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Functional Independence Measure (WeeFIM) for Chinese Children: Hong Kong Cohort

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ABSTRACT. *Background.* The Functional Independence Measure (WeeFIM) for children is a simple-to-administer scale for assessing independence across 3 domains in American children. WeeFIM was based on a conceptual framework by the World Health Organization (1980) of pathology, impairment, disability and handicap, and the "burden of care." WeeFIM is useful in assessing functional independence in children aged 6 months to 7 years. It can be used for children with developmental disabilities aged 6 months to 21 years. Normative WeeFIM data had been validated for American children. Because of cultural and environmental differences among countries, normative data for the Chinese population are needed. With a normative database, the progression of independence at home and in the community can be evaluated.

WeeFIM is an 18-item, 7-level ordinal scale instrument that measures a child's consistent performance in essential daily functional skills. Three main domains (self-care, mobility, and cognition) are assessed by interviewing or by observing a child's performance of a task to criterion standards. WeeFIM is categorized into 2 main functional streams: "Dependent" (ie, requires helper: scores 1–5) and "Independent" (ie, requires no helper: scores 6–7). Scores 1 (total assistance) and 2 (maximal assistance) belonged to the "Complete Dependence" category. Scores 3 (moderate assistance), 4 (minimal contact assistance), and 5 (supervision or set-up) belonged to the "Modified Dependence" category. Scores 6 (modified independence) and 7 (complete independence) belonged to the "Independent" category. The WeeFIM is a 7-level criterion-specific ordinal scale. Level 7 requires no assistance for the child and the child completes the task independently without requiring a device. During the task, there is no concern about safety or taking an inordinate amount of time. Level 6 reflects modified independence and includes use of an assistive device or not completing the task in a timely or safe manner.

Objective. To examine the utility of the WeeFIM in Chinese children and to create a normative WeeFIM profile suitable for Chinese children.

Method. Direct interviews were conducted for 445 normal Chinese children, aged 6 months to 7 years, in the community.

Results. 1. WeeFIM total score and 3 domains subscores versus age. The total WeeFIM scores increased progressively with age, reaching a plateau at 72 months.

There was a progressive increase in subscores of self-care, mobility, and cognition independence between 6 to 62 months, especially between 6 to 45 months. Similarly, the WeeFIM self-care subscores increased progressively with age, reaching a plateau at around 72 months. The WeeFIM mobility subscores increased progressively with age, reaching a plateau at around 54 months. The WeeFIM cognition subscores increased progressively with age, reaching a later plateau at around 80 months.

2. WeeFIM subtotal scores versus age. The total WeeFIM score and 3 domain subscores correlated significantly with age. We further classified the 18 items into 3 groups according to the degree of correlation with age. Most items had high correlation with Spearman's correlation coefficient of $\rho > 0.8$. Only 1 item (chair transfer) showed moderate correlation with $\rho = 0.7$ – 0.8 . The item "walk" had the lowest correlation with $\rho = 0.6$ – 0.7 .

3. Chronological order for achieving different items. The 50th percentile of age in months for achieving level 6 (modified independence) of the 18 items were compared and ranked according to the age of achieving level 6. In creating a developmental scale of achievement of level 6 (modified independence) for all 18 items, the developmental sequence clustered in the following order: chair transfer (order 1) and walk (order 2) were achieved much earlier (at 18 and 24 months, respectively). Thereafter, there was a clustering of 4 items achieved at around 45 months: toilet transfer (order 3), stair (order 4), expression (order 5), and social interaction (order 6). Then, 9 items were achieved at around 54 to 56 months: tub or shower transfer (order 7), eating (order 8), bathing (order 9), bowel management (order 10), dressing of lower body (order 11), comprehension (order 12), dressing of upper body (order 13), bladder management (order 14), and grooming (order 15). At 60 months, the following ranked in order: memory (order 16), problem-solving (order 17), and toileting (order 18).

4. Impact of sex factor. Girls aged 22 to 45 months had higher scores in self-care subscores and cognition subscores. From 63 months onwards, boys had statistically significant higher scores in mobility subscores. Otherwise, there was no statistically significant difference in WeeFIM scores for different age groups.

5. Impact of domestic helpers. There was also significant difference for self-care subscore with the presence of a maid at home. Those children with a maid at home obtained lower self-care subscores. However, the mobility and cognition subscores were not affected.

Conclusion. We have created a normative functional independence profile for Chinese children by adapting the American-based WeeFIM. There were cultural differences when compared with American children.

Interestingly, Chinese children in Hong Kong scored better than their American counterparts in domain 1 (self-care) in all ages. This might be attributable to early

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attendance in preschool settings where children are taught to tend to their needs. Even for domain 2 (mobility), the higher scores in younger Chinese children in Hong Kong (<3 years) might be explained by earlier attendance in preschool settings. The American children did catch up after 3 years. As for domain 3 (cognition), the local educational system emphasized reading, writing, memorizing materials, and social interaction. Thus, Chinese children in Hong Kong had better cognition scores until 42 months, when their American counterparts caught up by attending preschool.

There are definitely environmental and cultural practices affecting functional independence in both ethnic groups, especially in the upper age range (>4 years) both in America and Hong Kong. Thus, a locally validated WeeFIM instrument should be adopted for Chinese children. Our study demonstrated that WeeFIM could be used as a functional independence measure for Chinese children. Hong Kong has a different cultural background compared with America; thus, usage of WeeFIM with different age criteria for achieving independence should be adopted. *Pediatrics* 2002;109(2). URL: <http://www.pediatrics.org/cgi/content/full/109/2/e36>; WeeFIM, functional independence measure, Chinese children.

ABBREVIATIONS. WeeFIM, Functional Independence Measure for Children.

There are currently many developmental tests for children at risk of having disabilities. Most of these tests use psychometric principles for assessing a child's clinical developmental profile at one setting. Interventional programs for tracking the progress of children with disabilities are rare.

Functional Independence Measure for Children (WeeFIM) was developed to emphasize habitative and developmental aspects of children with special health care needs, genetic disorders, developmental disabilities, and acquired disabilities. WeeFIM was based on a conceptual framework by the World Health Organization (1980) of pathology, impairment, disability, and handicap (1998)¹ and the "burden of care." The "burden of care" is the type and amount of assistance and resources required by a person with disability to perform basic life activities effectively. The burden of care should be translated into consumption of social supports and economical resources.

WeeFIM is a developmental adaptation of Functional Independence Measure (FIM), which was developed by the National Task Force for Medical Rehabilitation (1983) to measure the functional independence of adults and severity of disability with acquired disability.²⁻⁶ It served as an evaluative measure of rehabilitation outcomes in adults with stroke, spinal cord injury, traumatic brain injury, musculoskeletal problems (hip replacement and amputation), and multiple sclerosis.

WeeFIM is an 18-item, 7-level ordinal scale instrument that measures a child's consistent performance in essential daily functional skills. Three main domains (self-care, mobility, and cognition) are assessed by interviewing or by observing a child's performance of a task to criterion standards. WeeFIM

is useful in assessing functional independence in children aged 6 months to 7 years.^{7,8} It can be used for children with developmental disabilities aged 6 months to 21 years and for individuals of all ages with developmental disabilities and mental age <7 years. WeeFIM is especially useful for measuring developmental progression of functional independence in children aged 2 to 5 years.

WeeFIM requires less administration time and provides information directly relevant to evaluating functional outcomes for children with disabilities.⁹⁻¹² The advantages of WeeFIM include its conciseness (simple scoring of 1-7), comprehensiveness (covers all developmental aspects), uniformity (certified training), and discipline-free requirements (can be administered by trained health, developmental, or educational professionals). Its reliability and validity have been studied in healthy and disabled children.¹³⁻¹⁷

Normative WeeFIM data have been validated for American children.⁸ Because of cultural and environmental differences among countries, normative data for the Chinese population is needed. With a normative database, the progression of independence at home and in the community can be evaluated. The objective of this study was to examine the utility of the WeeFIM in Chinese children and to create a normative WeeFIM profile suitable for Chinese children.

METHODS AND PARTICIPANTS

The WeeFIM questionnaire, which was translated into Chinese, consisted of 3 domains according to WeeFIM Clinical Guide.¹⁵ The self-care domain consisted of 8 items and included eating (feeding self and using appropriate utensils), grooming (washing face and hands, brushing teeth, and brushing or combing hair), dressing body above the waist including inner and outer clothes, bathing, toileting (hygiene and adjustment of clothes), and maintaining bowel and bladder consistency. Five items comprise the motor domain: changing positions from chairs, getting on and off the toilet, getting in and out of showers and bathtubs, self-mobility indoors and outdoors, and ascending and descending stairs. The 5 items in the cognition domain are understanding of language, expressive use of language, social interaction with peers, problem solving, and memory.

The WeeFIM is a 7-level, criterion-specific ordinal scale. Level 7 requires no assistance for the child and the child completes the task independently without requiring a device. During the task, there is no concern about safety or taking an inordinate amount of time. Level 6 reflects modified independence and includes use of an assistive device or not completing the task in a timely or safe manner.

WeeFIM is categorized into 2 main functional streams: "Dependent" (ie, requires helper; scores 1-5) and "Independent" (ie, no helper; scores 6-7). Scores 1 (total assistance) and 2 (maximal assistance) belonged to the category of "Complete Dependence". Scores 3 (moderate assistance), 4 (minimal contact assistance), and 5 (supervision or set-up) belonged to the category of "Modified Dependence". Scores 6 (modified independence) and 7 (complete independence) belonged to the "Independent" category.

A score of 1 through 7 is given for each of the 18 items. A score of 1 through 5 means that the child need help for performing different daily task. A score of 6 or 7 means that no help was required.

Score:

No assistance:

7 = complete independence (no helper, no device, safely and timely);

6 = modified independence (assistive device, not timely or not safely);

Assistance:

- 5 = supervision, set-up, or standby prompting;
- 4 = minimal contact assistance or prompting with participant performing >75%;
- 3 = moderate contact assistance or prompting with participant performing 50% to 74% of effort;
- 2 = maximal contact assistance or prompting with participant performing 25% to 49% of effort;
- 1 = total assistance or not testable (participant <25%).

Therefore, the minimum score is 18 with a maximum of 126. In self-care, the range of scores are 8 to 56. In motor, the range of scores are 5 to 35. In cognition, the range of scores are 5 to 35. We calculated both a total score and domain subscores in self-care, mobility, and cognition.

Additional information about the educational level of parents, social class, and the presence of domestic help at home was also obtained.

Participants

In Hong Kong, >99% of the population is Chinese. We stratified the cohort into equal distribution according to 5 social classes based on Giddens classification (I = Professional, II = Managerial and technical, III = Clerical and minor supervisory and IIIm = Skilled manual, IV = Semi-skilled manual, and V = Unskilled manual).¹⁸

Inclusion Criteria

Our community sample consisted of 1) Maternal and Child Health Centers where healthy children aged 3 months to 5 years attend the clinics regularly for vaccination and developmental screening; and 2) healthy kindergartens organized by a local Catholic group (Caritas Hong Kong). Children aged 6 months to 7.25 years were randomly selected in all 19 districts of Hong Kong. Only healthy Chinese children are recruited. Healthy children are defined as those who had passed the developmental screening tests in Maternal and Child Health Centers for children aged 6 months to 5 years. The mothers were interviewed directly by face-to-face contact. Consent form was signed and approved by the ethics committee of Faculty of Medicine, University of Hong Kong.

Statistical Analysis

Analyses were conducted using SAS Software, Version 12 (Cary, NC). Pearson correlation coefficient was computed for the relation between total WeeFIM and age. Spearman's rank correlation coefficient was computed the relation of 3 domains (self-

care, mobility, and cognition) with age. A significance level of $P < .05$ was used for all analyses.

Interrater Reliability

Twenty mothers of healthy children were interviewed independently by 2 examiners (S.W. and K.C.). Interrater reliability was calculated using weighted kappas (κ) for individual item scores. In addition, interclass correlation coefficients were obtained for total scores and self-care, mobility, and cognition domain subscores.

RESULTS

Interrater reliability (Table 1): The weighted κ ranged from the lowest 0.92 to 1. The interclass correlation coefficient was 0.99 for self-care subscore, 1 for motor subscore, and 0.99 for cognitive subscore.

Participants

Four hundred forty-five Chinese children were recruited and equally distributed in all 3 major regions of Hong Kong: Hong Kong Island ($N = 177$); Kowloon ($N = 122$); and New Territories ($N = 146$). The boys to girls ratio was 0.57: 0.43 (1.3:1). The age distribution was 34.6% ($N = 154$) at 6 to 21 months; 27% ($N = 120$) at 22 to 45 months; 22% ($N = 98$) at 46 to 62 months and 16.4% ($N = 73$) at 63 to 100 months. The mean age was 3.1 years (age range: 6 months-7 years, 3 months; standard deviation: 1.87 years).

WeeFIM Total Score and 3 Domains Subscores Versus Age (Fig 1-4)

The total WeeFIM scores increased progressively with age, reaching a plateau at 72 months (Fig 1). There was a progressive increase in subscores of self-care, mobility, and cognition independence between 6 to 62 months, especially between 6 to 45 months (Fig 2-4). Similarly, the WeeFIM domain 1 (self-care) subscores increased progressively with age, reaching a plateau at around 72 months (Fig 1). The WeeFIM domain 2 (mobility) subscores in-

TABLE 1. Interrater Reliability of All 18 Items in WeeFIM ($N = 20$ Children)

Items	Descriptive Items	Weighted Kappa	Interclass Correlation Coefficient
Domain 1: self-care (maximum = 56)			0.99
1	Eating	1	
2	Grooming	1	
3	Bathing	1	
4	Dressing-upper	1	
5	Dressing-lower	0.99	
6	Toileting	0.96	
7	Bladder	1	
8	Bowel	1	
Domain 2: mobility (maximum = 35)			1
9	Chair transfer	1	
10	Toilet transfer	1	
11	Tub transfer	1	
12	Walk	1	
13	Stairs	1	
Domain 3: cognition (maximum = 35)			0.99
14	Comprehension	1	
15	Expression	0.99	
16	Social interaction	1	
17	Problem solving	0.98	
18	Memory	0.92	
Total scores = 126			0.99

Fig 1. WeeFIM total score. Maximum score = 18 items \times 7 = 126.

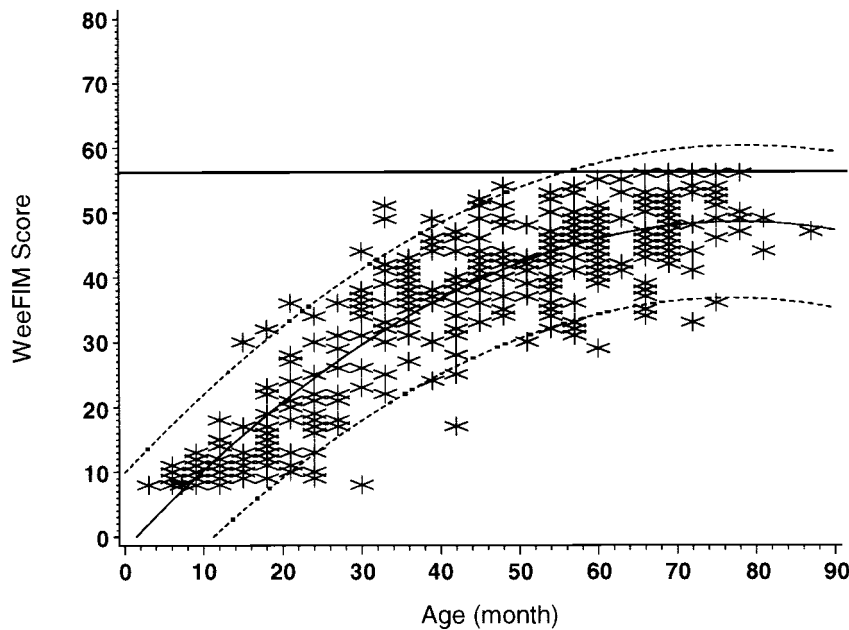
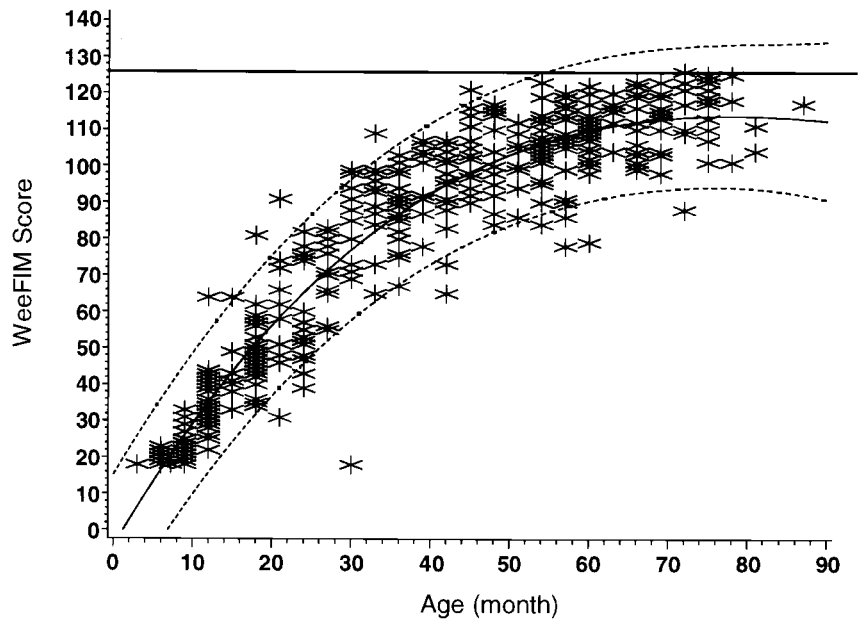


Fig 2. WeeFIM domain 1: self-care. Maximum score = 8 items \times 7 = 56.

creased progressively with age, reaching a plateau at around 54 months (Fig 3). The WeeFIM domain 3 (cognition) subscores increased progressively with age, reaching a later plateau at around 80 months (Fig 4).

WeeFIM Subtotal Scores Versus Age (Fig 5)

The total WeeFIM score and 3 domains (self-care, mobility, and cognition) subscores correlated significantly with age and the Spearman's correlation coefficient were 0.92, 0.90, 0.84, and 0.91 (all with $P < .0001$), respectively. We further classify the 18 items into 3 groups according to the degree of correlation with age. Most items had high correlation with Spearman's correlation coefficient of $\rho > 0.8$. Only 1 item (chair transfer) showed moderate correlation with $\rho = 0.7$ to 0.8. The item "walk" had the lowest

correlation with $\rho = 0.6$ to 0.7. We then calculated the correlation for the item "walk" with age.

For age < 3.5 years, the correlation was $r = 0.504$, whereas there was poor correlation ($r = 0.07$) for those aged > 3.5 years.

Chronological Order for Achieving Different Items (Table 2)

The 50th percentile of age in months for achieving level 6 (modified independence) of the 18 items were compared and ranked according to the age of achieving level 6.

Median Age and Age Range of Achieving Near Independence (ie, Level 6) in Individual Items 1 to 18 (Fig 6)

In creating a developmental scale of achievement of level 6 (modified independence) for all 18 items, the developmental sequence clustered in the follow-

Fig 3. WeeFIM domain 2: mobility. Maximum score = 5 items \times 7 = 35.

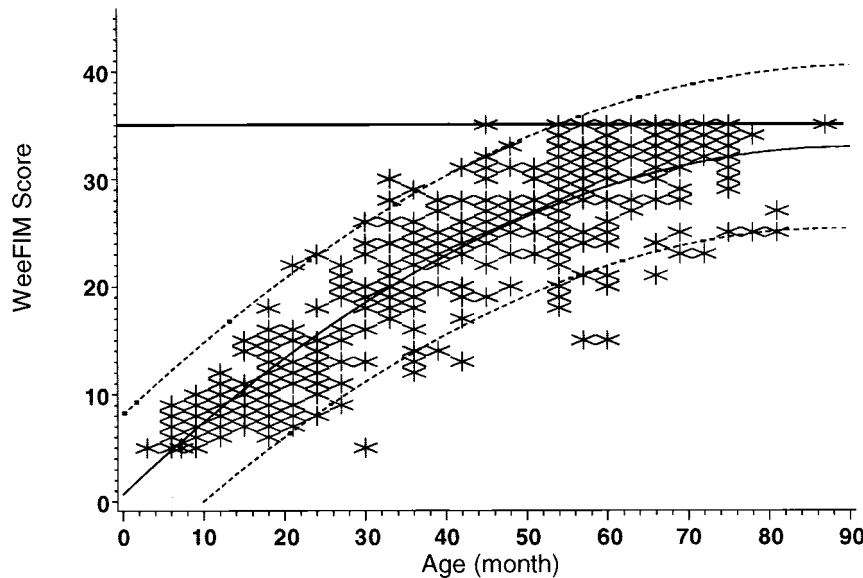
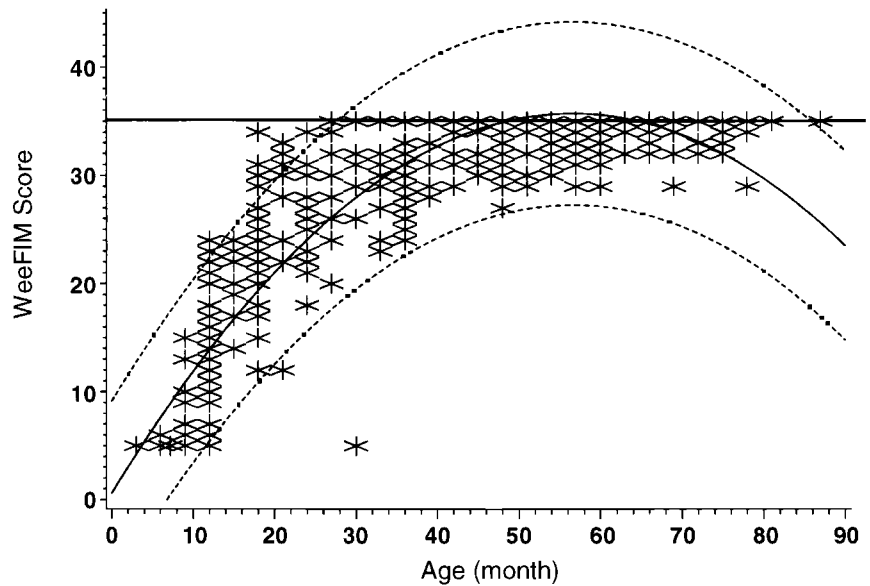


Fig 4. WeeFIM domain 3: cognition. Maximum score = 5 items \times 7 = 35.

ing order: chair transfer (order 1), walk (order 2) were achieved much earlier, at 18 and 24 months, respectively. Thereafter, there was a clustering of 4 items achieved at around 45 months: toilet transfer (order 3), stair (order 4), expression (order 5), and social interaction (order 6). Then, 9 items were achieved at around 54 to 56 months: tub or shower transfer (order 7), eating (order 8), bathing (order 9), bowel management (order 10), dressing of lower body (order 11), comprehension (order 12), dressing of upper body (order 13), bladder management (order 14), and grooming (order 15). At 60 months, the following ranked in order: memory (order 16), problem solving (order 17), and toileting (order 18).

Impact of Sex Factor

When we further studied the significance of sex in different age groups on the 3 main WeeFIM domains (self-care, mobility, and cognition) by *t* test, girls

aged 22 to 45 months had higher scores in self-care subscores and cognition subscores, which were statistically significant ($P < .005$). From 63 months onwards, boys had higher scores in mobility subtotal scores which was also statistically significant ($P < .05$). Otherwise, there was no statistically significant difference in WeeFIM scores for different age groups.

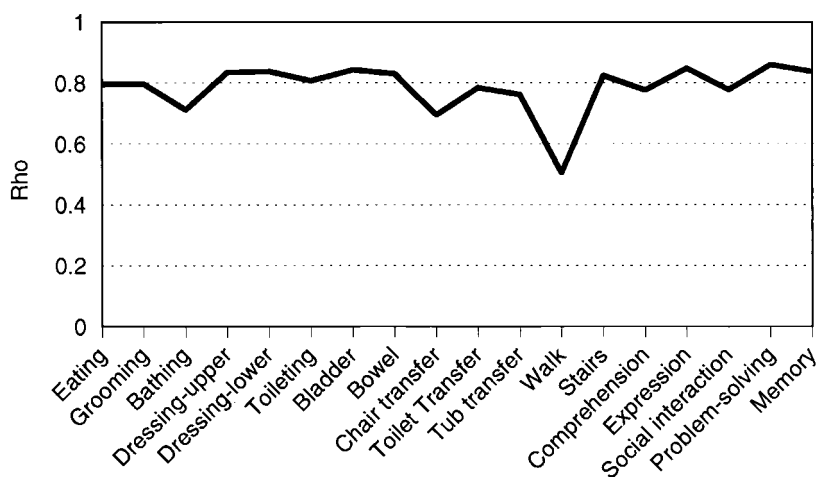
Impact of Domestic Helpers

There was also significant difference ($P < .05$) for self-care subscore with presence of maid at home. Those children with maid at home obtained lower self-care subscores. However, the mobility and cognition subscores were not affected.

Impact of Social Class

There was no effect of social class on the WeeFIM scores.

Fig 5. Correlation between age and WeeFIM levels (1-7).



Spearman's rank correlation Rho coefficients correction for ties; rho
High correlation : Rho = > 0.8;
Moderate correlation: Rho = 0.7-0.8;
Low correlation : Rho = 0.6 - 0.7

TABLE 2. Order of 50th Percentiles for Attaining Level 6 in Hong Kong Chinese Children

Order of Achievement	Items	25th Percentile (Months)	50th Percentile (Months)	75th Percentile (Months)
1	Chair transfer	15	18	24
2	Walk	18	24	45
3	Toilet	33	45	54
4	Stair	35	45	54
5	Expression	36	45	57
6	Social interaction	36	45	57
7	Tub/shower transfer	30	53	60
8	Eating	39	54	60
9	Bathing	39	54	66
10	Bowel	42	54	66
11	Dressing-lower	45	54	66
12	Comprehension	45	54	66
13	Dressing-upper	45	54	69
14	Bladder	48	54	60
15	Grooming	42	56	66
16	Memory	48	60	69
17	Problem solving	54	60	66
18	Toileting	60	65	69

DISCUSSION

We have created a normative functional independence profile for Chinese children by adapting the American based WeeFIM. There was cultural difference when compared with the American children.¹² In other studies, interrater reliability had been confirmed for WeeFIM with Pearson's correlation coefficients and excellent agreement was indicated by Interclass Correlation Coefficient (ICC) >0.75.¹³⁻¹⁷ Our study demonstrated good interrater reliability with ICC >0.98 and weighted kappas (κ) of 0.92. We chose direct face-to-face interview with the mother as the usefulness of information collected by clinical interview had demonstrated good agreement when WeeFIM was administered either by direct observation or by interview with a parent.¹⁷

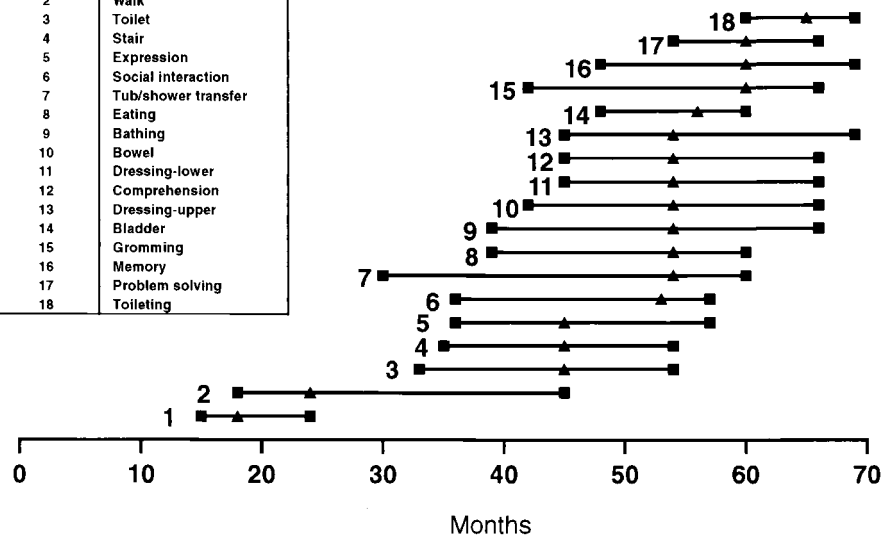
Interestingly, Chinese children in Hong Kong scored better than the American counterparts in domain 1 (self-care) in all ages. This might be attribut-

able to early attendance in preschool settings where children are taught to tend to their needs. Even for domain 2 (mobility), the higher scores in younger Hong Kong children (<3 years) might be explained by earlier attendance in preschool settings. The American children caught up after 3 years. As for domain 3 (cognition), the local educational system emphasized on reading, writing, memorization of materials and social interaction. Thus, Chinese children in Hong Kong had better cognition scores until 42 months, when their American counterparts caught up by attending preschool.

It is well-accepted in traditional Chinese culture that girls are more capable of self-caring and language development, whereas boys are stronger in mobility and manual work. The reasons are that girls are trained earlier in self-care techniques (like eating, grooming, and dressing), whereas boys are encouraged to participate in more physical activities. So, not

Order	Items
1	Chair transfer
2	Walk
3	Toilet
4	Stair
5	Expression
6	Social interaction
7	Tub/shower transfer
8	Eating
9	Bathing
10	Bowel
11	Dressing-lower
12	Comprehension
13	Dressing-upper
14	Bladder
15	Grooming
16	Memory
17	Problem solving
18	Toileting

Fig 6. Median age and age range of Chinese children in achieving level 6 (modified independence) in WeeFIM.



surprisingly, girls had a higher score in self-care and boys a higher score in mobility.

Although WeeFIM has been validated for use as an outcome measure for rehabilitation of chronic disabilities in children, it was designed for American children. In our study, our rating scale was the same as the American WeeFIM.¹⁵ Environmental and cultural practices definitely affect functional independence in both ethnic groups, especially in the upper age range (>4 years), both in America and Hong Kong. Thus, a locally validated WeeFIM instrument should be adopted for Chinese children.

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