HK J Paediatr (new series) 2013;**18**:159-166

The Correlation of Health of Preschool Taiwanese Children with Developmental Delay

RL ***Hsieh,*** YM ***Hsueh,*** HY ***Huang,*** MI ***Lin,*** WC ***Lee***

Abstract We evaluated the correlation of health in preschool Taiwanese children with developmental delays. A total of 70 primary caregivers of 48 male and 22 female preschool Taiwanese children who had been diagnosed with developmental delays were recruited. We administered the Child Health Questionnaire-Parent Form 28 to the parents to evaluate parent-reported children's health. The relationship between the health status of children with developmental delays and demographic variables, such as age, gender, family structure, parental employment status, child care arrangements, and financial support were examined. Older children, delayed development of gross and fine motor functions, maternal unemployment, and financial support were associated with lower health status. Boys had better health in the areas of parental emotional impact and worse health in the area of family cohesion and impact than girls. The health status of preschool Taiwanese children with developmental delays is related to the children's age, gender, and motor development, maternal employment status, and financial support.

Key words Correlation; Developmental delays; Health; Preschool children; Taiwanese

Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital; School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

RL **Hsieh** (謝如蘭) *MD*

Department of Public Health, School of Medicine, College of Medicine, Taipei Medical University, Taipei, Taiwan

YM **Hsueh** (薛玉梅) *PhD*

Institute of Epidemiology and Preventive Medicine, College of Public Health, National Taiwan University, Taipei, Taiwan

HY **Huang** (黃筱元) *MS*
WC **Lee** (李文宗) *MD, PhD*

Department of Pediatrics, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan

MI **Lin** (林明益) *MD*

Correspondence to: Dr RL Hsieh

Received September 17, 2012

Introduction

Children's health results from a complex interaction among developmental, behavioural, social, and environmental factors.[1] It is estimated that 10% to 15% of children require special health-care assessment and intervention because of motor and behavioural disorders and mental problems.[2,3]

In Taiwan, National Health Insurance was implemented in 1995, and the current coverage rate is 99%. Under this well-established health insurance system, early diagnosis and intervention of preschool children has been advocated since 1997. Children with chronic conditions, such as cerebral palsy, attention-deficit hyperactivity disorder (ADHD), or with other disabilities were found to have a worse health status than children without these conditions.[4-6] However, little comprehensive research has been performed on the health status of Taiwanese children with developmental delays. Our previous study showed that Taiwanese children with developmental delays had a lower quality of life and worse health status than children with typical development.[7]

However, the factors contributing to the health of Taiwanese children with developmental delays remains uncertain.

Therefore, we conducted this study to examine the correlations in parent-reported health of preschool children exhibiting developmental delays in Taiwan. We hypothesised that parent-reported health in preschool Taiwanese children with developmental delays is related to different developmental domains and that Chinese culture may partly affect this.

Methods

Shin Kong Wu Ho-Su Memorial Hospital is a teaching hospital with 936 beds located in Northern Taiwan. Children with suspected developmental delays in urban (Shi-Lin and Bei-To Districts in Taipei City) and suburban access (Ru-Cho and San-Chung Districts in New Taipei City) located near the hospital were referred to the developmental assessment clinic of the hospital by local clinics, kindergartens, and community centers for evaluation. Evaluations were performed by members of the early development intervention team in the hospital, which includes a physiatrist, paediatrician, ophthalmologist, otolaryngologist, psychiatrist, psychologist, social worker, occupational therapists, speech therapists, and physical therapists. All subjects underwent developmental assessment to confirm developmental delays, including gross and fine motor functions, and the speech-language, cognition, social, and emotional domains. The diagnosis of the developmental delay was based on universal applications of the Peabody Developmental Motor Scales (PDMS), Preschool Language Evaluation Tool (PLET) or Child Expression Evaluation Tool, and Chinese Wechsler Intelligence Scale for Children (third edition) (Chinese-WISC) or Bayley III Scales of Infant and Toddler Development (Bayley III). These test is measured different developmental aspects. PDMS measured gross motor and fine motor domains. Chinese-WISC or Bayley III measured intelligence (depends on child's age). PLET or Child Expression Evaluation Tool measured language performance (depends on child's age). A developmental delay was defined as performance two standard deviations or greater below the mean on age-appropriate, standardised, norm-referenced tests. Other measurements would be used based on the referral reason or presenting problems, such as using Gross Motor Function Measure for the gross motor assessment of children with suspected cerebral palsy.

Eligibility criteria for the study were as follows: preschool children, primary caregivers of children available for interviews, children confirmed to have delays in either one or more of the domains of gross motor function, fine motor function, speech-language, and cognition. Children with identified diagnoses, such as cerebral palsy, ADHD, autism spectrum disorder, epilepsy, chromosomal abnormalities, malformation of the brain, etc. were excluded. Families were excluded from the study if the primary language was other than Chinese, and refused to participate in the intervention for themselves and their children. This study was approved by the Institutional Review Board for the Protection of Human Subjects in the hospital. Appropriate written consents for study were obtained from the parents of the children with developmental delays. They provided permission for themselves and their children to be enrolled in this study.

We used the Child Health Questionnaire-Parental Form 28 (CHQ-PF28) [8] for the assessment of parent-reported child health-related quality of life and their family. This form has good inter-rater reliability and intra-rater reliability in Chinese.[9] It assesses the physical, social, and emotional well-being of children during the preceding month. Mean scores based on a 4- to 6-point response scale for each item were calculated and transformed to a 0-to-100 scale. Higher scores indicate better health status. The scale contains the following subscales: 1) physical function, 2) role/social functioning: emotional/behaviour, 3) role/social functioning: physical, 4) bodily pain, 5) hebaviour, 6) mental health, 7) self-esteem, 8) general health perceptions, 9) changes in health, 10) parental impact: emotional, 11) parental impact: time, 12) family activities, and 13) family cohesion. Two summary scores were obtained: physical and psychosocial. The 13 health scales can measure different health domains, including the well-being of the child (contains 9 scales), the impact of the child's health on the parents' health-related quality of life (parental impact: including 2 scales), and the impact on family (family impact: including 2 scales).[10] One scale concerning the changes of the child's health during the last 12 months was not used in the present study.

All of the evaluations were performed with the primary caregivers by the same well-trained examiner. Additional data on the parents' age, employment, and family structure (nuclear family: children lived with their parents and siblings; extended family: children lived with their parents, siblings, and other relatives, such as grandparents, uncles, and/or aunts), child care arrangements (any assistants or extended family members as care providers when the parents are working), and financial support (with any social

financial support) were also collected from the primary caregivers.

The results are expressed as mean ± standard deviation. The chi-square test or *t* test was used to analyse the demographic data, such as children's age and gender, parents' age and employment status, family structure, child care arrangement, financial support, domain of developmental delays, and the severity of impairment (single domain vs. multiple domains of developmental delay). The Pearson correlation test was used to assess the factors contributing to the health status of the children with developmental delays, including 12 scales, physical and psychosocial summary scores, and domains of well-being of the child, family impact, and parental impact. Relationships were defined as mild (≤0.39), moderate (0.4-0.69), or strong (≥0.7).[11] The level of statistical significance was set at $p<0.05$.

Results

A total of 70 primary caregivers provided their informed consent for themselves and their children to participate in the study during the study period for one year.

Table 1a shows the basic characteristics of the study subjects. Mothers filled out the majority of the questionnaires. The study group included 48 boys and 22 girls, with a mean age of 4 years. The mean parental age was 38.6 years for fathers and 35.6 years for mothers. Most of the fathers (96%) were employed, and nearly half of the mothers were employed. For family structure, 67% of the subjects belonged to nuclear families, and 33% of subjects belonged to extended families. Twenty-three percent of subjects had child-care arrangements, and 41% had financial support. A total of 79% of children with developmental delays were in the gross motor domain, 76% in the fine motor domain, 57% in the speech-language domain, and 53% in the cognitive domain. Seventy-nine percent of children showed developmental delays across multiple domains. The detailed percentages of delay in isolated gross motor, fine motor, language, and cognition; delay in 2, 3, and more than 3 domains are shown in Table 1b.

Table 2a shows the results of the CHQ-PF28 of preschool children with developmental delays tabulated by child's gender, parental employment status, family structure, and domains of delayed development.

Table 3 shows the significant relationship of parent-reported health in preschool children with developmental

Table 1a Basic demographics of subjects (n=70)

Variable	Value
Child's age, mean±SD (years)	4±2.1
<4 years	28 (40)
≥4 years	42 (60)
Child's sex	
Male	48 (69)
Female	22 (31)
Parent age, mean (range) (years)	
Father	38.6 (28-53)
Mother	35.6 (25-48)
Parents' employment	
Father: yes	67 (96)
Mother: yes	35 (50)
Both parents: yes	33 (47)
Family structure	
Nuclear	47 (67)
Extended	23 (33)
Child care arrangement (yes)	16 (23)
Financial support (yes)	29 (41)
Delayed development	
Gross motor	55 (79)
Fine motor	53 (76)
Speech-language	40 (57)
Cognition	37 (53)
Multiple domains	55 (79)

Note: Data are given as number (%) except where otherwise indicated.

Table 1b Detailed number (percentage) of children with developmental delays

Developmental domain	Number (%)
Delay in single domain	
Gross motor	6 (9)
Fine motor	3 (4)
Language	3 (4)
Cognition	3 (4)
Delay in 2 domains	
Gross motor, fine motor	9 (13)
Gross motor, language	2 (3)
Gross motor, cognition	1 (1)
Fine motor, language	2 (3)
Fine motor, cognition	1 (1)
Language, cognition	1 (1)
Delay in 3 domains	
Gross motor, fine motor, language	8 (12)
Gross motor, fine motor, cognition	7 (10)
Gross motor, language, cognition	1 (1)
Fine motor, language, cognition	2 (3)
Delay in >3 domains	
Gross motor, fine motor, language, cognition	21 (31)

Table 2a Parent-reported health in children using the CHQ-PF28 form

	CHQ-PF28 score													
Variable	**PF**	**REB**	**RP**	**BP**	**BE**	**MH**	**SE**	**GHP**	**PIE**	**PT**	**FA**	**FC**	**PS**	**PSS**
Sex														
Male (n=48)	63.1	78.1	72.8	76.7	49.5	67.6	59.4	56.1	44.8*	72.4	52.3	62.7**	41.4	38.7
	(34.1)	(29.3)	(30.9)	(25.5)	(13.9)	(17.2)	(19.3)	(20.6)	(22.9)	(22.2)	(24.1)	(28.5)	(14.7)	(6.2)
Female (n=22)	52.9	61.9	61.9	73.6	54.5	70.2	62.5	46.5	30.1*	79.6	62.5	79.1**	34.4	38.2
	(33.9)	(36.7)	(36.7)	(25.8)	(20.9)	(15.3)	(17.2)	(20.6)	(24.9)	(18.6)	(24.4)	(18.4)	(16.5)	(5.5)
Parental employment														
Father														
Yes (n=67)	59.8	73.3	70.7	75.2	50.9	68.2	60.4	52.9	40.5	73.5	56.0	67.9	39.4	38.3
	(34.5)	(32.3)	(31.3)	(25.8)	(16.6)	(16.4)	(19.0)	(20.7)	(24.7)	(21.3)	(24.4)	(26.8)	(15.2)	(5.9)
No (n=3)	70.4	83.3	50.0	86.7	55.8	69.4	58.3	56.3	33.3	94.4	45.8	66.7	44.9	43.3
	(28.0)	(23.6)	(70.7)	(11.6)	(10.1)	(25.5)	(8.3)	(31.6)	(14.4)	(9.6)	(31.5)	(31.8)	(21.3)	(9.0)
Mother														
Yes (n=35)	68.2	72.0	66.7	78.9	49.4	74.0**	65.8*	57.6	40.4	75.8	55.7	70.4	42.3	39.3
	(34.7)	(31.5)	(33.3)	(24.2)	(16.9)	(15.1)	(19.5)	(19.1)	(21.2)	(20.6)	(25.8)	(26.9)	(13.6)	(5.8)
Family structure														
Nuclear (n=47)	61.5	75.9	70.4	78.3	52.0	67.6	61.4	55.4	39.4	77.9	55.3	69.6	40.0	38.9
	(33.8)	(29.4)	(33.6)	(24.3)	(16.2)	(16.6)	(16.7)	(21.7)	(25.5)	(20.8)	(24.6)	(24.8)	(15.4)	(5.7)
Extended (n=23)	57.4	68.6	68.8	70.4	49.3	69.7	57.9	48.3	41.9	67.5	56.0	64.4	38.8	37.8
	(35.6)	(37.5)	(31.0)	(27.6)	(17.0)	(17.0)	(22.5)	(18.8)	(22.2)	(21.1)	(25.0)	(30.7)	(15.4)	(6.9)
Delayed development														
Gross motor														
Normative (n=27)	77.8*	85.7*	76.2	72.9	50.8	71.4	63.9	68.7***	36.8	79.8	57.4	70.9	47.4	39.1
	(28.8)	(17.1)	(30.5)	(28.2)	(15.2)	(16.1)	(19.6)	(13.8)	(25.2)	(17.5)	(31.0)	(22.0)	(12.1)	(7.0)
Delayed (n=43)	53.8*	67.8*	68.9	77.2	50.8	68.1	58.6	47.9***	41.9	73.7	54.1	69.1	36.8	38.7
	(35.7)	(37.6)	(36.0)	(26.0)	(15.9)	(17.1)	(18.0)	(21.0)	(21.5)	(21.8)	(20.0)	(25.9)	(16.1)	(6.3)
Fine motor														
Normative (n=26)	77.8*	90.0**	83.3	85.3*	49.7	64.9	64.7	58.8	40.0	82.1	57.5	73.3	50.1*	39.2
	(24.4)	(16.1)	(23.6)	(16.0)	(11.9)	(15.7)	(17.1)	(21.0)	(22.8)	(17.9)	(26.6)	(19.2)	(10.3)	(6.0)
Delayed (n=44)	53.8*	67.7**	67.7	73.2*	50.7	70.2	58.1	51.6	40.6	72.1	54.0	68.0	36.3*	38.3
	(36.5)	(35.8)	(36.8)	(28.9)	(16.5)	(17.2)	(18.8)	(21.2)	(22.9)	(21.2)	(22.7)	(26.5)	(16.0)	(6.6)
Speech-language														
Normative (n=33)	49.3	69.2	64.1	71.8	48.4	65.5	65.7	52.8	43.2	72.8	52.8	63.4	34.3	39.1
	(37.2)	(37.2)	(41.9)	(29.4)	(16.7)	(15.0)	(19.2)	(21.4)	(25.8)	(20.9)	(26.4)	(26.3)	(19.9)	(7.2)
Delayed (n=37)	65.4	75.6	75.6	79.5	51.4	71.0	55.7	53.7	39.9	74.5	54.7	71.4	43.2	38.1
	(34.2)	(32.7)	(31.5)	(25.2)	(14.9)	(17.8)	(17.5)	(21.5)	(21.6)	(20.7)	(22.3)	(24.4)	(13.9)	(6.1)
Cognition														
Normative (n=35)	62.6	70.2	70.2	70.8	49.4	71.4	63.6	56.3	38.5	76.9	58.3	70.2	38.9	38.7
	(35.7)	(36.7)	(41.4)	(32.3)	(16.4)	(17.6)	(19.5)	(20.4)	(23.6)	(25.5)	(26.5)	(25.9)	(18.4)	(7.3)
Delayed (n=35)	60.9	76.0	73.3	80.6	51.7	67.7	56.5	52.5	41.8	73.3	51.8	68.7	42.2	38.2
	(34.9)	(31.2)	(28.9)	(21.9)	(14.4)	(16.1)	(17.7)	(21.8)	(22.2)	(16.7)	(21.9)	(24.3)	(13.7)	(5.3)

Note: Data are given as mean (standard deviation).

*p<0.05; **p<0.01; ***p<0.001.

CHQ-PF28, Child Health Questionnaire-Parental Form 28; PF, physical functioning; REB, role/social functioning: emotional/behavior; RP, role/social functioning: physical; BP, bodily pain; BE, behavior; MH, mental health; SE, self-esteem; GHP, general health perception; PIE, parental impact-emotional; PT, parental impact-time; FA, family activities; FC, family cohesion; PS, physical summary; PSS, psychosocial summary.

Table 2b Correlates of parent-reported health in Taiwanese children with developmental delays by age and domains of development

Developmental domain	Number (%)	Well-being of child	Parental impact	Family impact
<4 years old	**28 (100)**			
Delay in single domain				
Gross motor	2 (7)	–	–	0.45
Fine motor	1 (4)	–	0.09	0.23
Language	1 (4)	0.50	0.09	0.28
Delay in 2 domains				
Gross motor, fine motor	3 (10)	-0.37	0.27	-0.27
Gross motor, language	2 (7)	–	0.22	0.06
Gross motor, cognition	1 (4)	–	-0.16	0.07
Fine motor, language	1 (4)	–	-0.27	0.07
Delay in 3 domains				
Gross motor, fine motor, language	1 (4)	–	-0.35	0.07
Gross motor, fine motor, cognition	5 (17)	–	0.01	0.07
Gross motor, language, cognition	1 (4)	0.40	0.09	0.07
Fine motor, language, cognition	2 (7)	-0.15	-0.23	-0.25
Delay in >3 domains				
Ggross motor, fine motor, language, cognition	8 (28)	-0.12	0.05	-0.35
≧4 years old	**42 (100)**			
Single domain	11 (26)	0.17	0.28	0.14
Multiple domains	31 (74)	-0.17	-0.28	-0.14

Note: P values in all variables were >0.05.

delays by the age of the child and the parents, the child's gender, the parents' employment status, family structure, child-care arrangements, financial support, domain of developmental delay, and severity of impairment. The age of child had a significant negative relationship with family cohesion (-0.3) and family impact (-0.2). The male gender had a significant negative relationship with family cohesion (-0.3) and family impact (-0.3), and a positive relationship with parental emotional impact (0.3). Maternal employment had a significant positive relationship with mental health (0.3). Financial support had a significantly negative relationship with the well-being of the children (-0.3). Developmental delays in both gross and fine motor skills had a statistically significant negative relationship with parent-reported physical functions and physical summary scores (-0.3 and -0.4, respectively). Delayed gross motor development was also negatively related to general health (-0.4), and delayed fine motor development was significantly negatively related to the well-being of the child (-0.3). The severity of the impairments of the children with developmental delays had a significant negative relationship with behaviour (-0.3) and physical functions (-0.3).

There were 40% of children that are less than 4 years old. Therefore, we further looked at the relationship of parent-reported health of children with developmental delays by (1) age less than 4: with different delayed developmental domains (by delay in single domain, delay in 2 domains, delay in 3 domains, and delay in more than 3 domains); and (2) age of 4 or more: by comparing the developmental delays in single domain vs. multiple domains. The results showed no statistically significant difference in the parent-reported health of children by these classifications (Table 2b).

Discussion

This is the first study to investigate the key factors contributing to the health of preschool children with developmental delays in Taiwan. This study found that the child's age, presence of gross and fine motor developmental delays, the severity of the impairment, and financial support were negatively related to parent-reported health in preschool Taiwanese children with developmental delays. Maternal employment and children's gender also affected the parent-reported health.

We showed that male children occupied 69% of our cases. The result is approximately the same as the gender

Table 3 Significant correlates of parent-reported health in Taiwanese children with developmental delays

Variable	Physical function	Behaviour	Mental health	General health	Parental impact-emotional	Family cohesion	Physical summary	Well-being of child	Family impact
Child's age						-0.29*			-0.24*
Child's sex (male vs. female)					0.29*	-0.27*			-0.27*
Parental employment									
Mother (yes)			0.34**						
Financial support (yes)								-0.31*	
Domain of delayed development									
Gross motor	-0.33*			-0.42***			-0.37*		
Fine motor	-0.30*						-0.42*	-0.34*	
Severity of impairment (single vs. multiple domains)	-0.34*	-0.30*							

*p <0.05; **p <0.01; ***p<0.001.

distribution in the administrative population report on children with developmental delays in Taiwan (male gender was reported as approximately 66.7% to 67.3% from 2003 to 2007).[12] Compared with previous studies conducted in Taiwan,[5,6] although the children's ages (mean of 4.2 years in our study vs. 8 to 10 years in previous studies) and measurement tools used (CHQ-PF28 vs CHQ-PF50) were not identical, the physical component of health in children with developmental delays was better than that in children with cerebral palsy (39.7±15.3 vs 31.6±13.5), and the psychosocial component of health was higher than that in subjects with ADHD (38.6±6.0 vs 34.5±10.3). However, because of the differences in age, gender, and assessment tools, additional studies with age- and gender-matched controls are required to confirm our results.

This study showed that the gross- and fine-motor status of children with developmental delays had a mild to moderate negative relationship with the physical function of health. Gross-motor status had a moderate negative correlation with general health, and fine-motor status had a mild negative correlation with the well-being of the children. Physical activity has been found to be positively related to self-rated health, academic achievement, and quality of life in children.[13-15] Although being physically active may be challenging for children with developmental delays, it has been found that physical activity programs have a positive impact on both the physical appearance and athletic competence of children with cerebral palsy.[16,17] This study had a cross-sectional design. Therefore, whether increasing the level of physical activity and implementing exercise programs would further improve motor performance remains unknown. Further longitudinal studies are necessary to confirm the relationships among motor function, physical activity, and the physical component of health in children with developmental delays.

Children within a single domain of developmental delays were associated with better health status in both behaviour and physical function than those children with developmental delays in multiple domains. This finding indicates that the severity of the impairments in children was related to their behaviour and physical functions. Studies focusing on children with cerebral palsy also showed that the severity of the impairment was associated with lower physical function.[18,19] Therefore, the improvement of the impairment by means of intensive rehabilitation programs is urgent.

Our study showed that younger ages of children with developmental delays were related to better health status in the area of family cohesion and family impact. Previous studies showed a positive relationship between younger children's ages and parental acceptance and support of pediatric practices.[13] As the children with developmental delays grew older, the burden impact on the family decreases.[20] Thus, we could speculate that when the child is younger, the family impact is greater, and therefore, there is a greater necessity for family cohesion. As the child grows older, the family may gradually develop the ability to handle the situation and care for the child, resulting in decreased family impact and cohesion. Further long-term follow-up studies are required to confirm this hypothesis.

Our study revealed that girls with developmental delays had a better health status in the area of family cohesion and family impact, and boys with developmental delays had a better health status in the area of parental emotional impact.

Hospitalised Chinese children were found to display obedience, good behaviour, and emotional control, with parents expecting their children to maintain these characteristics despite their disabilities.[21] In traditional male-dominant Chinese society, men are the primary family decision makers, and boys receive more attention and long-term support from the family;[22-24] a son is expected to carry out the funeral rituals, continue the family name, and is more likely to inherit property.[22, 25] In contrast, Chinese girls and women are placed in a subordinate position, and are expected to be obedient, timid, and unselfish.[26] Therefore, traditional Chinese concepts may contribute to gender differences in the health status in the areas of parental emotional impact, family cohesion, and family impact among children with developmental delays in Taiwan.

Children with developmental delays whose mothers were employed had greater mental health than those whose mothers were unemployed. Studies focusing on the Chinese family showed increased stress and financial strain in relation to medical assistance and daily necessities.[25] Lack of economic resources can lead to deterioration of the caregiving relationship and worse mental health in unemployed mothers.[25, 27] Employed Chinese mothers show higher degrees of life satisfaction, optimism, and positivity than Western women.[28] These attitudes could positively affect the mental health of children with developmental delays. Developmentally delayed children who need financial support showed worse well-being than children with developmental delays who do not need financial support. In Taiwan, families of children could receive financial support from the government if they fit low total income profiles with their family, or they fit with the criteria of being handicapped of social welfare laws. These findings indicated that in addition to the working status of mother, the socioeconomic status of family also related to the health status of children with developmental delays. However, we could not rule out that the relationship between financial support and well-being of children with developmental delays in the present study was related to the limitation of the study design itself rather than the genuine findings.

Health status reflects the subjects' perceptions of their quality of life.[19] Although pediatric subjects' self-reports are the standards for measuring perceived health status, preschool children with developmental delays are too young and cognitively immature to rate their own health, and complete the health measures. Caregivers of children with chronic conditions typically reported worse health for children by proxy report than did the children themselves across most subscales.[4] However, parents' perceptions of their children's health are important because health advice and health-care use for children are usually influenced by their parents.[29] Therefore, we used the CHQ-PF28, which has high alpha coefficients between children's and their parents' perspectives[8] to provide a proxy rating in this study.

Study Limitations

Certain limitations exist in this study. First, the sample is small and biased. Therefore, we may not be able to generalise the findings to other children with developmental delays. A larger sample size from the community is necessary to translate these study results to other populations in the future. Second, we used a questionnaire that was originally developed for Western children. Previous studies have shown that the translated questionnaire is a reliable alternative cross-cultural method of assessing health status.[30,31] However, certain cultural differences may occur that are not considered in the translated version. Third, we used a parent-reported questionnaire to assess the health status of children with unclassified developmental delays. Certain differences may exist between the child's and parent's viewpoints on health status.

Conclusion

This study found that child age, delayed gross- and fine-motor functions, severity of impairment, and financial support in preschool Taiwanese children with developmental delays were negatively related to parent-reported health. Maternal employment and children's gender affected health status, which may be partly explained by characteristics of traditional Chinese culture. Future studies of children with developmental delays of different races and cultures are warranted to confirm this result.

Acknowledgments

This study was partially supported by a research grant (SKH-TMU-100-06 and SKH-8302-97-DR-38) from Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan, and also partially supported by Taiwan's National Science Council (NSC 99-2628-B-002-061-MY3).

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