9.2 ± 1.5 years; mean height, 121.4 ± 14.3 cm; mean weight, 22.0 ± 7.3 kg, IQ≤70) and their mothers from three elementary schools for physically disabled children in Korea. The CP subjects had no history of newly developed neurological problems, musculoskeletal disorders, or botulinum toxin injections within the previous six months. The present study was approved by CHA Bundang Medical Center, CHA University Institutional Review Boards and written parental consent was also obtained.

Methods

Participants with CP were categorized by GMFCS levels I to V (I, walks without restrictions; II, walks with limitations, III, walks using a hand-held mobility device; IV, self mobility with limitations; V, transported in a manual wheelchair). Both researchers had followed a training session for the WeeFIM, measurements of the CP type, tone distribution, and GMFCS levels. The face-to-face interview with the mothers of the subjects took place at the school. The interview consisted of administration of three assessment tools, a study questionnaire and two measures (the WeeFIM and the CHQ-PF28), which are described below.

The study questionnaire included questions regarding general characteristics of the sample: gender, age, height, weight, grade, schooling, area of domicile, mother's work status, mother's education level, and parents' marital status.

The WeeFIM contains 18 measurement items that are divided into 6 areas: self-care (6 items), sphincter control (2 items), transfer (3 items), locomotion (2 items), communication (2 items), and social cognition (3 items). It measures usual performance to criterion standards for children with developmental disabilities aged 6 months – 12 years. An example of one of the questions included in the WeeFIM is: "I'm interested in how your child gets around most of the time. Does he or she walk, use a wheelchair or crawl?" The child's performance on each item is scored on a 7-point scale, 1 indicating complete dependence and 7 signifying complete independence. A total raw score was calculated for the WeeFIM as well as a raw score for each of the subscales. Scoring procedures were consistent with the procedure outlined by the WeeFIM training manual (WeeFIM SystemSM 1998). This tool was chosen because methods of administration include interviews (face-to-face or telephone) or direct observation[18,19].

The CHQ-PF28 is designed to measure the physical and psychosocial well-being of children above 5 years of age, regardless of the presence or type of disability[20]. The CHQ-PF28 is a 28-item caregiver-completed questionnaire that asks questions about the child in 14 domains contributing to HQOL. A 5-point scale is used for each item, and items are reverse-scored and transformed (0–100 scale), with higher scores indicating a better HQOL. The 14 domains of the CHQ are not summed to derive one total score, but rather two different summary scores: a physical summary score and a psychosocial summary score. Calculations of summary scores are based on normative data from the general population of the USA, and a weighting factor is applied to each subscale. The CHQ physical summary is weighted to represent principally the subscales of physical functioning, role limitations due to physical health, general health, and bodily pain. The CHQ psychosocial score is weighted to represent principally the subscales of self-esteem, mental health, general behavior, and role limitations due to emotional health and behavioral issues.

Descriptive statistics were used to summarize the characteristics of the sample. One-way ANOVA followed by Scheffe's post hoc test was performed for the CHQ-28 and the WeeFIM scores. Pearson correlation coefficients were calculated to study the relationships between the WeeFIM and CHQ-PF28 subscales and summary scores.

According to Portney and Watkins, correlations ranging from 0.00 to 0.25 indicate little or no relationship; 0.25 to 0.50, a fair degree of relationship; 0.50 to 0.75, a moderate to good relationship; and above 0.75, a good to excellent relationship[21].

The unpaired t-test and ANOVA were used to estimate differences between categories of factors related to the child (gender, CP type, CP distribution, GMFCS level, grade, epilepsy, schooling), family (area of domicile, parent's employment status, mother's education level, parents' marital stage) and the mean scores for each measure separately. All analyses were conducted using SAS (v1.0) and a statistical significance level of 0.05.

RESULTS

The characteristics of the 155 subjects who participated in this study are shown in Table 1.

The mean of the total raw score and standard deviations for the subscales and total score of the WeeFIM, as well as the mean scores and standard deviations for the 14 subscales and 2 summary scores on the CHQ-PF28 are described in Table 2. The Scheffe post hoc test was performed for multiple comparisons. The test gives a measure of the

Table 1. Summary of sample characteristics (N=155)

Gender	Boys	89 (57.42)
	Girls	66 (42.58)
Mean age (yrs)		9.2 ± 1.5
Mean height (cm)		121.4 ± 14.3
Mean weight (kg)		22.0 ± 7.3
Epilepsy	Yes	53 (34.19)
	No	102 (65.81)
CP type	Spasticity	129 (83.23)
	Athetosis	10 (6.45)
	Ataxia	8 (5.16)
	Hypotonia	7 (4.52)
	Mixed	1 (0.65)
Tone distribution	Hemiplegia	16 (10.32)
	Diplegia	56 (36.13)
	Quadriplegia	83 (53.55)
GMFCS	I	13 (8.39)
	II	28 (18.06)
	III	15 (9.68)
	IV	51 (32.90)
	V	48 (30.97)
Grade	1–3	102 (66.23)
	4–6	52 (33.77)
Schooling	Special school	108 (69.68)
	Special class in mainstream school	7 (4.52)
	Mainstream school	22 (14.19)
	Home schooling	18 (11.61)
Area of domicile	City	108 (69.68)
	Rural	43 (27.74)
Mother's work status	No	104 (67.10)
	Looking for work	3 (1.94)
	Yes	48 (30.97)
Mother's education level	High school ≥	71 (45.81)
	College	13 (8.39)
	University ≤	71 (45.81)
Parents' marital status	Married	150 (96.77)
	Divorced	5 (3.23)

Values are mean ± SD or n (%).

difference between all means for all combinations of means. When stratified by GMFCS levels, the greatest effect of CP severity was seen in 'physical function', 'bodily pain', as well as 'physical summary'. For the WeeFIM subscales and total scores, more severe GMFCS levels were associated with lower functional ability ($p<0.05$) (Table 2).

Table 3 describes the correlation between the children's scores on the WeeFIM and the CHQ-PF28 scales. Pearson correlation coefficients were used. The total WeeFIM score and all the subscale scores had statistically significant correlations with the CHQ-PHS ($r= 0.48$, $r=0.45$, $r=0.42$, $r=0.48$, $r=0.47$, $r=0.41$, $r=0.39$ respectively), and CHQ-PSS correlated with the total WeeFIM score, sphincter control, communication, and social cognition scores ($r= 0.17$, $r=0.20$, $r=0.21$, and $r=0.26$ respectively).

Table 4 presents the results of unpaired t-tests and ANOVAs for categories of factors related to the child and family with the WeeFIM and the CHQ-PF28. Tone distribution was significantly related with the PHS and all the WeeFIM subscales except the PSS ($p<0.05$). Those who responded "Yes" to epilepsy showed significant relations with all the scales such as PHS, PSS, total WeeFIM score and the subscales scores. Those with "city" addresses had lower total WeeFM and all the subscale scores than those with "rural" addresses ($p<0.05$). There was a relationship among the types of schooling ($p<0.05$). Also, GMFCS level stratified as "mild" had higher PHS and WeeFIM scores than "severe" except PSS ($p<0.05$).

DISCUSSION

To our knowledge, this is the first study involving a large

Table 2. Descriptive statistics: CHQ-PF28 and WeeFIM scores for children with CP stratified by GMFCS (N=155)

	I	II	III	IV	V	T
GGH	58.1 (28.0)	46.4 (29.0)	43.0 (25.7)	40.8 (29.1)	34.9 (23.3)	41.6 (27.4)
GBE	60.0 (21.5)[5]	43.6 (30.1)	50.7 (30.5)	38.8 (32.3)	25.6 (34.0)[1]	38.5 (32.9)
FC	70.0 (16.2)	63.9 (19.4)	62.3 (20.3)	71.0 (19.3)	67.2 (22.4)	67.6 (20.2)
PF	51.3 (31.9)[4,5]	38.1 (29.4)[4,5]	22.2 (24.8)	10.0 (23.0)[1,2]	10.4 (24.2)[1,2]	19.9 (29.0)
REB	84.6 (29.2)	79.8 (26.2)	88.9 (20.6)	87.6 (24.0)	77.1 (25.9)	82.8 (25.3)
RP	76.9 (28.5)	59.5 (35.6)	73.3 (33.8)	66.0 (39.7)	49.3 (40.1)	61.3 (38.5)
BP	89.2 (17.5) [5]	79.3 (19.2)	85.3 (16.0)	78.8 (21.3)	64.6 (30.9)[1]	76.0 (24.9)
BE	64.0 (11.5)	58.7 (14.5)	61.8 (13.4)	63.3 (15.6)	55.0 (22.2)	59.8 (17.5)
MH	64.7 (16.0)	62.8 (15.3)	71.7 (14.4)	68.5 (25.3)	63.9 (29.3)	66.0 (23.6)
SE	63.5 (15.4)	60.4 (15.7)	63.3 (15.4)	62.7 (13.6)	64.4 (16.5)	63.0 (15.1)
GH	54.4 (19.7) [5]	45.8 (19.5)	46.6 (17.4)	43.0 (23.7)	32.0 (23.3)[1]	41.1 (22.8)
PE	62.5 (25.5)	58.5 (19.9)	64.2 (22.1)	58.8 (30.9)	48.2 (26.3)	56.3 (26.8)
PT	62.1 (35.0)	51.8 (28.1)	68.9 (22.6) [5]	49.0 (34.4)	35.2 (31.2)[3]	48.3 (32.7)
FA	70.2 (23.1)[5]	50.0 (27.0)	60.0 (21.2)	46.8 (32.3)	35.2 (27.9)[1]	47.0 (29.9)
PHS	37.0 (13.4)[5]	30.2 (12.9)5	30.0 (12.4)[5]	22.9 (11.5)[1]	15.9 (13.5)[1–3]	23.9 (14.1)
PSS	43.5 (8.1)	42.0 (8.2)	47.7 (8.8)	46.0 (10.4)	41.0 (10.9)	43.7 (10.1)
WeeFIM Self-care	37.1 (5.1)[2–5]	26.9 (10.7)[1,4,5]	25.8 (12.4)[1,4,5]	12.1 (6.6)[1,2,5]	6.8 (2.1)[1,2,4]	16.6 (12.3)
Sphincter control	13.0 (2.5)[4,5]	10.3 (3.9)[4.5]	9.4 (4.9)[4,5]	5.1 (3.8)[1–3]	3.7 (3.3)[1–3]	6.7 (4.8)
Transfer	20.1 (1.3)[2–5]	15.4 (5.4)[1,4,5]	13.1 (5.8)[4,5]	5.5 (3.0)[1–3]	3.4 (1.9)[1–3]	8.6 (6.7)
Ambulation	13.6 (1.0)[2,4,5]	10.6 (2.9)[1,3–5]	7.4 (2.9)[1,2,4,5]	3.2 (2.0)[1–3]	2.3 (1.3)[1–3]	5.5 (4.5)
Communication	12.7 (1.5)[2,4,5]	8.8 (4.2)[1,4,5]	9.4 (4.2)[4,5]	6.1 (4.0)[1–3]	4.1 (2.6)[1–3]	6.8 (4.3)
Social Cognition	18.1 (3.0)[2,4,5]	12.3 (6.6)[1,5]	13.4 (6.6)[5]	8.6 (5.9)[1]	5.7 (3.9)[1–3]	9.6 (6.5)
Total	114.5 (9.5)[2–5]	84.1 (30.2)[1,4,5]	78.5 (34.6)[1,4,5]	40.7 (20.2)[1,2,5]	25.9 (11.9)[1,2,4]	53.8 (35.9)

Values are mean(SD). CHQ: Child Health Questionnaire, WeeFIM: Functional Independence Measure for Children. GMFCS: Gross Motor Function Classification System. GGH: Global Health, GBE: Global behavior FC: Family Cohesion, PF: Physical Function, REB: Role-Emotional/Behavioral, RP: Role-Physical, BP: Bodily Pain, BE: Behavior, MH: Mental Health, SE: Self Esteem, GH: General Health, PE: Parental Impact-Emotional, PT: Parental Impact-Time, FA: Family Activities, PHS: Physical Summary, PSS: Psychosocial Summary, 1: significantly different compared with GMFCS I. 2: significantly different compared with GMFCS II, 3: significantly different compared with GMFCS III, 4: significantly different compared with GMFCS IV, 5: significantly different compared with GMFCS V.

Table 3. Correlations between CHQ-PF28 and WeeFIM (N=155)

	Self-care	Sphincter control	Transfer	Ambulation	Communication	Social cognition	Total
GGH	0.37*	0.42*	0.37*	0.32*	0.43*	0.40*	0.42*
GBE	0.41*	0.46*	0.35*	0.30*	0.51*	0.53*	0.46*
FC	–0.05	–0.06	–0.04	–0.02	0.05	0.02	–0.03
PF	0.46*	0.37*	0.48*	0.53*	0.34	0.31*	0.46*
REB	0.07	0.17*	0.08	0.06	0.10	0.14	0.11
RP	0.16	0.21*	0.19*	0.17*	0.18*	0.20*	0.20*
BP	0.26*	0.27*	0.27*	0.25*	0.33*	0.33*	0.31*
BE	0.21*	0.28*	0.13	0.08	0.31*	0.34*	0.25*
MH	0.07	0.16	0.01	0.00	0.13	0.19*	0.10
SE	0.14	0.11	0.06	0.02	0.17*	0.20*	0.13
GH	0.36*	0.40*	0.35*	0.33*	0.40*	0.38*	0.40*
PE	0.24*	0.24*	0.20*	0.20*	0.22*	0.23*	0.25*
PT	0.24*	0.25*	0.22*	0.22*	0.24*	0.21*	0.25*
FA	0.34*	0.40*	0.32*	0.32*	0.41*	0.40*	0.39*
PHS	0.45*	0.42*	0.48*	0.47*	0.41*	0.39*	0.48*
PSS	0.15	0.20*	0.06	0.02	0.21*	0.26*	0.17*

*p<0.05. CHQ: Child Health Questionnaire, WeeFIM: Functional Independence Measure for Children. GGH: Global Health, GBE: Global behavior FC: Family Cohesion, PF: Physical Function, REB: Role-Emotional/Behavioral, RP: Role-Physical, BP: Bodily Pain, BE: Behavior, MH: Mental Health, SE: Self Esteem, GH: General Health, PE: Parental Impact-Emotional, PT: Parental Impact-Time, FA: Family Activities, PHS: Physical Summary, PSS: Psychosocial Summary.

population of Korean children with CP to determine the correlation between the function and the HRQOL of children with CP, and examine the factors related to each of them. When evaluating the efficacy of care, most research focuses on improvements in function rather than aspects of HRQOL[22]. The results of this study provide information about the importance of measuring both function and HRQOL in the field of pediatric physical therapy.

Table 4. Comparison of CHQ-PF28 and WeeFIM scores with child-parent factors (N=155)

	PHS	PSS	Self- care	Sphincter control	Transfer	Ambulation	Communication	Social cognition
Sex								
Boy	24.5	42.7	16.6	6.9	8.5	5.5	7	9.6
Girl	23.2	45.1	16.5	6.4	8.7	5.5	6.7	9.7
Type								
Spastic	24.8	43.4	17.2	7	9	5.7	7.1	10
Athetosis	15.6	43.5	12.8	4.6	6.2	3.6	6	7.7
Ataxia	22.4	48.8	13.5	6	7.3	7.3	4.6	6.6
Hypotonia	24.2	44.5	14.6	5.1	6.7	6.7	5.3	6.9
Mixed	4.5	40.5	12	4	3	3	6.9	9
Tone distribution								
Hemiplegia	30.5[3]	47.5	24.3[3]	10.0[3]	12.8[3]	8.3[3]	9.5[3]	13.7[3]
Diplegia	27.8[3]	41.9	21.6[3]	8.4[3]	11.4[3]	7.6[3]	8.3[3]	11.8[3]
Quadriplegia	20.2[1,2]	44.2	11.7[1,2]	4.9[1,2]	5.9[1,2]	3.5[1.2]	5.3[1,2]	7.4[1,2]
Epilepsy								
Yes	17.7*	40.1*	9.6*	3.7*	4.7*	3.1*	4.2*	5.4*
No	27.3	45.7	20.2	8.2	10.6	6.7	8.2	11.8
Address								
City	23.3	43.2	14.2*	5.7*	7.5*	4.8*	5.9*	8.4*
Rural	26.3	45.3	22	8.8	11.1	7.1	8.7	12.3
Schooling								
Special school	21.8[3]	43.2	12.7[2,3]	4.8[2–4]	6.5[2,3]	4.2[2,3]	5.2[2–4]	7.0[2–4]
Special class in	24	37.7	26.6[1]	12.3[1]	15.3[1]	10.0[1]	9.6[1]	13.9[1]
Mainstream school	32.1[1]	45.5	30.9[1,4]	11.6[1]	15.5[1,4]	9.2[1]	11.3[1]	18.1[1,4]
Home schooling	26.1	46.9	18.43	9.8[1]	10.23	7	10.3[1]	13.6[1,3]
Grade								
1–3	25.3	43.7	16.4	7	8.3	5.3	7.1	9.9
4–6	24.8	43.7	16.9	5.9	9	5.7	6.3	9.1
Mother's work status								
No	23.6	43	15.7	6.3	8	5.1	6.7	9.2
Looking for work	5.4	37.9	11.7	6	6.3	3	5.7	6.3
Yes	25.8	45.5	18.8	7.6	10.1	6.6	7.3	10.7
Mother's education level								
High school ≥	23.3	42.7	15.9	6.4	8.2	5.1	6.9	9.4
College	28.3	45.7	23.3	8.7	12.4	8.1	8	10.6
University ≤	23.8	44.4	15.9	6.5	8.3	5.5	6.6	9.7
Parents' marital status								
Married	24.1	43.7	16.4	6.6	8.6	5.5	6.8	9.5
Divorced	19	45.2	20.4	8	9	4.8	8	14.6
GMFCS								
Mild	31.5*	43.8	28.9*	10.7*	15.9*	10.4*	9.9*	13.9*
Severe	19.6	43.6	9.6	4.4	4.5	2.7	5.1	7.2

*$p<0.05$. PHS: Physical Summary, PSS: Psychosocial Summary. Tone distribution- 1: significantly different compared with hemiplegia,. 2: significantly different compared with diplegia, 3: significantly different compared with quadriplegia. Schooling - 1: significantly different compared with special school. 2: significantly different compared with special class in mainstream school. 3: significantly different compared with mainstream school. 4: significantly different compared with home schooling.

We found a high degree of variation in the WeeFIM and CHQ-PF28 scores reflecting the heterogeneity of diagnosis in our sample. In this study, psychosocial quality of life of the children with CP was higher than physical quality of life. Our results were consistent with the trend identified by Livingston et al.[4], who reviewed 20 original studies and concluded that functional status measures are reliable indicators of variations in physical function, but do not correlate consistently with psychosocial well-being. When stratified by GMFCS level, severer GMFCS levels were associated with lower physical quality of life such as 'physical function', 'bodily pain', and 'physical summary'. Interestingly, psychosocial quality of life of children with CP wasn't correlated with the severity of their condition as measured by the GMFCS. This apparently absurd result might be explained by a previous report that children with CP incorporate their impairment into their sense of self from birth and don't recognize it as an unhealthy status[23]. For the purpose of comparison, the study reported by Bae et al.[24] from Korea, which applied the CHQ-PF28 to assess HRQOL, was identified because the participants of both studies were school-aged children. Bae et al. recruited 134 healthy children in Korea to compare their CHQ-PF28 with that of children with juvenile idiopathic arthritis (JIA). As expected, the performance of children with CP (GMFCS level I–V) in this study was significantly worse than that of the group of typical developing children, as reported by Bae et al.[24]. This result suggests that the HRQOL of children

with CP in Korea is lower than that of typical developing school-aged children in Korea.

The WeeFIM scores within our study sample indicate that children classified as the GMFCS II, IV, and V had more difficulties with ambulation than with the other subscales of the WeeFIM. However, Grilli et al.[8] reported that self-care tasks and social cognition ability were lower than transfer and ambulation. These results are not in accordance with our findings because their sample had different characteristics from those of this study. As children with CP, irrespective of the severity of the cerebral palsy, have weakness, poor selective control, and poor balance reactions, it was not surprising to see the lowest score in the ambulation subscale of the WeeFIM[25].

The fair degree of correlations between the CHQ-PF28-PHS and all the subscales of the WeeFIM suggest there is some congruence as both measure the physical dimension of functioning. The WeeFIM was designed to measure a child's level of independence in performance of daily activities across the physical and cognitive domains. The CHQ-PF28 was designed to measure how much of a problem the child has with items across several domains: physical, psychosocial, and family functioning. To our knowledge, there is little research regarding quality of life and function of school-aged children with CP. Schneider and colleagues studied school-aged children with CP and found a lack of correlation between the WeeFIM self-care and mobility subscales and the CHQ. The difference between their study and the present study may be explained by the differences in sample size, severity of cerebral palsy, and cultural differences. However, in that same study, a fair degree of correlation was found between WeeFIM total score and the disease-specific HQOL measure, the Caregiver Questionnaire (CQ), which suggests some overlap in the constructs of these two assessments[10]. Also, Grilli et al.[8] reported that the WeeFIM mobility and self-care subscales had a fair degree of correlation with the PedsQL-Physical Health Summary Score.

Conversely, the poor correlation between the WeeFIM communication and social cognition subscales and CHQ-PF28-PSS indicate that different constructs are assessed by the tools. Our findings are consistent with Grilli et al.[8] who reported that the WeeFIM was not designed to measure a child's psychosocial integration and well-being. Higher cognitive skills do not necessarily lead to psychosocial well-being with other children. Given the fact that individuals with equal degrees of functional limitations may exhibit a range of different scores for HRQOL, the need for HRQOL measures to provide additional information from that offered by traditional functional measures is justified[10]. Consequently, the CHQ-PF28 can be used as a complementary measure to the WeeFIM in providing a more comprehensive portrait of a child's well-being for physical therapists and researchers.

A previous study found that higher parental education was related with higher quality of life of children with school-aged CP[26]. However, the mother's education level was not related with either HRQOL or function in our study, which may be explained by the differences in the use of the different tool, KIDSCREEN, for measuring HRQOL and cultural differences. The level of parents' understanding of their child's disability did not differ irrespective of their education levels in Korea. Most mothers of children with CP have excessive concerns about their child's health conditions, especially physical well-being rather than psychosocial satisfaction in Korean culture.

Epilepsy is one of the comorbidity conditions of children with CP[1]. In this study, children with CP who have epilepsy presented significantly lower function and HRQOL than those who did not. These results are consistent with previous studies. It has been suggested that reported medical problems such as epilepsy may be related to the psychosocial aspect of HRQOL[27]. Voorman et al.[28] reported that epilepsy was associated with greater restrictions in social functioning and communication. However, both the physical well-being and the psychosocial well-being were found to be affected by epilepsy in the present study. We suggest this because epilepsy not only negatively affects perceptive, emotive and social aspects of life but also motor skills, the main problem for children with CP.

Tone distribution and the GMFCS levels were highly related with CHQ-PF28-PHS and the WeeFIM, indicating that the severity of cerebral palsy may have an adverse impact on physical aspects of HRQOL and function.

There was a difference in the PHS levels of children with CP depending on the type of educational system they participated in. One needs gross motor skills to function well in school.

In the transfer and ambulation subscales of the WeeFIM, basic mobility activities such as crawling, walking and stair climbing are main items. In addition to the items in the transfer and ambulation subscales of the WeeFIM, the CHQ-PF28-PHS assesses more advanced motor skills such as walking, running, and participation in exercise which are typically quite difficult for most children with cerebral palsy[8].

Although most of the children in this study were unable to self-report, the need to assess their HRQOL is no less important. Therefore, the parent-reported method was used to quantify their HRQOL. However, previous studies have suggested that children might report differently from their caregivers regarding their own well-being[29]. It was possible, therefore, that children with CP in this study might have viewed their HRQOL differently from their caregivers.

In the case of children with CP in Korea, their PHS level was lower than their PSS, and tone distribution, epilepsy, address, schooling and GMFCS level had effects on HRQOL and function of school-aged children with CP. The WeeFIM subscales as well as the CHQ-PF28-PHS appear to measure somewhat similar physical dimensions of health and functioning. However, the WeeFIM subscales and the CHQ-PF28-PSS measure different aspects of a child's function and well-being. The results of our study support the need to incorporate complementary measures that are not only focused on function but also include general health and quality of life when measuring the overall status of children with CP. Therefore, we recommend that the focus of

physical therapy goals should be shifted to promoting and enhancing health and well-being, rather than the traditional emphasis on preventing and minimizing long term disabilities and impairments.

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