

# Construction and Examination of an Early Childhood Development Composite Index: Evidence from Iran's Multiple Indicator Demographic and Health Survey

## Abstract

**Background:** Assessing children's early development can help health and social policymakers to improve children's well-being. This study aims to develop an early childhood composite index for measuring early childhood care and education among Iranian children considering each child's geographical area, socioeconomic status and gender. **Methods:** In this cross-sectional secondary study, the data come from Iran's Multiple Indicator Demographic and Health Survey 2010. Of the 9,345 eligible children whose information had been collected, 3,532 fulfilled the inclusion criterion of being 3 or 4 years old at the time of the interview. We examined a composite index and three subscales of early childhood development including "Quality of Care", "Early Childhood Care and Education", and "Overall Developmental Status". Factor analysis and latent class analysis were used for analyzing the data. **Results:** The results indicate that of the children in the sample, 47.3% were in the "low early child development" class, 6% were in the "middle early child development" class, and 46.7% were in the "high early child development" class. The means of the three subscales and the composite index were significantly different across geographical areas ( $P < 0.01$ ) and between the socioeconomic classes ( $P < 0.0001$ ), with children from poorer families having lower scores. The composite index was significantly higher for girls ( $M = 11.28$ ,  $SD = 3.96$ ) than boys ( $M = 10.99$ ,  $SD = 3.87$ ,  $P = 0.029$ ). **Conclusions:** The study presents significant differences in childhood development based on geographical divisions, quartile classes and gender. We suggest that future research is needed to explore the robustness of findings in this study over time and diversity between and within various Iranian populations.

**Keywords:** Early child development, gender, geographical area, Iran (Islamic Republic), multidimensional index, socioeconomic status

## Introduction

The United Nations Committee on the Rights of the Child defines a child as an individual between the ages of 0 and 18 years.<sup>[1]</sup> Early childhood, which spans the period from birth to 8 years of age, is critical to a child's well-being. In early childhood, the human's brain has a high capacity for improvement in health and wellbeing throughout life. Ensuring that young children have healthy cognitive, social and emotional development is a clear focus of the Convention on the Rights of the Child.<sup>[2]</sup> World Health Organization (WHO) has reported 250 million children in low- and middle-income countries are at risk of not getting the nutrition, protection and stimulation they need.<sup>[3]</sup> Early childhood development (ECD) is a multidimensional

construct that covers numerous aspects of a child's well-being. The early years of life are critical to ensuring that children have healthy cognitive, emotional and physical development.<sup>[4]</sup> There are studies provided strong economic and social explanations for investing in young children, particularly in children younger than 5 years old.<sup>[5,6]</sup>

In addition, social and economic determinants play critical roles in health outcomes especially in the early phases of children's development.<sup>[7,8]</sup> Among these factors, family's socioeconomic characteristics are the most influential in young children's development. One of the most prominent findings in social epidemiology is that individuals and families with lower socioeconomic status (SES) have worse health and development than do individuals with higher SES; this is true across the life span, from childhood to older adulthood.<sup>[9]</sup>

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Recently, some programs such as Integrated “Management of Child Illness”, “Well-Baby Care”, “Baby-Friendly Hospitals” that related to ECD have started in Iran. The main purpose of those programs is to design and upgrade early childhood development at community, and family levels.<sup>[10]</sup> However, according to some studies, the prevalence of developmental delays among children ranged from 18.7% to 19.8% in several Iranian cities.<sup>[11,12]</sup>

Today, there is increasing support for using more than just survival indicators as well as focusing on multidimensional nature of child development.<sup>[13,14]</sup> Several instruments have been developed to measure ECD in various settings,<sup>[15-17]</sup> but no research has been conducted to develop a multidimensional index for measuring early childhood development in the context of Iran. Assessing children’s early development can give health and social policymakers efficient measures for improving children’s well-being. Moreover, a multidimensional composite index of ECD would provide policymakers with sound evidence to effectively determine which provinces and geographical areas are performing better and which are performing worse regarding children’s well-being. Owing to the lack of a composite index for measuring multiple domains of children’s development, there is insufficient evidence to monitor ECD in Iran. Thus, the present study aims to develop a composite index for measuring early childhood development among Iranian children considering each child’s geographical area and gender.

## Methods

### Data and sample

This is a cross-sectional secondary study involving analysis of data which come from Iran’s Multiple Indicator Demographic and Health Survey (IrMIDHS-2010). This national household survey is designed for large samples and provides high-quality data on population and health-related issues in Iran.<sup>[18]</sup> The IrMIDHS is mainly based on the Multiple Indicator Cluster Surveys 4 and the Demographic and Health Survey Phase 6. The first health and demographic survey (HDS) was conducted during 2000-2001. In 2010, the Iranian Ministry of Health and Medical Education was responsible for administering Iran’s Multiple Indicator Demographic and Health Survey (IrMIDHS). The IrMIDHS-2010 included three questionnaires: a household questionnaire, a questionnaire for children under 5 years old and a questionnaire for women aged 15-54 years. A representative sample, including 31,350 resident households, from urban and rural areas, was selected from all 31 Iranian provinces using multistage stratified cluster sampling.<sup>[18]</sup> Each IrMIDHS participant which may be the parent or guardian of children had provided verbal consent for the questionnaire before the interview. Moreover, all stages of the current study were ethically reviewed and approved by the ethics board of Isfahan University of Medical Sciences. The ethical code is IR.MUI.REC.1396.2.103.

### Procedures and assessment of variables

In the current study, the variables are constructed based on the household questionnaire and the questionnaire administered to children under 5 years old. These questionnaires’ validity has been satisfied.<sup>[18]</sup> The children’s questionnaire includes 88 questions that gather information about the children’s health and well-being. It includes eight modules, one of which focuses on the ECD. This module consists of 19 questions and 38 items. We used this module to examine a composite index and three subscales of ECD: “Quality of Care”, “Early Childhood Care and Education” and “Overall Developmental Status”.

Of the 9345 eligible children whose information has been collected, 3532 fulfilled the inclusion criterion of being 3 or 4 years old at the time of the interview. According to the IrMIDHS protocol, for each child under 5 years old, the mother (or other caregiver living in the household) answered the questionnaire in a face-to-face interview.

Information for the geographical division variable was obtained from administrative data released by the Ministry of Interior of the Republic of Iran. The country is divided into five areas based on geographical borders, each of which includes several provinces (see Appendix A). To measure the SES of the children’s families, each household’s current income was measured. In addition, many ownership variables were extracted from the household questionnaire. We applied the variable of household income together with ownership variables as to make SES.

### Statistical analysis

To develop a composite index for measuring early childhood development, we used confirmatory factor analysis (CFA) and latent class analysis (LCA). According to results of the previous study,<sup>[18]</sup> we focused on three subscales of ECD, so we firstly used CFA on the 38 items from the children questionnaire (26 items in the “Quality of Care” subscale, 10 items in the “Overall Developmental Status” subscale and 2 items in the “Early Childhood Care and Education” subscale). The comparative fit index (CFI), the Tucker-Lewis index (TLI) (range both of them from 0 to 1 with values of 0.90 or above indicate acceptable fit), and the root mean square error of approximation (RMSEA) (ranges from 0 to 1, with smaller values of this index indicating better model fit) were used for evaluating the goodness of model fitting. Then, we calculated the subscale scores by summing the scores in each subscale after weighting them by their factor loadings. As such, each participant received a score for each subscale. The composite index (i.e., a total score) was constructed by summing the scores of each subscale for each participant.

In addition to the composite index, which is a continuous variable, we also constructed a categorical scale based on LCA. We fitted LCA values to the three subscales to find the appropriate number of classes (2-5 classes).

Accordingly, we chose a model with three latent classes based on the relatively low values of the Bayesian information criterion (BIC) and the relatively high values of the entropy index. Then, the distribution of demographic and geographical variables was compared in the constructed classes.

Other variables in the current study include gender, geographical area and SES. We established the different categories of SES, as a latent variable, using the LCA technique based on various indicator variables (see Appendix B). LCA addresses the complex patterns of associations that appear among observations. This model examines the pattern of relations among a set of observed categorical variables and classifies similar individuals in terms of SES into homogeneous latent classes. This leads individuals within each latent class to be highly similar to each other, and uniquely different from those in other classes across the set of evaluated items. Accordingly, comparisons can be made across the latent classes with the items evaluated.<sup>[19]</sup> According to BIC and the entropy index, four classes (poor quartile, lower-middle quartile, upper-middle quartile and rich quartile) were appropriate for SES variables. Participants' membership in each constructed class was used for SES.

Continuous and categorical variables were expressed as mean (standard deviation, SD) or as frequency (percentage), respectively. An analysis of variance and an independent Student's *t*-test were used for comparing the continuous variables among the studied subgroups. Bonferroni *post hoc* test also was used for pairwise comparisons. The distribution of the study participants in terms of categorical variables was compared across the classes and subgroups using the  $\chi^2$  test, and  $P < 0.05$  were considered as statistically significant. In the present study, the percentage of missing data was low and the list-wise deletion technique was used for handling them. R-free statistical software, version 3.6.2 was used for analyzing data.

## Results

Overall, we included 3,532 Iranian children having participated in the IrMIDHS 2010 into our study analyses: 1,761 (49.9%) boys and 1,771 (50.1%) girls. By age, 50.6% of the study participants were 3 years old, and 49.4% were 4 years old. We found significant differences between boys and girls on 19 out of the 38 items; all with  $P < 0.05$ .

The total score (the composite index) was calculated by summing the scores of each factor for each participant. The means (SDs) were 8.23 (3.55) for "Quality of Care", 2.79 (0.64) for "Overall Developmental Status", and 0.12 (0.31) for "Early Childhood Care and Education". In addition, the mean (SD) of the composite index was 11.14 (3.92).

The means (SDs) of the composite index and subscales across the geographical, gender and SES subgroups are

presented in Table 1. The means of the three subscales and the composite index were significantly different across geographical areas ( $P < 0.01$ ). For instance, in area 1, the mean (SD) for "Quality of Care" was 9.30 (3.40), and the mean (SD) for "Overall Developmental Status" was 2.92 (0.56), both of which were significantly higher than the scores for those subscales in other areas ( $P < .0001$ ). The mean (SD) of the "Early Childhood Care and Education" subscale for area 2 was 0.15 (0.35), which was significantly higher than in other areas ( $P = 0.003$ ). The means (SDs) of the composite index were 12.34 (3.67), 11.45 (3.73), 10.83 (3.46), 11.26 (3.65) and 9.77 (4.34), for areas 1 through 5, respectively ( $P < 0.0001$ ). There was a significant difference between boys, 2.72 (0.66), and girls, 2.85 (0.62), only for the "Overall Developmental Status" subscale. The composite index was significantly higher for girls, 11.28 (3.96), than boys, 10.99 (3.87) ( $P = 0.029$ ). In addition, the means (SDs) of the three subscales and the ECD composite index were significantly different across the SES subgroups ( $P < 0.0001$ ). For instance, the means (SDs) of the composite index were 8.90 (3.35), 11.25 (3.60), 12.54 (3.51) and 14.17 (3.03), for the poor, lower-middle, upper-middle and rich SES subgroups, respectively ( $P < 0.0001$ ).

We determined the latent structure of the study population in terms of the composite index using LCA. We observed that, when compared to other models, the model with three latent classes had lower values for the BIC (17068.2041) and higher values for the entropy index (0.70). These values indicate that participants are appropriately classified by our fitted model. The three identified classes were labeled as "high ECD class", "middle ECD class", and "low ECD class". Of the children in the sample, 47.3% were in the "low ECD class", 6% were in the "middle early child development" class and 46.7% were in the "high ECD class". The distribution of the Iranian children's geographical; gender and SES characteristics across the three extracted classes are presented in Table 2. The distributions of the participants' geographical areas and genders were significantly different across the extracted classes ( $P < 0.05$ ). As indicated, 30.4% of the children in area 1 belonged to the "high ECD class". In contrast, 18.1%, 18.3% and 28.3% of the children living in areas 3, 4 and 5, respectively, belonged to the "low ECD class". Furthermore, 51.9% of boys belonged to the "low ECD class", and 51.7% of girls belonged to the "high ECD class" [Table 2]. In addition, the distribution of the participants' SES showed strongly significant differences between the extracted classes ( $P < 0.0001$ ). As indicated, of children with poor SES, 49.8% belonged to the "low ECD class", 15% belonged to the "middle ECD class", and 28.3% belonged to the "high ECD class". Of children with upper-middle SES, 15.3% belonged to the "low ECD class", 29.2% belonged to the "middle ECD class" and 31.0% belonged to the "high ECD class".

**Table 1: The means (SDs) of the ECD composite index and its subscales across geographical, gender and SES subgroups**

	Subscale			Composite Index
	Quality of care	Overall developmental status	Early childhood care and education	
<b>Gender</b>				
Boys (n=1761)	8.15 (3.51)	2.72 (0.66)	0.12 (0.31)	10.99 (3.87)
Girls (n=1771)	8.31 (3.59)	2.85 (0.62)	0.11 (0.30)	11.28 (3.96)
<i>P</i> *	0.197	<.0001	0.543	0.029
<b>Geographical area</b>				
<sup>a</sup> Area 1 (n=833)	9.30 (3.40) <sup>†,‡,§,  </sup>	2.92 (0.56) <sup>†,‡,§,  </sup>	0.13 (0.30)	12.34 (3.67) <sup>†,‡,§,  </sup>
<sup>b</sup> Area 2 (n=718)	8.47 (3.42) <sup>††</sup>	2.84 (0.62) <sup>††</sup>	0.15 (0.35) <sup>**††</sup>	11.45 (3.73) <sup>†,††</sup>
<sup>c</sup> Area 3 (n=571)	7.95 (3.12) <sup>IX</sup>	2.76 (0.62) <sup>IX</sup>	0.12 (0.32)	10.83 (3.46) <sup>IX</sup>
<sup>d</sup> Area 4 (n=588)	8.36 (3.32) <sup>X</sup>	2.80 (0.60) <sup>X</sup>	0.10 (0.28)	11.26 (3.65) <sup>X</sup>
<sup>e</sup> Area 5 (n=822)	7.04 (3.87)	2.63 (0.74)	0.09 (0.28)	9.77 (4.34)
<i>P</i> *	<.0001	<.0001	0.003	<.0001
<b>SES</b>				
<sup>a</sup> Poor quartile (n=1057)	6.26 (3.03) <sup>†,‡,§</sup>	2.60 (0.68) <sup>†,‡,§</sup>	0.05 (0.20) <sup>†,‡,§</sup>	8.90 (3.35) <sup>†,‡,§</sup>
<sup>b</sup> Lower-middle quartile (n=980)	8.32 (3.30) <sup>†,‡,§</sup>	2.81 (0.61) <sup>†,‡,§</sup>	0.12 (0.32) <sup>**</sup>	11.25 (3.60) <sup>†,‡,§</sup>
<sup>c</sup> Upper-middle quartile (n=734)	9.50 (3.23) <sup>††</sup>	2.89 (0.61) <sup>††</sup>	0.15 (0.33) <sup>††</sup>	12.54 (3.51) <sup>††</sup>
<sup>d</sup> Rich quartile (n=484)	10.91 (2.76)	3.03 (0.51)	0.24 (0.41)	14.17 (3.03)
<i>P</i> *	<.0001	<.0001	<.0001	<.0001

\*The *P* values resulted from independent *t*-tests or ANOVA tests. <sup>†</sup>Significant difference a versus b; <sup>‡</sup>Significant difference a versus c; <sup>§</sup>Significant difference a versus d; <sup>||</sup>significant difference a versus e; <sup>††</sup>significant difference b versus c; <sup>\*\*</sup>significant difference b versus d; <sup>†††</sup>significant difference b versus e; <sup>††††</sup>significant difference c versus d; <sup>IX</sup>significant difference c versus e; <sup>X</sup>significant difference d versus e

**Table 2: The distribution of geographical, gender and SES characteristics of Iranian children across three extracted classes**

	Early Childhood Development			<i>P</i> *
	Low (47.3%) n (%)	Middle (6.0%) n (%)	High (46.7%) n (%)	
<b>Gender</b>				
Boys (n=1761)	819 (51.9)	91 (45.5)	751 (48.3)	0.043
Girls (n=1771)	758 (48.1)	109 (54.5)	803 (51.7)	
<b>Geographical areas</b>				
Area 1 (n=833)	259 (16.4)	43 (21.5)	473 (30.4)	<.0001
Area 2 (n=718)	296 (18.8)	62 (31.0)	330 (21.2)	
Area 3 (n=571)	286 (18.1)	22 (11.0)	226 (14.5)	
Area 4 (n=588)	289 (18.3)	35 (17.5)	242 (15.6)	
Area 5 (n=822)	447 (28.3)	38 (19.0)	283 (18.2)	
<b>SES</b>				
Poor quartile (n=1057)	716 (49.8)	218 (15.0)	53 (28.3)	<.0001
Lower-middle quartile (n=980)	420 (29.2)	449 (30.9)	55 (29.4)	
Upper-middle quartile (n=734)	220 (15.3)	423 (29.2)	58 (31.0)	
Rich quartile (n=484)	81 (5.6)	361 (24.9)	21 (11.2)	

\*The *P* values resulted from Pearson  $\chi^2$  tests

## Discussion

Ensuring that young children can achieve their developmental potential is an important step in promoting the health and well-being of them in the other life courses especially academic performance, emotional and social well-being, health status, and economic outcomes,<sup>[10,13-17,20,21]</sup> which benefit whole society.<sup>[22]</sup> Vital cognitive, physical and psychosocial development occurs during the first few years of human life.<sup>[10,23-26]</sup> In this study, we constructed a composite ECD index for use in Iran and explored the geographical, gender and SES quartile divergences of

ECD. This is the first study of a composite index and its subscales in Iran. As such, this study may provide policymakers (especially those in the health sector) with valuable information on monitoring young children's overall developmental trends.

This study focused on three major dimensions of childhood development: "Quality of Care", "Early Childhood Care and Education" and "Overall Developmental Status". The study's findings can be considered as the first national evidence regarding the degree of childhood development in Iran, and its data can be used as reference statistics



for monitoring progress in the childhood development over time at the national level or for various geographical contexts, genders and quartile classes.

We found significant regional and quartile disparities in the total index and the subscale indices. To more extent, we found that children who lived in more developed areas (e.g., industrial provinces and metropolitan areas) and who belonged to higher socioeconomic classes demonstrated higher scores on the subscales and ECD composite index, meaning that children in more prosperous regions and those in higher socioeconomic classes are more likely to achieve their developmental potentials. Our results support the conclusions of previous studies from other countries confirmed that neighborhood differences and/or family's SES can influence young children's achievement in a varied spectrum of ECD indicators such as early child neurodevelopment,<sup>[13,24,27,28]</sup> emotional and social development,<sup>[7,29]</sup> cognitive and language development,<sup>[7,16,26,27]</sup> and physiological development.<sup>[28]</sup> We suggest that policymakers adopt policies to reduce all types of inequality and that they establish programs to remove regional and social-class barriers to ensure that all young children in Iran reach their developmental potential.

We also found that, on all parts of the ECD indices in our representative sample, girls outscored boys; thus, taken together, Iranian girls have more advantages than Iranian boys in terms of childhood development. There is an existing study in six developing countries in the east Asia-Pacific region indicating young girls significantly or slightly gain an advantage over boys in childhood development scores.<sup>[30]</sup> Still, the distribution of items between the genders is volatile. Girls had advantages in some of the items on the "Quality of Care" subscale, such as having books or homemade toys, being told stories, playing and drawing with their mothers. On the other hand, boys had advantages over girls on some other items on that subscale, such as having computer-based games, spending time outside with parents or acquaintances and playing with their fathers. In terms of the "Overall Developmental Status" subscale, girls seem to have more advantages, like performing duties correctly and independently, not being sick, brushing their teeth independently, not kicking others, and not being easily distracted. Finally, girls enjoyed more access to early childhood education.

The study has the advantage that it is based on a large, nationally representative and reliable data set. To the best of our knowledge, it is the first study on ECD indices in Iran. As such, it can be used as a reference point to monitor childhood-development trends in this country. However, we acknowledge that one limitation of the study is that we restricted our study to children aged 3-5 years. Thus, the generalization of the study's findings to older children is difficult.

## Conclusions

The present study is the first one that constructed and examined early childhood development in Iran. The composite ECD index and its subscales are evidence-based measures that can be applied to monitor childhood development. Future surveys on the current composite index can collect better information allowing advance interpretation on the index. By doing so, we can provide policymakers with information on children's overall development in Iran. We found significant differences in ECD based on geographical divisions, quartile classes and gender. We encourage future researchers to explore the robustness of our findings over time and explore diversity within various Iranian children.

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## Conflicts of interest

There are no conflicts of interest.

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## Appendices

### Appendix A

26 items from the children questionnaire used for developing the “Quality of Care” subscale were EC1, EC2a, EC2b, EC2c, EC2d, EC2e, EC3a, EC3b, EC7am, EC7af, EC7ao, EC7bm, EC7bf, EC7bo, EC7cm, EC7cf, EC7co, EC7dm, EC7df, EC7do, EC7em, EC7ef, EC7eo, EC7fm, EC7ff, and EC7fo. 10 items in the “Overall Developmental Status” subscale were EC9, EC10, EC11, EC12, EC13, EC14, EC15, EC16, EC17, and EI, and 2 items in the “Early Childhood Care and Education” subscale were EC5 and EC6.

As shown in Table below, there were significant differences between boys and girls on 19 out of the 38 items (EC1, EC2a, EC2d, EC7bo, ECYbn, EC7dm, EC7df, EC7do, EC7em, EC7ef, EC7fm, EC12, EC13, EC14, EC15, EC16, EC17, EI, and EC5; all with  $P < 0.05$ ).

The distribution of the 38 items of the questionnaire for children under 5 years old					
Questions	Responses	Total (n=3532)	Boys (n=1761)	Girls (n=1771)	P*
EC1: How many children’s books or picture books do you have?	-	3 [0-10] 3.99 (4.01)	7 [0-10] 6.29 (3.80)	10 [0-10] 6.62 (3.79)	0.006
EC2a: Does the child have homemade toys such as dolls or cars?	No	2758 (78.3)	1408 (80.3)	1350 (76.4)	0.005
	Yes	763 (21.7)	346 (19.7)	417 (23.6)	
EC2b: Does the child have toys from a shop or manufactured toys?	No	210 (5.9)	108 (6.1)	102 (5.8)	0.64
	Yes	3321 (94.1)	1652 (93.9)	1669 (94.2)	
EC2c: Can the child play with household objects such as bowls or pots or with objects found outside?	No	941 (26.6)	480 (27.3)	461 (26.0)	0.40
	Yes	2590 (73.4)	1280 (72.7)	1310 (74.0)	
EC2d: Does the child have computer-based games?	No	2909 (82.4)	1392 (79.1)	1517 (85.7)	<.0001
	Yes	620 (17.6)	367 (20.9)	253 (14.3)	
EC2e: Does the child watch TV often?	No	284 (8.0)	149 (8.5)	135 (7.6)	0.36
	Yes	3248 (82.0)	1612 (91.5)	1636 (92.4)	
EC3a: Is the child frequently left alone in the house for more than an hour at a time?	-	0 [0-7] 0.22 (0.86)	0 [0-7] 0.18 (0.74)	0 [0-7] 0.23 (0.88)	0.32
EC3b: Does a babysitter younger than 10 years old usually take care of the child for more than an hour at a time?	-	0 [0-7] 0.27 (0.89)	0 [0-7] 0.19 (0.81)	0 [0-7] 0.2 (0.81)	0.29
EC7am: Does the mother often read books or show pictures to the child?	No	2038 (57.8)	1023 (58.2)	1015 (57.4)	0.64
	Yes	1490 (42.2)	736 (41.8)	754 (42.6)	
EC7af: Does the father often read books or show pictures to the child?	No	3073 (87.1)	1549 (88.1)	1524 (86.2)	0.09
	Yes	455 (12.9)	210 (11.9)	245 (13.8)	
EC7ao: Does someone else often read books or show pictures to the child?	No	2997 (84.9)	1504 (85.5)	1493 (84.4)	0.36
	Yes	531 (15.1)	255 (14.5)	276 (15.6)	
EC7bm: Does the mother tell the child stories?	No	1720 (48.7)	883 (50.1)	837 (47.3)	0.08
	Yes	1812 (51.3)	878 (49.9)	934 (52.7)	
EC7bf: Does the father tell the child stories?	No	3048 (86.3)	1525 (86.6)	1523 (86.0)	0.6
	Yes	484 (13.7)	236 (13.4)	248 (14.0)	
EC7bo: Does someone else tell the child stories?	No	3035 (85.9)	1502 (85.3)	1533 (86.6)	0.28
	Yes	497 (14.1)	259 (14.7)	238 (13.4)	
EC7cm: Does the mother sing lullabies or other songs to the child?	No	1618 (45.8)	840 (47.7)	778 (43.9)	0.025
	Yes	1914 (54.2)	921 (52.3)	993 (56.1)	
EC7cf: Does the father sing lullabies or other songs to the child?	No	3248 (92.0)	1637 (93.0)	1611 (91.0)	0.029
	Yes	248 (8.0)	124 (7.0)	160 (9.0)	
EC7co: Does someone else sing lullabies or other songs to the child?	No	3217 (91.1)	1609 (91.4)	1608 (90.8)	0.55
	Yes	315 (8.9)	152 (8.6)	163 (9.2)	
EC7dm: Does the mother take the child outside the home?	No	525 (14.9)	233 (13.2)	292 (16.5)	0.007
	Yes	2471 (70.0)	1239 (70.4)	1232 (69.6)	
EC7df: Does the father take the child outside the home?	Missing	536 (15.2)	289 (16.4)	247 (13.9)	0.002
	No	525 (14.9)	233 (13.2)	292 (16.5)	
	Yes	1572 (44.5)	830 (47.1)	742 (41.9)	
	Missing	1435 (40.6)	698 (39.6)	737 (41.6)	

Contd...

Contd...					
Questions	Responses	Total (n=3532)	Boys (n=1761)	Girls (n=1771)	P*
EC7do: Does someone else take the child outside the home?	No	525 (14.9)	233 (13.2)	292 (16.5)	0.011
	Yes	405 (11.5)	204 (11.6)	201 (11.3)	
	Missing	2602 (73.7)	1324 (75.2)	1278 (72.2)	
EC7em: Does the mother play with the child?	No	525 (14.9)	243 (13.8)	282 (15.9)	0.011
	Yes	1972 (55.8)	972 (55.2)	1000 (56.5)	
	Missing	1035 (29.3)	546 (31.0)	489 (27.6)	
EC7ef: Does the father play with the child?	No	525 (14.9)	243 (13.8)	282 (15.9)	0.038
	Yes	1258 (35.6)	660 (37.5)	598 (33.8)	
	Missing	1749 (49.5)	858 (48.7)	891 (50.3)	
EC7eo: Does someone else play with the child?	No	525 (14.9)	243 (13.8)	282 (15.9)	0.207
	Yes	1188 (33.6)	599 (34.0)	589 (33.3)	
	Missing	1819 (51.5)	919 (52.2)	900 (50.8)	
EC7fm: Does the mother often teach the child vocabulary, counting or drawing skills?	No	1576 (44.6)	816 (46.3)	760 (42.9)	0.041
	Yes	1956 (55.4)	945 (53.7)	1011 (57.1)	
EC7ff: Does the father often teach the child vocabulary, counting or drawing skills?	No	2926 (82.8)	1467 (83.3)	1459 (82.4)	0.47
	Yes	606 (17.2)	294 (16.7)	312 (17.6)	
EC7fo: Does someone else often teach the child vocabulary, counting or drawing skills?	No	2821 (79.9)	1400 (79.5)	1421 (80.2)	0.56
	Yes	711 (20.1)	361 (20.5)	350 (19.8)	
EC9: Can the child read at least four simple, popular words?	No	1194 (34.1)	612 (35.0)	582 (33.1)	0.22
	Yes	2312 (65.9)	1135 (65.0)	1177 (66.9)	
EC10: Does the child know the name of and recognize the symbol for all numbers from 1 to 10?	No	2236 (64.3)	1134 (65.2)	1102 (63.3)	0.24
	Yes	1244 (35.7)	605 (34.8)	639 (36.7)	
EC11: Can the child read sentences with four or five words?	No	121 (3.4)	67 (3.8)	54 (3.1)	0.22
	Yes	3408 (96.6)	1692 (96.2)	1716 (96.9)	
EC12: Is the child sometimes too sick to play?	No	1017 (28.8)	544 (30.9)	473 (26.7)	0.006
	Yes	2512 (71.2)	1216 (69.1)	1296 (73.3)	
EC13: Does the child follow simple directions on how to do something correctly?	No	212 (6.0)	124 (7.0)	88 (5.0)	0.010
	Yes	3309 (94.0)	1635 (93.0)	1674 (95.0)	
EC14: When asked to do something, is the child able to do it independently?	No	515 (14.7)	282 (16.1)	233 (13.2)	0.015
	Yes	2997 (85.3)	1467 (83.9)	1530 (86.8)	
EC15: Does the child get along well with other children?	No	678 (19.3)	366 (20.9)	312 (17.7)	0.016
	Yes	2844 (80.7)	1389 (79.1)	1455 (82.3)	
EC16: Does the child kick, bite, or hit other children or adults?	No	2426 (68.9)	1101 (62.6)	1325 (75.1)	<.0001
	Yes	1097 (31.1)	657 (37.4)	440 (24.9)	
EC17: Does the child get distracted easily?	No	1275 (36.8)	672 (39.0)	603 (34.7)	0.009
	Yes	2188 (63.2)	1053 (61.0)	1135 (65.3)	
EI: Can the child brush his or her teeth (independently or with help)?	Never	874 (24.8)	474 (26.9)	400 (22.6)	0.006
	Sometimes	1700 (48.2)	838 (47.6)	862 (48.8)	
	Always	954 (27.0)	448 (25.5)	506 (28.6)	
EC5: Does the child regularly attend early childhood education programs?"	No	2811 (79.6)	1425 (81.0)	1386 (78.3)	0.042
	Yes	719 (20.4)	334 (19.0)	385 (21.7)	
EC6: How many hours has the child spent in early childhood education programs in the last 7 days?	-	7 [0-40]	10 [0-40]	6 [0-40]	0.12
		11.05 (10.41)	11.68 (10.33)	10.50 (10.49)	

\*The P values resulted from independent-sample t-tests for continuous data and from Pearson  $\chi^2$  tests for categorical data. Values are expressed as number (%) or mean [SD]

## Appendix B

The country is divided into five geographical areas:

Area 1 includes seven provinces: Alborz, Tehran, Qazvin, Mazandaran, Semnan, Golestan and Qom

Area 2 includes six provinces: Isfahan, Fars, Bushehr, Chahar mahaal and Bakhtiari, Hormozgan, and Kohgiluyeh and Boyer-Ahmad

Area 3 includes six provinces: Azerbaijan, East, Azerbaijan, West, Ardabil, Zanjan, Gilan, and Kurdistan.



Area 4 includes six provinces: Kermanshah, Ilam, Lorestan, Hamadan, Markazi, and Khoozestan

Area 5 includes five provinces: Khorasan, Razavi, Khorasan, North, Khorasan, South, Kerman, Yazd, and Sistan and Baluchestan

### **Appendix C**

SES was constructed base on the indicator variables including: freezer, refrigerator, freezer and refrigerator, TV and LED, telephone, washing machine, dish washer, macro waive oven, vacuum cleaner, personal computer or laptop, internet access, radio, cell phone, bicycle, motorcycle, wrist watch, household income, home occupancy