A Study of Child Developmental Norms for Children from birth to 5 years of age in Chiang Mai

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Abstract

This study aims to determine the developmental norms for children from birth to 5 years of age who live in Chiang Mai and to identify an order of assessment items of a child development tool for children from birth to 5 years of age, of the Department of Mental Health, Ministry of Public Health.

The sample consisted of children from birth to 5 years of age living in Chiang Mai; a total of 420 subjects from a multi-staged stratified random sampling method. The tool used was the child development assessment form for children aged from birth to 5 years of Mental Health Department, Ministry of Public Health. The analysis was based on Multiple Logistic Regressions at 25^{th}, 50^{th}, 75^{th} and 90^{th} percentiles and order of development of children from birth to 5 years of age, divided into 60 months based on the 75^{th} and 90^{th} percentile.

The results showed that the developmental norms for Thai children could be assessed, based on those who were able to pass each question, classified according to the percentile. For Gross Motor skills, the children were able to pass 154 out of 155 items. The item for which the developmental norm could not be assessed, was the ability to place their feet on bike pedals while the bike was being pushed forward. For Fine Motor Skills, the children passed 161 out of 162 items. The item which could not be assessed for, was the ability to hand an object to the evaluator when asked to. For Receptive Language Skills, the children passed 104 out of 105 items. The item that could not be assessed for, was physical reaction when hearing a sound. For Expressive Language, the children were able to complete all 104 items. For Personal and Social Skills, the children completed 126 out of 128 items. The two items that could not be assessed, were item numbers 75 and 76; issues of assessment being: the child stops crying when held by the parents, and the child can look at faces for 1-2 seconds, respectively. It was found that all Thai children who were evaluated, could pass the behavioral assessments. The results showed that 649 of 654 assessment items (99.24%) were able to identify developmental norms in children aged from birth to 5 years in Chiang Mai and were able to identify an order of assessment items

of the child development tool of The Department of Mental Health, Ministry of Public Health. This can be used for children from each age range (60 months) and the assessment items are put in order according to the number of items used to assess the children from 1 month to 60 months of age, classified into 5 skills areas of Gross Motor, Fine Motor, Receptive Language, Expressive Language and Personal and Social care.

Keywords: *Developmental Norms, Child Development, Child Development Assessment Form*

Introduction

Child development in early childhood (from birth to 5 years of age) is a very important foundation in the quality of public health. The Thai government has given priority to prepare and to empower the development of children in early childhood, as can be seen clearly from the National Economic and Social Development Plan No. 8 (BE 2540 - 2544) until the 10th Plan (BE 2550-2554) which continues to focus on child development in the early childhood stage, as well as disease control and prevention. Importance is given to each stage of child development in different areas; physical, mental, emotional and social intelligence. This will result in the growth of children who will help in developing the country later on.
(Office of Economic and Social Development Board, 2005).

Most child development assessment forms in Thailand are translated and developed from foreign forms whose diversity is used for different kinds of assessments. For instance; the evaluation form developed by the Department of Health, Denver II, Diagnostic Inventory for Screening Children (DISC), etc. The usage of these tools is evaluated in different steps in order to assess and compare the development of Thai children. The Department of Mental Health conducted a survey on child development in early childhood on 1,558 children, aged 1-3 years and 4-5 years from around the country using the Denver II developmental assessment tool. It was found that the percentage of children who have the standard of development for the 4 areas; Gross Motor, Fine Motor, Expressive Language and Personal and Social in the years 1998, 2004 and 2007 were 71.0, 72.0 and 67.7, respectively.

Assessment tools which are standardized tests such as the Bayley Scales of Infant and Toddler Development 3rd Edition (549 items), and Battelle Developmental Inventory (450 items) can accurately tell the exact developmental delays of children. However, although international development assessment tools have been translated correctly, the

norm of assessment is still from abroad, and is therefore different from Thailand in race, culture, cuisine and cultural environment. These factors could also have an influence on the developmental assessment of children. Therefore, it could not be concluded that the developmental delays of Thai children are due to the different context, or from errors of measurement.

One of the child developmental assessment tools that gives accurate and detailed results is the assessment form for birth to 5 years of age (Developmental Skills Inventory: DSI) developed by Rajanukul Institute in Bangkok, Department of Mental Health, Ministry of Public Health, which the Rajanagarindra Institute of Child Development has used as a model of child developmental assessment and as a guide to the development of children at risk or children having developmental problems. Child development was classified into five areas: Gross Motor, Fine Motor, Receptive Language, Expressive Language, and Personal / Social care. The advantage of this tool, in addition to the assessment of children with developmental delays, is that it also provides detailed instructions for the development of children in each area. The Rajanukul Institute in Bangkok has prepared the handbook to promote the development of children aged from birth to 5 years (1994) and distributed them to different sectors within the Department of Mental Health, Ministry of Public Health. (The Committee of Developmental Promotion Project, Rajanukul Institute, 1999). This form has been used widely. During the years 1996 to May 2009, the Rajanagarindra Institute of Child Development in Chiang Mai arranged training for 4,791 public health personnel (1,865 people with the full version and 2,926 people with the screening version) (Rajanagarindra Institute of Child Development, 2007). Although the tool has been widely used, it was found that quality assessment, such as validity and reliability of the test, has not been studied explicitly. In addition, some items in the test are difficult to understand.

Rajanagarindra Institute of Child Development, Department of Mental Health, Ministry of Health based in Chiang Mai, is a tertiary care unit with a mission to support academic promotion, prevention, treatment and rehabilitation services for children with developmental delays. The main policy is to promote child development from birth to 5 years of age. The institute realizes the importance of studying the developmental norms of Thai children from birth to 5 years of age in order to achieve the standard and to continue to monitor developments of the children. Therefore, the Institute has developed a child developmental assessment tool, Department of Mental Health, Ministry of Health, which is accurate and prompt in assessment of child development. The questionnaire was developed from 3 tools which are: 1) Developmental Skills Inventory (DSI), developed by

Rajanukul Hospital and used to evaluate the development of Thai children in 1989 and has been updated several times. Until the year 2000, it was revised for the fifth time by the Northern Child Development Center (Samai Sirithongtaworn, and Sineenart Jitpakdi, 1998)
2) Diagnostic Inventory for Screening Children (DISC), developed by Samai Sirithongtavorn and Amporn Hatsiri (1999) to assess the development of children who have been evaluated as having developmental delays by other assessment tools. The DISC has developed a high reliability of .99 3) Denver II, translated into Thai by Nittaya Kachapakdi and team (2003) and is developed from the Denver Developmental Screening Test (DDST. total) to help in screening children with developmental problems or who are at risk of developmental problems. The Rajanagarindra Institute of Child Development has therefore developed a child developmental assessment form for children from birth to 5 years of age, Department of Mental Health, Ministry of Public Health, that suits the Thai context. This was used to evaluate the quality of developmental assessment tools and the results showed a content validity of .85 and inter-rater reliability of .80, which is the appropriate level. This leads to the assessment of developmental norms for children from birth to five years of age in Chiang Mai which can progress to a study at national level and then the ASEAN region later on.

Objectives

1. To determine the developmental norms for children from birth to 5 years of age who live in Chiang Mai.

2. To identify an order of assessment items of child development tools for children, the Department of Mental Health, Ministry of Public Health.

Methodology

Population and Samples

The population in this study was 81,455 children aged from birth to 5 years, with census registration in the year 2008 from 24 districts (can be divided into groups as; 17,996 children from the city area, 63,509 children from other districts outside the city, 42,172 males and 39,283 females).

The sample consisted of 398 children aged from birth to 5 years of age using Taro Yamane's formula to calculate the sample size at the 95 percent confidence level (Kiatsuda Srisuk, 2009) However, in order to have the samples from different areas and age groups, the sample size was expanded to 420 children using the multi-stage random sampling method.

Samples were classified into 60 age groups (the age range of 1 month) ± 7 days on the day of evaluation. The criteria for selection are that the children must be registered in the census; are within the age range from birth to 5 years; have their parents' or guardian's consent and cooperation in the evaluation process. In addition, there were eliminating criteria for children who could not participate throughout the evaluation process or children with illnesses and could not undergo the evaluation.

Research Tools

1. Data collection forms for parents

    1.1 Approval letter to participate in the developmental evaluation.

    1.2 Questionnaire on general information about the child i.e. gender, age, birth order, weight at birth, parental care, congenital disease, region of residence, participation of child, fear of assessment or evaluator, concentration and attention.

    1.3 Questionnaire on general information about the parents i.e. occupation, income, level of education.

2. The developmental assessment form for children from birth to five years of age, the Department of Mental Health, Ministry of Public Health (654 items), developed by Rajanagarindra Institute of Child Development. This assessment tool has a content validity index (CVI) of .84 and inter-rater reliability using the kappa inter-observer agreement according to the age ranges as follows; birth - 6 months, 6 months - 1 year, 1-2 years, 2-3 years, 3-4 years and 4-5 years, were .79, .82, .97, .79, .82, .86, respectively. There were 268 devices (1,024 pieces) used for developmental assessment of the children in 5 different areas;

    2.1 Gross Motor (GM) consists of 155 tests and 39 pieces of equipment. The tests include six skills; movement / ladder and climbing / playing with a ball / balancing, walking, running / jumping / tricycle.

    2.2 Fine Motor (FM) consists of 162 tests and 395 pieces of equipment. The tests include 13 skills; stability of materials / looking / handling items / placing items / picking an object / using hands / placing items into containers / finding a solution, puzzle / problem solving / reading / drawing / matching and classifying objects and pictures / matching, classifying and selecting according to criteria.

    2.3 Receptive Language (RL) consists of 105 tests and 39 pieces of equipment. The tests include eight skills; listening and attention / response to a gesture or simple

command / following simple commands / selecting objects and images / following commands (action) / following instructions (according to features of objects) / following instructions (according to the location of objects) / and following instructions (according to grammatical structure).

2.4 Expressive Language (EL) consists of 104 tests and 312 pieces of equipment. The tests include seven skills; vocalization / vocal interaction / vocal imitation and imitation / vocal interaction with intended meaning / interpretation / volume and clarity of speech / using sentences with correct grammatical structure.

2.5 Personal and Social care (PS) consists of 128 tests and 58 pieces of equipment. The tests include five skills; social skills and playing / eating and drinking / dressing / excretion /body cleaning and dressing.

Data collection

1. Liaise with the coordinator in the area.
2. Training field researchers to use the child development assessment form for children from birth to five years of age, the Department of Mental Health, Ministry of Public Health. Field researchers are physicians, nurses and psychologists.
3. Collection of information. Physicians conduct clinical assessments of children in child care, according to selection criteria, in order to have normal children as samples. Field researchers assess child development of all children from birth to 5 years of age, for eight times, and follow up with weekly results for a period of 2 months.

Data Analysis

1. Data was analyzed by frequency, percentage, mean and standard deviation.
2. The developmental norms of the children were analyzed by Logistic Regression to determine whether children of each age range would be able to go through each question in the 25^{th}, 50^{th}, 75^{th} and 90^{th} percentiles as below.

    Step 1: Choose a variable that is correlated with the dependent variable (child development). The relations were analyzed by Chi-square test and were found to have a statistical significance relationship with the development of the children.

    Step 2: Check the conditions of the logistic regression analysis.

    Step 3: Test the validity of the model by considering the -2 log likelihood (-2LL) and the Hosmer-Lemeshow goodness of fit.

Step 4: Create the Logistic Response Function equation and verify the results using pseudo R2 and the Wald Statistics.

3. Order and develop by considering the difference in age between the 75th and 90th percentiles.

Protection rights of the samples

This study was approved by the Ethics Committee, Department of Mental Health, Ministry of Public Health. Protection rights of the samples have been considered throughout the process of data collection.

Results

1. General Data

Table 1: Table showing the general data of children from birth to 5 year of age.

Age (month)	Urban Area			Rural Area			Total (%)
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)	
At birth – 6 months	4 (0.95)	4 (0.95)	8 (1.90)	19 (4.52)	19 (4.52)	38 (9.05)	46 (10.95)
6-12	4 (0.95)	4 (0.95)	8 (1.90)	17 (4.05)	18 (4.28)	35 (8.33)	43 (10.24)
12-24	8 (1.90)	8 (1.90)	16 (3.81)	35 (8.33)	35 (8.33)	70 (16.67)	86 (20.48)
24-36	9 (2.14)	9 (2.14)	18 (4.28)	33 (7.86)	33 (7.86)	66 (15.71)	84 (20.00)
36-48	9 (2.14)	9 (2.14)	18 (4.28)	28 (6.67)	32 (7.62)	60 (14.28)	78 (18.57)
48-60	8 (1.90)	8 (1.90)	16 (3.81)	35 (8.33)	32 (7.62)	67 (15.95)	83 (19.76)
Total	42 (10.00)	42 (10.00)	84 (20.00)	167 (39.76)	169 (40.24)	336 (80.00)	420 (100.00)

From table 1, the data shows that 420 children from birth to 5 years of age are female 58%, living in a rural area 80%, from birth to 6 months, 6-12 months, 12-24 months, 24-36 months, 36-48 months, and 48-60 months is 10.95%, 10.24%, 20.48%, 20.00%, 18.57%, and 19.76% by order.

2. Developmental norms for children from birth to 5 years of age

Table 2: Table showing details of items for which developmental norms could be assessed for in each developmental area.

Developmental Areas	No. of items which developmental norms could be assessed for	No. of items which the age group of children does not correspond with the capacity (developmental norms could not be assessed)	No. of items in total
Gross Motor	154	1	155
Fine Motor	161	1	162
Receptive Language	104	1	105
Expressive Language	104	0	104
Personal and Social care	126	2	128
Total	649	5	654

From table 2, the developmental norms for Thai children could be assessed based on those who were able to pass each question, classified according to the percentile. For Gross Motor skills, children were able to pass 154 out of 155 items. For Fine Motor skills, the children passed 161 out of 162 items. For Receptive Language skills, the children passed 104 out of 105 items. For Expressive Language skills, the children were able to complete all 104 items. For Personal and Social skills, the children passed 126 out of 128 items.

Table 3: Table showing details of the items which children's age group does not correspond with the capacity to undergo the evaluation.

Developmental Areas	Age (month)	Item
1 Gross Motor	24-47	The child is able to place his/her feet on bike pedals while the bike was being pushed forward
2 Fine Motor	24-47	The child was able to hand a particular object to the evaluator when asked to
3 Receptive Language	1-5	The child shows a physical reaction when hearing a sound
4 Personal/Social care	1-5	The child stops crying when held by a parent The child can look at faces for 1-2 seconds

From table 3 evaluation results showed that 649 of 654 assessment items (calculated as 99.24%) were able to identify child developmental norms for children aged from birth to 5 years in Chiang Mai (The Department of Mental Health, Ministry of Public Health) using Logistic Regression analysis. There were 5 items which could not be assessed; 1 item of Gross Motor, 1 item of Fine Motor, 1 item of Receptive Language and 2 items of Personal/ Social care. These were because the age range of the children did not correspond with the capacity to undergo the evaluation.

3. Identify order of assessment items of child development tool for children, The Department of Mental Health, Ministry of Public Health.

Table 4: Table showing number of assessment items of DSI in age range order and classified according to developmental areas

Age (month)	Number of assessment items for developmental evaluation in each area					Total
	Gross Motor	Fine Motor	Receptive Language	Expressive Language	Personal/ Social care	
1	1	-	1	-	-	2
2	1	1	2	4	-	8
3	3	4	2	2	6	17
4	5	3	1	1	1	11
5	5	4	2	1	4	16
6	6	1	2	4	2	15
7	4	4	1	2	3	14
8	7	4	2	3	4	20
9	4	5	2	7	2	20
10	6	5	2	5	4	22
11	3	5	3	4	2	17
12	2	8	3	4	8	25
13	6	6	1	3	4	20
14	2	9	1	3	3	18
15	6	8	2	3	2	21
16	5	5	5	3	2	20
17	3	4	3	4	6	20
18	2	2	4	3	7	18
19	4	3	4	3	7	21
20	7	3	3	4	5	22
21	4	3	2	3	6	18
22	4	2	5	4	7	22
23	4	5	5	4	10	28

Age (month)	Number of assessment items for developmental evaluation in each area					Total
	Gross Motor	Fine Motor	Receptive Language	Expressive Language	Personal/ Social care	
24	3	8	5	6	10	32
25	6	11	5	7	6	35
26	8	8	6	6	7	35
27	9	5	4	8	5	31
28	10	2	4	7	3	26
29	9	3	4	3	4	23
30	11	4	4	3	7	29
31	9	7	6	4	7	33
32	9	9	10	4	6	38
33	7	9	12	3	10	41
34	10	13	14	3	10	50
35	11	15	16	5	10	57
36	9	15	17	5	12	58
37	12	15	9	7	10	53
38	7	10	8	9	12	46
39	5	10	6	7	10	38
40	4	10	5	6	9	34
41	9	8	7	8	9	41
42	11	9	10	7	13	50
43	9	8	10	7	13	47
44	11	10	10	7	14	52
45	8	12	10	8	17	55
46	10	14	14	8	18	64
47	8	15	13	8	18	62
48	9	18	11	6	17	61
49	10	12	15	5	16	58
50	10	9	10	6	16	51
51	9	9	8	7	12	45
52	8	11	10	3	12	44

Age (month)	Number of assessment items for developmental evaluation in each area					Total
	Gross Motor	Fine Motor	Receptive Language	Expressive Language	Personal/ Social care	
53	8	10	9	2	10	39
54	5	13	8	3	12	41
55	4	15	6	4	11	40
56	4	15	5	5	8	37
57	4	15	7	5	6	37
58	3	10	5	7	4	29
59	5	10	4	7	2	28
60	6	12	4	7	3	32

From table 4 to identify the order of assessment items of the child development tool, The Development of Mental Health, Ministry of Public Health, it was found that of all the 649 developmental items that can be used to assess the developmental norms of children aged from birth to 5 years in Chiang Mai, there were 608 items that could be put in an order according to the number of items used to assess the children from 1 month to 60 months of age, classified into the 5 skills areas of Gross Motor, Fine Motor, Receptive Language, Expressive Language and Personal and Social Care. (See Table 3).

Discussion

From the analysis of the logistic regression model to assess the development of children aged from birth to 5 years in Chiang Mai, The Department of Mental Health, Ministry of Public Health, in total of 654 items, it was found that the developmental norms of children aged from birth to 5 years in Chiang Mai could be assessed based on 649 items and approved that the most accurate validity can be found at P75 and P90.

The developmental norms assessment for Thai children was conducted using the age range of the children and the children's ability in the development, as the variable in the analysis by logistic regression. From the DSI evaluation form with a total of 654 assessment items,651 items (99.54%) were able to be assessed. This shows that the age range of the children is compatible with development in each area. This is consistent with the concept of Nittaya Kachapakdi (1987), Patcharee Suankaew (1993) and Sucha ChanAme (1997) who

defined development as a continuing process of change in the maturity of different systems of the person, starting from conception up until maturity. It enables individuals to act more effectively, perform more difficult and more complex tasks, as well as adding new skills. This has resulted in progress in accordance with physical, emotional and social intelligence and the ability to adjust to the new state of that person. It is an ongoing process that begins from conception to maturity and in many cases, development continues throughout a life time. In general, as the body of a child continues to grow, emotional and behavioral changes are developed at the same time. It is also consistent with results of a study by Anupan Suwannapan (1997) and Sirisara Lipipan (2008) which found that children's age range is an important factor associated with development of Thai children. However, it is not only the age of the children that affect child development, as can be seen from results of Tharnthip Prasarnsap's study (1994) on the influence of direct and indirect factors affecting the development of intelligence in children aged 2 years with a birth weight less than 2000 grams born between the year 1982-1988, in Ramathibodi Hospital. This study found that the factors which directly influence the level of intelligence of children at the age of 2 years were: occupation of the mother, period of pregnancy, marital status, factors after birth period, disability or disorder, family and length of head circumference at 8 months. Factors that have an indirect influence on the level of intelligence at the age of 2 years were: level of education of the parents, factors during labor and the child's weight at 8 months. Ladda Ahamad-Mahidi (2004) studied the development of international boys and girls in kindergarten whose learning program focused on experience and practice. The results showed that those boys and girls showed the highest development score as can be observed from an average score of 4 activities. Also, when considering the graph, it was found that the development score of the children continues to be greater. Ariyaporn Kongnawang's research (1999) studied the trends and changes in the development of writing skills in children by giving training activities at a different time. Samples used in the study were boys and girls between the ages of 5-6 years. The study found that the writing skills of the children given training activities were likely to develop to a higher level. Development during 1-2 weeks has a slight increase which is unclear. However, during the period of 3-9 weeks, development is more obvious.

When identifying an order of assessment items of the child development tool, The Department of Mental Health, Ministry of Public Health, it was found that 608 assessment items were statistically sorted to fit the development of each age group. Moreover, when the items were classified and used to evaluate children of any specific age range (60

months) it was found that the number of assessment items could be reduced for more than 50%.

Assessment items could be removed because when the first part (5 items) was applied to assess the development of children of a specified age (month), it appeared that the children of all age groups could pass through the assessment items. For instance, an evaluation of children aged from 1 to 5 months with the assessment item that children show physical reaction upon hearing a sound. It was found that most of children aged from 1 to 5 months, showed a reaction. Thus, this assessment item cannot be used to identify the development of normal children aged from1 to 5 months, but may be used to screen children and identify whether they have problems. In another section of the assessment (41 items), the analysis cannot specify a certain age group for a child's development. Further studies in the future should compare results to assess the development of Thai children to further confirm the results.

Suggestion

Recommendations for use

1. Child development assessment tools should be developed to assess developmental norms of children in Chiang Mai.

2. Assessment tools to evaluate the development of children aged from birth to 5 years should also be developed, based on the ability of each unit of service in order to achieve integration between the community and a consistent approach of the working process.

Recommendations for further research

1. There should be a detailed study of the characteristics of children and families who were evaluated to consider as another factor in determining a child's development.

2. Simple and easy-to-use assessment tools should be developed. Parents of the children should be involved in the development of such tools.

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Thai Language

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