INFLUENTIAL FACTORS OF THE DEVELOPMENT IN INFANTS AND TODDLERS – APPLICATION OF THE “INTERNATIONAL CLASSIFICATION OF FUNCTIONING, DISABILITY AND HEALTH” FRAMEWORK

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Abstract

Objective: The Structural Equation Modeling (SEM) analysis was conducted based on “International Classification of Functioning, Disability and Health”(ICF) framework to examine the multiple factors relating to general development of infants and toddlers. Methods: The health condition at birth and family characteristics of 122 infants born at National Taiwan University Hospital were collected during the period between May and October in 2004. Scores of the Comprehensive Developmental Inventory for Infants and Toddlers (CDIIT) at 6 months and toddler stage served as the outcomes and represented the domain of activities and participation in the ICF
framework. The birth weight was used as an indicator of the infant’s health condition at birth. The Chinese Toddler Temperament Scale (CTTS) reported by the main caregivers and balance function at 6 months were the parameters in the domain of body function and structure of the ICF model. Scores of the Home Observation for Measurement of the Environment (HOME) collected by trained visitors at the infant’s home were used to quantify the home environment under contextual factors.

**Results:** The path coefficients linking variables were all significant and the directions of the path coefficients were consistent with hypothesized model. The fit indices ($\chi^2(52, N=122)=51.2, p>.05$, NFI=.763, NNFI=0.007, CFI=1.000, IFI=1.005, MFI=1.003, GFI=.933, AGFI=.900, RMR=55.988, SRMR=.063, RMSEA=0.000(95%CI:.000-.056)) indicated acceptable model fit according to the 2-index presentation strategy. At the level of individual structural equations, the GA and home environment accounts for 67% of the total variance in general development; and temperament types account for 12% of the home environment.

**Conclusions:** The hypothesized model analyzed by SEM is one possible model that may be used to explain the relationships between theoretical factors under the ICF model. In this model, the important factors include home environment, health condition, and body function. Whether to intervene with these factors in the early childhood can promote the developmental outcome needs further study.

Key Words: child developmental, ICF, health promotion.
Introduction

Faced with decreasing birth rate and medical technology advances, policy related to early child health care have shifted from an emphasis on survival rate to promoting quality of development. Any identified influential factors of child outcomes in infant or toddler age, such as environmental stimulation or biological factors, would be the critical points for early prevention or promotion in the field of pediatric health care.

Effect of multiple factors on child development has been validated in several birth cohort studies for both children with risk (Fetters & Tronick, 1996; Greenberg & Crnic, 1988) or those with typical development (Appelbaum et al., 1997; Jones, Rantakallio, Hartikainen, Isohanni, & Sipila, 1998; Richards, Hardy, Kuh, & Wadsworth, 2002; Sorri & Jarvelin, 1998; Tseng et al., 2000). In most cases, early development was only well followed in children with biological or psychological risks (Fetters & Tronick, 1996; Greenberg & Crnic, 1988). Except for some studies focusing on early emotional of behavior outcomes for typically developing children (Appelbaum et al., 1997; Tseng et al., 2000), the birth cohort studies based on large sample always began to collect data concerning developmental outcomes at the age older than 4 to 5 years. Based on large sample cohort studies for typical children, the influence of birth weight on later cognitive ability persisted across school age to adult. Besides, the environmental factors has been known to play an increasingly important role with age growth (Jefferis, Power, & Hertzman, 2002; Rakison & Poulin-Dubois, 2002). In other cohort studies with smaller sample size, the social and physical aspect of home environment were proven to be important determinants for children under 3 years old (Bradley & Caldwell, 1980; Bradley et al., 1989). With regard to influential
factors of early development in typically developing infants and toddlers, how early the home environment begins to affect child development independent of birth weight has hitherto not been understood.

To meet the goal of comprehensiveness in studying multiple influential factors of outcomes in infants and toddlers, this study introduced a framework, the International Classification of Functioning, disability and health (ICF) published in 2001 (WHO, 2001) (http://www3.who.int/icf/icftemplate.cfm). The ICF framework (Figure 1) reflects a biopsychosocial perspective that acknowledges the interaction between health condition and four components (body function and structures, activity and participation, environmental factors, and personal factors) in the framework: (WHO, 2001). Apart from important factors (birth weights, home environment) studied in aforementioned birth cohort studies, the other variables reflecting components of the ICF framework would needed to be taken into consideration in investigating child outcomes. The application of ICF framework to children is recently be encouraged by the experts in the fields of health care and education (Palisano, 2006; Palisano, Snider, & Orlin, 2004; Simeonsson & Leonardi, 2004; Simeonsson et al., 2003; Simeonsson & Lollar, 2006).

The definitions for the health condition and four components described in the official publication by WHO (WHO, 2001)are as follows: (1) Health condition: disease or disorder. (2) Body function and structures: Body functions are the psychological and physiological functions of body systems and body structures are anatomical parts of the body such as organ, limbs and their components. Body structure refers to anatomical parts of the body such as organs, limbs and their components. (3) Activity and participation: these two areas are combined to form one of the ICF components and mean the execution of a task or action by an individual while participation is involvement in a life situation. (4) Environmental factors: the
physical, social and attitudinal environment in which people live and conduct their lives. (5) Personal factors: the individual such as age, gender, social status, life experience and so on.

For infants and toddlers who may not have definite diagnosis, the severity of health condition, biological risk factor at pre-, peri-, and post-natal period, would be appropriate to represent health condition. The personal factors were not included in this study due to unavailability of appropriate measures for infants and toddlers in Taiwan.

For testing the ICF framework in children, possible hypothetic models have been addressed (Bartlett & Palisano, 2000; Palisano, 2006). But the confirmation of these proposed models based on ICF framework has not been studied. The structural equation modeling (SEM) was recommended in some published literature for investigating the complex relationships among multiple environmental and biological factors in explaining developmental outcome or motor change for children (Bartlett & Palisano, 2000; Kolobe, 2004). SEM is a technique used to specify and establish models of linear or nonlinear relationships among variables. Variables in a model may include both measured variables (MVs) and latent variables (LVs). LVs are hypothetical constructs that cannot be directly measured but can be represented with multiple MVs that served as indicators of the constructs. The MVs used to indicate the LVs are called indicators. In the common form of SEM, the purpose of model is to account for variation and covariation of the MVs. (MacCallum & Austin, 2000) The merits of SEM include simultaneous estimation of paths in hypothesized models, taking into measure error, ability to involve the effect of feedback in the models, and clearly describing the mediating condition when third variable (mediator) exists between the relationship of one predictor and the dependent variable. (Baron & Kenny, 1986)
Before testing the hypothetical ICF-based model for infants and toddlers, the measurable variables for health condition and the four components in the ICF framework should be identified. The proposed theories for child development and empirical findings from literature review would help with choosing the most important and measurable variables for constructing the ICF-based model.

One of the ICF components, activity and participation has been considered as the most important child outcome (Bartlett & Palisano, 2000; Palisano, 2006; Simons, Ziviani, & Tyack, 2004) A broad range of outcomes covering each domain of child development were recommended for representing the ICF component of activity and participation in children (Liao, 2006; Simeonsson et al., 2003; Simons et al., 2004). For this reason, a comprehensive measure consists of every domains of child development would be appropriate to measure the component of activity and participation. Health condition, body function and structures, environmental factors, and personal factors thus encompass the predictive factors of child outcomes.

Birth weight, one of the indices of health condition at birth (American Academy of Pediatrics, 2004), has impact on later cognitive development for children with low birth weight and normal range of birth weights (Hollomon & Scott, 1998; Richards, Hardy, Kuh, & Wadsworth, 2001). Body function and structures can be measured with two elements, temperament (Gorman, Lourie, & Choudhury, 2001; Miech, Essex, & Goldsmith, 2001; Oberklaid, Sanson, Pedlow, & Prior, 1993) and posture control (Samsom, de Groot, Bezem, Lafeber, & Fetter, 2002; Samsom, de Groot, & Hopkins, 2001) in infancy. Both of them have been reported to be predictive of child outcomes. Temperament was the predictors of both cognitive and social outcomes (Gorman et al., 2001; Miech et al., 2001; Oberklaid et al., 1993) while posture control was only predictive of motor-related functions. From both theories and empirical findings, a lot of factors can be identified as the variables in the component of
environmental factors in the ICF framework, such as home environment and parental socio-economic-status (SES) (Bronfenbrenner & Ceci, 1994; Dunst & Trivette, 1990; Nihira, Weisner, & Bernheimer, 1994). However, the immediate setting in which child develops was hypothesized as the most influential factor for young children in many studies (Abbott & Bartlett, 1999; Bradley, Corwyn, Burchinal, McAdoo, & Coll, 2001; Bradley, Corwyn, McAdoo, & Coll, 2001; Bradley et al., 1994; Kolobe, 2004). In addition, the environmental factors were also proposed to be the mediators of the relationship between child’s temperament and outcomes (Belsky, 1984; Sameroff & MacKenzie, 2003; Scarr & McCartney, 1983).

The ICF –based model in this study was constructed according to above research evidence or theories in early child development. Therefore, we hypothesized birth weight and would affect general development; temperament types would have an impact on home environment; balance function was likely to be the influencing factor on perceptual-motor domain of general development; the general development of infant stage would predict the general development of toddler stage. Building the testable model of child developmental under the comprehensive framework of the ICF would help to identify the modifiable factors in early childhood prevention and promotion.

Methods

Study design

Based on birth cohort study design, the children enrolled in this study were followed at birth, 4 months, six months, and toddler stage (around 2.5 years).

Participants

335 infants born at National Taiwan University Hospital (NTUH) were collected during the period between May and October in 2004. For all 335 infants, 80 (24%) of them lost at 4 month-follow up, 177 (53%) of them lost at 6 month-follow
up, and 213 (64%) of them lost at toddler stage. Within the 3-year follow-up period, total 312 cases lost because of incomplete information on self-report questionnaires (14% out of 335 cases), moving to other countries (2% out of 335 cases), parents’ refuse to be interviewed at home (46% out of 335 cases), and lost of contact (2% out of 335 cases). The high attrition rate (64%) would bias the representation of the sample. The comparison of available basic information for participants and lost cases is listed in table 1. The analysis of demographic data reveals that the differences between the group which was followed up to toddler stage and which was lost in the following periods did not reach statistical significant. Finally 122 children were followed until toddler stage.

Procedures

The informed consent was obtained from 335 mothers who had arranged to give birth to a child in (NTUH) in Taiwan. After the birth of their babies, the birth health conditions, including birth weight, gestational age, Apgar Score, were collected. Approaching 4 months of age, the Chinese Toddler Temperament Scale (CTTS) was mailed to the mothers. All mothers were request to give the most appropriate score on each item and mail back the scoring sheets to the research team. One week before the infants’ six months of age, one of our team members contacted with their parents for scheduling the time of home visiting. The trained visitors went into the infants’ home and conducting 3 measures: the Sitting Balance Scale (SBS), The Comprehensive Developmental Inventory for Infants and Toddlers (CDIIT) (Wang et al., 1998), and Home Observation for Measurement of the Environment (HOME) (Caldwell & Bradley, 2003). All testing and interview procedures followed the guideline described in the manuals. The summary reports of testing were mailed to parents within two weeks to increase the parents’ motivation for being continuous followed. Around the 2nd birthday of the child, the parents were informed for arranging the follow up with
Measures

Activity and participation-The Comprehensive Developmental Inventory for Infants and Toddlers (CDIIT)

The Comprehensive Developmental Inventory for Infants and Toddlers (CDIIT) is a developmental test and commonly used for development diagnosis for infants and toddlers in Taiwan. Five domains of cognition, motor, language, self-help, and social development were constructed. The CDIIT has acceptable test-retest reliability ($r = 0.89-0.99$, $p<.001$), internal consistency (Cronbach $\alpha = 0.75-0.99$), content, concurrent and construct validity (Liao & Pan, 2005; Liao, Wang, Yao, & Lee, 2005; Wang et al., 1998).

Items on the CDIIT are scored 0 or 1, indicating failure or success, respectively, during the test or observation at home by the caregivers. In this study, all items of the cognitive and motor subtests, and part of the language subtest were individually and directly elicited by the tester. The social and self-help subtests were scored from a questionnaire completed by the main caregivers. Based on the norm, the mean DQ is 100, and the standard deviation (SD) of DQ is 15. For further examining the construct validity of CDIID, two constructs (perceptual-motor and social-adaptive) in infants stage (6-11 months) and three constructs (cognitive-language, motor, and social-adaptive) in toddler stage (12-35 months)(Hwang, Weng, & Liao, 2006) were extracted. These constructs served as indicators for the general development in infants and toddler stage separately.

Body function and structures-Revised Infant Temperament Questionnaire (RITQ)

The Carey’s Revised Infant Temperament Questionnaire has been applied to Chinese culture and established normative data for different gender in 1977. The scale is a 95-item parent response questionnaire and was standardized on 254 infants aged
from 4 to 8 months in Taiwan. The subdomains of the RITQ include: activity level, rhythmicity, approach or withdrawal, adaptability, persistence and attention, threshold, intensity of reaction, quality of mood. The test-retest reliability ranged between .67-.90 (p<.05). (Hong et al., 1979) Three major categories of children’s temperament types as easy, intermediate, and difficult are defined according to the algorithm (Carey, 1970) Ordinal scores were given for quantify the temperament type as follows: 1 point: easy; 2 point: intermediate; 3 point: difficult.

**Body function and structures-Sitting Balance Scale (SBS)**

The test was developed by our research team for measuring postural control for infants and toddlers with developmental delay. The agreement between two testers reached 69% in twenty nine 6 –month –old infants of this study. Test-retest (Weighted Kappa Coefficients, $\kappa = 0.78$) (95% CI: 0.63- 0.93) indicated good reliability (Shrout & Fleiss, 1979). The scores range from 0 to 7 as following: 0: Lean body against the wall for 0-1.9 seconds ; 1: Lean body against the wall for 2 seconds or longer; 2: Sit alone for 0-9.9 seconds; 3: Sit alone for 10-14.9 seconds; 4: Sit alone for 15-29.9 seconds; 5: Sit alone for 30 seconds or longer; 6: Retrieve toy 10 cm in front of the toes and maintain balance for 30 seconds and longer; 7: Retrieve toy 15 cm from either sides of buttock and maintain balance for 30 seconds or longer.

**Environmental factors- Home Observation for Measurement of the Environment (HOME)**

The measure was designed by Caldwell, Bradley and their colleagues to measures the quality and quantity of support for cognitive, social and emotional development available to a child in the home environment (Caldwell & Bradley, 2003). The instrument now have four versions: 0-3 years(Infant/Toddler HOME; IT-HOME); 3-6 years (Early Childhood HOME; EC-HOME); 6-10 years (Middle Childhood HOME; MC-HOME); and 10-14 years (Early Adolescent HOME; EA-HOME). Only IT-HOME will be used in our research because our target
population is younger than 3 years.

The inventory is administered by having the visitor go into the home at the time when the child is awake and engaged in a reasonably representative routine for that time of day. All items on all forms of the Inventory receive binary scores—plus or minus. The visitor would need about 1 hour to complete the observation and interview process. The version of the IT-HOME consist of 6 subscales, including responsivity, acceptance, organization, learning material, involvement, variety. The Internal consistency was .89 and the Stability of scores between 6 months and 24 months was .62 for the original IT-HOME (Bradley & Caldwell, 1988). The four domains of the HOME, organization, learning material, variety and involvement were reported to be most related to child outcome under 3 years of age (Bradley & Caldwell, 1980). The raw scores in four domains were then collected in this study for measuring the environmental factors.

**Data analysis**

Simple correlations and descriptive statistics among 12 MVs were analyzed with Statistical Package for Social Science version 11.0 (SPSS, Inc., Chicago, IL 2001). SEM was conducted to analyze the association between three LVs (the general development for infant and toddler stage separately, and home environment) and three MVs (birth weight, temperament types, and balance). The model fit, estimation of parameters were conducted with EOS 6.1(Bentler, 2004).

**Results**

The statistics for each ICF component is listed in table 2. The skewness and kurtosis for all the 12 MVs were around the range between +1 and -1. Table 3 presents the correlation matrix for the 12 variables. Birth weight

Table 3 presents the correlation matrix for the 12 variables. This matrix indicates associations as follows: birth weight and general development in infant stage,
domains in home environment and general development at both infant and toddler stage, balance and perceptual-motor development at infant stage, general development of infant stage and toddler stage.

Figure 2 indicates the significant paths estimated. The directions of the path coefficients were consistent with hypothesized model. The fit indices (χ² = 51.2, N=122, NFI=.763, NNFI=0.007, CFI=1.000, IFI=1.005, MFI=1.003, GFI=.933, AGFI=.900, RMR=55.988, SRMR=.063, MSEA=0.000(95% CI:.000-.056)) indicated acceptable model fit according to the 2-index presentation strategy (Hu & Bentler, 1998). At the level of individual structural equations, the birth weight and home environment accounts for 67% of the total variance in general development; and temperament types account for 12% of the home environment. The standardized coefficients or each path are showed in Figure 2.

**Discussion**

The hypothesized model analyzed by SEM is one possible model that may be used to explain the relationships between theoretical factors under the ICF framework. In this model, the important factors include home environment (organization, material, variety and involvement), health condition (birth weight), and body function (temperament and balance). The temperament would affect the outcomes through the medicating effect of environmental factors.

For the outcomes of infant stage in this study, the general development would be affected by the birth weight and home environment directly in toddler stage, the general development in infant stage would further affect later outcomes in toddler stage. However, the direct impact of birth weight on the outcomes in toddler stage did not persist. Previous studies showed the relationship between birth weight and child outcomes still persisted but weaker in children with normal range of birth weight.
(Matte, 2001; Richards et al., 2001; Shenkin et al., 2001) than children with low birth weight for the children older than four years of age. (Ounsted, Moar, & Scott, 1983)(Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Bohm, Katz-Salamon, Smedler, Lagercrantz, & Forssberg, 2002) The findings in this study further compromised the available findings and supported the weaker relationships between birth weight and outcomes for toddlers with normal birth weight. Previous evidence showed the lower birth weight would be accompanied by other pre-, peri- or post-natal risk factors, which were reported to have adverse general outcomes in infants and toddler stage. (American Academy of Pediatrics, 2004; Vohr et al., 2005). The direct influence from birth weight to infant development is still prominent in this study even for the infants without significant risk factors and with normal range of birth weight. Previous studies attain consensus that early development in infancy is susceptible to pre-, peri-, or post-natal biological risk factors such as adequate intrauterine growth retardation (Pallotto & Kilbride, 2006) or inappropriate birth weight (Jeng, Yau, & Teng, 1998; Vohr et al., 2000). This study further support the optimal growth in bodyweight for prenatal stage would promote better outcome in infancy even for children without biological risks at birth.

Another factors, sitting balance, showed similar pattern in affecting early child outcomes in this study. Sitting balance is selectively related to perceptual-motor domain in infant stage. Other studies also found basic postural control ability in early infancy would impact on later motor development (Campbell, Kolobe, Wright, & Linaere, 2002; Viholainen, Ahonen, Cantell, Tolvanen, & Lyytinen, 2006). Because this research collected the data of sitting balance and general development at the same time, the alternative model would emerge that the general development in infancy may also have impact on sitting balance. But the hypothesis for supporting the impact of sitting balance on general development was hold under theoretical basis. For infant
stage, the stability of trunk in sitting position helps infants to reach out for exploration (Bushnell & Boudreau, 1993). The exploration with both hands would further provide the infants with sensory stimulation and facilitate higher level of cognitive development (Bushnell & Boudreau, 1993; Thelen & Spencer, 1998). The pathway from body function to activity and participation was also supported for applying the framework to toddlers with disabilities under two years old (Palisano, 2006). There would be other items, such postural control ability in standing position, were also expected to affect the outcomes for toddler stage. This study was not allowed to include as many factors as expected due to sample size limitation.

Early home environment containing social and physical environment stimulation in infancy accounts for later developmental outcomes (Barnard, Bee, & Hammond, 1984; Bendersky & Lewis, 1994; Bradley et al., 1994; Chiarello & Palisano, 1998; Greenberg & Crnic, 1988; Kolobe, 2004; Palisano, 2006). When environmental factors and health condition were both taken into consideration under the ICF framework, environmental factors (home environment) showed stronger relationship to outcomes than health condition (birth weight) in the analyzed model in this study. In previous studies investigating the outcomes of infants and toddlers with biological risks at birth, the severity of complication at birth would either dominantly influence later motor or cognitive or had equal contribution to environmental factors. (Bendersky & Lewis, 1994) Compared with infants and toddlers with biological risks at birth, the general development of infants with normal birth weight was predominantly influenced by home environment in this study. A sizable of literature reached consensus on the importance of early home environment for child development since very young ages (Bradley & Caldwell, 1980; Olson, Bates, & Bayles, 1984; Tomopoulos et al., 2006) But, most of the previous study focused their population on lower SES, the adverse home environment below the suggested cut
point on scores in the HOME (Caldwell & Bradley, 2003). The scores in this study were all much higher than the suggested cut point. Even for the higher quality of home environment in this study, the fabulous home environment as early as 6 months of age can be one of the determinant of optimal development for infants and toddlers. Few study taking both biological and environmental factors into consideration for typical developing children in early years of life. This study can provide an overall effect for birth weight and home environment on early child development. Even for healthy condition at birth and adequate environment stimulation, the early development would still benefit from improving birth weight and quality of home environment. As a result, to attaining better condition at this two modifiable factors would serve as the major goal of the delivery of pediatric health service.

Difficult temperament in infant stage was also hypothesized to impair early child outcomes in this study based on various theories of child development (Belsky, 1984; Scarr & McCartney, 1983; Shonkoff & Meisels, 2000). The common description in these theories reveals two potential path ways from child temperament to child’s outcomes. The one is the direct way from early child characteristics to later outcomes; the other is indirect way from temperament to outcomes bypassing the environment such as parenting practice (Hsu, Soong, Stigler, Hong, & Liang, 1981; Shiner & Caspi, 2003). For most empirical data, the direct path from temperament to outcome showed contradictory findings for each temperament dimension in infant and toddler ages (Lowe, Woodward, & Papile, 2005; Oberklaid, Sewell, Sanson, & Prior, 1991; Sajaniemi, Salokorpi, & von Wendt, 1998). Instead, the prominent mediating effect of variables such as home environment existed between temperament types at infancy and child outcomes at averaged 4.7 years (Maziade, Cote, Bernier, Boutin, & Thivierge, 1989; Maziade, Cote, Boutin, Bernier, & Thivierge, 1987). The parents in this study were well educated and came mainly from middle or high SES compared
with aforementioned research findings. Besides, the easy temperament would facilitate better home environment provided by parents where difficult temperament would prevent the child from parents’ stimulation in Taiwan’s culture. Even though the smaller variations in home environment in this study, the effect of home environment in outcomes in infant stage was still significant. The results also agreed with the indirect way for explain the relationship between infant temperament and later outcomes. In addition, the path from the home environment to infant development was stronger than the path from temperament to home environment. That is, infants’ temperament may somewhat affect home environment provided by parents, while the home environment would be key determinants for infant development. The possible reason to explain the pattern of this indirect way may be that the parents who can provide the higher quality of home environment can also have better skills for handling with either a difficult or easy child. Consequently, the better parenting skills rather than temperament may be the critical factor for child outcomes for infants and toddlers.

To measure the variables in the ICF framework correctly for our population in young age, the appropriate measures must be selected to reflect the constructs in the framework. For collecting the information of home environment, some authors suggested that parenting behavior be less biased if collected by independent investigator in natural home environment rather than in highly-structured laboratories (Crnic, Gaze, & Hoffman, 2005). The maternal behaviors tended to be influenced by differing contexts as the mother at laboratory tended to talk and respond more to their 12-month-infants than at home (Belsky, 1980). These findings suggested a procedure containing home visit be less biased when parental behavior or home environment are important variables in our research. For testing general development, a standardized procedure and a comprehensive measure which is capable of detecting the individual
difference among the population is required in this study. Either conducting home visiting or standardized developmental tests would be impossible in most large scale birth cohort study. In this study, the early impact of health condition, body function, and environmental factors on development in infant and toddler stage can be detected based on well developed and reliable measures.

For typical developing children, few study taking both biological and environmental factors into consideration for predicting early child outcomes according standardized developmental tests in early years of life. In this study, the influence of multiple factors on early child outcomes can be simultaneously estimated using SEM technique. However, many factors which may be also important but not involved in this study because sample size restriction. The sample size in this study would be not enough to test more distal influential factors such as parental education, stress or SES, and other personal factors in infants and toddlers. The sample representation is also questioned because all the infants were born at the NTUH. In addition, the proposed ICF–based model is proven to be only one of possible model. There may be other models exist to be valid. Further studies would be focused on gathering larger sample with broader variety in home environment. The other population such as children with developmental challenges is also needed to cross validate the proposed model.

The possible model gives implications in conducting pediatric health care, such as to encourage parental involved in promoting home environment, to facilitate early postural control in infancy, and to promote care during pregnancy to keep proper birth weight.

Research on typically developing children is the basis for investigating the children with special needs. Further studies would be conducted to explore the population at risk under the proposed model in this study.
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<td>38.7±2.0 (27-41)</td>
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<tr>
<td>Corrected age at 1st test*</td>
<td>6.0±0.3 (5-7)</td>
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<tr>
<td>Corrected age at 2nd test*</td>
<td>27.0±1.6 (24-32)</td>
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<td>3277.6±537.9 (772-4384)</td>
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<td>71 (58%)</td>
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<td>Class V</td>
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<td>Mothers’ educational level*</td>
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<td>&lt; 9 years</td>
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<td>9-12 years</td>
<td>26 (21%)</td>
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<td>≥ 12 years</td>
<td>73 (60%)</td>
<td>132 (62%)</td>
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<td>Mother’s age (years)*</td>
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<tr>
<td>Father’s age (years)*</td>
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*Mean ± standard deviation (range)

b frequency (percentage)

c SES: Social economic status according to father’s occupation and educational level (Rin, Schooler, & Caudill, 1973)
Table 2. Descriptive statistics

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Figure 1. The ICF framework

Figure 2. Model for typically developing infants and toddlers

Abbreviation:
OR: organization; MA: material; VA: variety; IN: involvement; PM: perceptual-motor; SA: social-adaptive; CL: cognitive-language; MO: motor