**Factor Associated with Early Childhood Development status in Bangladesh**

**Introduction:**

The early years of a child's life play a key role in their cognitive development and socioeconomic characteristics1. According to the WHO, Early Childhood Development (ECD) refers to the physical, socio-emotional, cognitive, and motor development in the early years of a child's life2. Children begin to learn about the world around them within 5 years of birth and this development refers to the sequence of physical, language, thought and emotional changes,3 which allows them to stay focused, understand and follow directions, communicate with others, and solve increasingly complex problems 1. At the early age of prenatal periods to infancy and early childhood, a child’s newly developing brain is highly productive and responsive to change 4. This period is the golden period for them to make themselves highly thirsty for learning and physically fit to become a successful and productive person in later life 5.

Using the data from UNICEF and the World Bank, The Lancet 2007 and 2011 Child Development Series concluded that 219 million children under the age of five fail to achieve their developmental potential each year6. The series confirms the links between poverty and inequality in childhood development that are mediated through biological factors, including intrauterine growth restriction, child malnutrition, microbial deficiencies, infectious diseases, environmental exposure, and psychological factors 7.

Since the turn of the twenty-first century, the interest in ECD has become popular all over the world. Developed countries suggest that population-based measures may be helpful in both measuring ECD and predicting later life wellness 1.Yet, despite the valuable importance of the ECD, population-based measures have not been readily available to low-and middle-income countries (LMICs) 8. It is estimated that more than 200 million children less than five years across the LMICs will not be able to reach their full developmental on-track status due to malnutrition, inadequate stimulation, and other risk factors associated with poverty 6.

As a developing country like Bangladesh, all kinds of development occur every spare of life. Government and non-government organizations are working with a lot of developmental facilities for the child, child parents, and child care-takers to ensure all kinds of rights they deserved 9. Creating an innovative foundation for strong development during the early years of life is essential for successful communities, economic productivity, and civil societies. But most parents in Bangladesh are unaware of this scientific fact, which forms the core of Early Childhood Development. UNICEF continues to popularize the concept of ECD, demonstrate policies, strengthen networks and partnerships, as well as provide technical assistance and support 10. However, there is as yet a lack of empirical evidence of the mechanisms of the factors associated with early childhood development in Bangladesh. Thus, this paper aims to draw the relationship among factors associated with early childhood development in Bangladesh and we try to show the developmental condition of the child in Bangladesh.

**Methodology**

**Data source and study variables**

We used two different survey data sets of the 2012, 2019 Multiple Indicator Cluster Survey (MICS). MICS is a large, multi-dimensional nationally representative household survey conducted by the United Nations Children’s Fund (UNICEF). This survey uses standardized questionnaires to provide the information and key indicators on the situation of children. Mostly, they focus on reproductive health, maternal, and child health interventions, child nutrition status and early childhood development. MICS also collects an identical set of socioeconomic characteristics of individuals and households11,12. Data-sets were open access for the public domain.

**Sampling design and sample size**

The MICS survey is a two-stage cluster sampling procedure, randomly selecting households with children under the age of 5 years. 2012 MICS is based on a sample of 51,895 households interviewed with a response rate of 98.5% and 2019 MICS is based on a sample of 61,246 interviewed with a response rate of 99.4%. MICS provides a comprehensive picture of children’s and women’s health in the seven administrative divisions (Dhaka, Chittagong, Sylhet, Rajshahi, Rangpur, Barisal, Khulna) of Bangladesh. Districts were identified as the main sample strata for sample selection at two stages11,12. In this study, the child age ranged from 36 to 59 months were included. Therefore, the sample included 8148 children in 2012 MICS and 9346 children in 2019 MICS having the information about the ECD and used for analysis.

**Early Childhood Development Index**

The primary objective of the Early Childhood Development Index (ECDI) is to inform public policy on the development status of children in Bangladesh. To measure early childhood development UNICEF made a great contribution by developing the ECDI questionnaire. The ECDI began to materialize when UNICEF, working with countries and partners, designed indicators to assess the quality of a child’s home environment, and access to early childhood care and education (ECCE). From UNICEF’s the ECDI was 1st initiated in 2009 during the 4th round of MICS (2012 MICS) and has been available in the following survey. It includes 10 dichotomous (yes/no) items in four early developmental domains: Literacy-numeracy (3 items), physical (2 items), social-emotional (3 items), and approaches to learning (2 items). The MICS includes questions in the ECD module for children under five and is addressed to mothers (or caregivers) of children ages 3 and 4 8.

**Outcomes variable**

For creating the outcome variable (ECD status), for each ECDI domain, a score of 1 was assigned to each ‘developmentally on track’ and a score of 0 for ‘developmentally delay’. ECDI variable then constructed based on the summation of these scores and used as the outcome variable. This had a possible range of 0 to 4, whereby at least three of these four domains or scores greater than or equals to three were indicated developmentally on track and the rest scores were treated as to fall in the category of developmentally delay 11,12.

**Covariates**

For identifying the factors associated with ECD status some reliable variables are selected as of the respondent. A set of covariates such as child age, child sex, place of residence, division, mother’s education, wealth index, religion, sex of household head, the ethnicity of household head was used. Details including levels of covariates are provided in Table 2.

**Statistical Analysis**

Bivariate analysis (chi-square test) was conducted to evaluate the association between ECD status with other covariates. Binary logistic regression model applied in the two-way, univariate logistic regression model, and multivariate logistic regression model to show the factors individuals and adjusted associations. For both the 2012 and 2019 MICS survey data we applied unadjusted and adjusted models to find the associations separately. To account for the complex survey design, we used the Svyset command in Stata (StataCorp LP, College Station, Texas). The Svyset command helps us to use design elements such as the primary sampling unit, strata, cluster, and sample weight.

**Results**

Table 1 shows a comparison of ECD on-track status for indicated domains between the years 2012 and 2019. Percentages of the status have increased for each of the domains, the highest increase in ECD on track status (21.2% to 28.8%) was found in the literacy-numeracy domain. The lowest increase in ECD on track status (68.4% to 72.7%) was found in the social-emotional domain. The overall percentage of ECD on track status increased over time in both surveys. In 2012 MICS, the percentage was 65.46% and it was increased by 74.86% in 2019 MICS (Fig 1).

Table 2 represents the percentage of overall ECD status by their socio-demographic characteristics for 2012 MICS and 2019 MICS surveys. The distribution of developmentally on track status of child age of 3 years is 59.46% according to 2012 MICS whereas it is increased to 68.72% in 2019 MICS and child age of 4 years 71.40% was on track in 2012 MICS whereas that increased to 81.26% in 2019 MICS. By the sex of the child, the female child was always more developmentally on track than the male child. In 2012 MICS, male child developmentally on track status was 63.41% and 67.65% for female. Similarly, in 2019 MICS, 71.51% and 78.46% were male and female developmentally on track, respectively. The children from rural 72.17% in 2012 MICS and 78.15% in 2019 MICS were more developmentally on track than the urban 63.72% in 2012 MICS and 73.99% in 2019 MICS children.

For divisional region, the children with highest developmentally on track status was in Rangpur 78.38% 2012 MICS and it is also highest in 2019 MICS (83.71%) than all other division. On track developmental status was lowest in Sylhet 54.15% in 2012 MICS and 61.73% in 2019 MICS than all other division. The most developmentally on track child was with the mother having secondary complete or higher educational level with 79.46% 2012 MICS and it is increased to 81.27% in 2012 MICS whereas child with mother having primary incomplete education were minimum developmental on track status with 58.80% in 2012 MICS and 68.53% in 2019 MICS. By the wealth index, children living in the richest family were most developmentally on track status with 77.55% in 2012 and 84.05% in 2012 MICS and lowest developmentally on track status in poorest family with 58.34% in 2012 MICS and 68.35% in 2019 MICS.

Table 3 shows the result of the univariate and multivariate logistic regression model to show associations between early childhood developmentally on track status and child age, place of residence, division, mother’s education, wealth index, religion, sex of household head, the ethnicity of the household head. The univariate logistic model indicates the individual associated with the ECD status. The univariate result from 2012 and 2019 MICS data, child age of 4 had 70% (2012 MICS OR:1.70, 95% CI: 1.52-1.91) and 97% [2019 MICS OR:1.97, 95% CI: 1.77-2.20] higher chance of developmentally on track than the age of 3. In multivariate results, when all other variables adjusted, the developmentally on track status had the higher chance (2012 MICS OR:1.78, 95% CI: 1.58-2.01) and (2019 MICS OR:2.08, 95% CI: 1.85-2.32) for child age of 4 than the age of 3 in both datasets. There were significant differences in ECD status among child sex, female children had a higher chance of developmentally on track in both surveys than the male child. In both models, children living in the Rangpur division had a 72% higher chance (2012 MICS OR: 1.72, 95% CI: 1.38, 2.13) and after adjusting 71% higher chance (2012 MICS OR:1.71, 95% CI: 1.36, 2.14) of developmentally on track compared to Barishal division.

For univariate and multivariate models, the child with a secondary complete or higher educated mother had a higher chance of ECD on track status than the child bought by the primary incomplete mother in both surveys. In 2012 MICS, household religion effects on ECD on track status but it is not statistically significant in 2019 MICS. No statistically significant effects of household head’s sex and ethnicity on ECD on track status were observed in both surveys.

**Discussion:**

We investigated the ECD status among children of Bangladesh. We observed that a large portion of children (74.86%) had developmentally on track. This finding is in line with the previous MICS reports in 2012 and 2019 11,12. However, this percentage is lower in Pakistan (Balochistan) and higher in Vietnam 13. Moreover, this figure varying in low- and middle-income countries, mean percentage of children aged 36–59 months with on-track development was 65·5%, ranging from 42·6% in Sierra Leone to 85·9 % in Belize 13. We also found a strong impact of child age, child sex, place of residence, division, mother’s education, and wealth index on the ECD status.

In this study, boy’s ECD on track status is poor compared to girls and correspondingly had a higher chance of developmental delay on boys. These findings are consistent with other cohort studies done in Western Cape, South Africa, where they explored developmental performance by cognitive, language, and fine motor in very young children 14. Statistically significant gender differences among children with developmental delay in two or more countries were found by using two indicators. Concerning “learning support”, the direction of gender inequality was inconsistent (higher disadvantage among boys in Vietnam and girls in Nepal). Concerning “aggression” to others, a significantly higher prevalence was observed among boys with developmental delay in Bangladesh, Pakistan, and Vietnam 15.

Child bought in the richest family had a higher chance of overall development compared to their poorest counterparts. Because early childhood programs may exacerbate existing developmental inequalities if uptake of promoted activities is greater in higher socio-economic groups with already comparatively better growth and development 16. Evidence shows a graded effect of deprivation and adversity across the entire spectrum of socioeconomic status, with even those children from the second-highest social class showing poorer health and development compared with those from families of the very highest socioeconomic status 17. In five of the six countries, children with developmental delay were more likely to be living in poverty than their peers. In three countries (Bangladesh, Laos, and Vietnam) differences were statistically significant. The highest rates of relative disadvantage were observed in Vietnam with children with development delay being 2.2 times more likely to be living in poverty 15.

Our study findings also confirmed that the on-track developmental status of children occurred among secondary or higher educated mothers. Parents’ cultural backgrounds have been associated with the learning environments provided to children of all ages. Parents tend to promote not only those skills that they value but also those they have mastered. In a recent study, immigrant parents of different cultural backgrounds—Cambodian, Dominican, and Portuguese—differed significantly concerning the areas of their children’s education in which they were involved. These differences existed even when a large majority of parents in all groups reported valuing education and having high aspirations for their children’s educational attainment 18.

**Strengths and limitations**

To the best of our knowledge, this is the first study based on the most recent MICS data in the context of developmental status using ECDI scores with Bangladeshi children. We used a sufficiently large nationally representative dataset, which represents the general population of Bangladesh. We also considered a wide range of factors that are influencing the developmental status. Despite all these strengths, our study had some limitations. As we used secondary data, the selection of variables, quality of data, and measurement indicators were beyond control. Data on child development are also available only for children of ages 3 and 4, and it is not clear how similar developmental scores among younger children are to the outcomes observed among 3- and 4-y-olds. Additional data spanning the full 0- to 5-y age range are needed to more precisely understand children’s development at the country levels. Moreover, the survey was conducted in 2012 and 2019; in the meantime, the developmental status may have changed.

**Conclusion:**

The study focused on the level and influencing factors of early childhood developmental status among children aged 3 and 4 years from both rural and urban areas of Bangladesh. A strong impact of the child’s age, area, division, education of the mother, wealth index, and religion on the child’s developmental status was detected. Although a considerable number of children had developmentally on track, initiatives should be taken to enlarge the mothers in higher education. Children in the poorest group in of the countries, in general, are the most in need of assistance to reach their full development potential. Adding the early learning setting procedures in higher-secondary text-books could be a valuable step towards reducing the developmental delay. A deeper understanding of the relationship between the risk factors and children's early development and approaches to encouraging parent’s engagement in children’s learning, development, and health are needed to most effectively ensure that children in Bangladesh reach full developmental potential.

**Recommendations:**

The findings of this study have implications for governments, international agencies, non-government organisations, and public health professionals who are working to improve early childhood development. To ECD, future research is needed to develop more detailed and age-specific measures that can more accurately capture children’s abilities across a wide range of cultures and local contexts. Further work is needed that goes beyond measures of typical development to understand the specific needs of children who may experience more severe disabilities requiring more intensive treatment and care.

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**Disclosure statement**

No potential conflict of interest was reported by the authors.

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**Table 1: Comparison of the developmentally on track status for indicated domains between two consecutive MICS survey.**

|  |  |  |
| --- | --- | --- |
| **Domains** | **2012 MICS (%)** | **2019 MICS (%)** |
| Literacy-numeracy | 21.2 | 28.8 |
| Physical | 92.2 | 98.4 |
| Social-Emotional | 68.4 | 72.7 |
| Learning | 87.5 | 91.4 |

|  |
| --- |
|  |
| **Fig 1. Distribution of developmental status of children by different survey years.** |

**Table.2 Sample characteristics of children by developmental status, MICS 2012 and 2019.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **2012** | | | **2019** | | |
| **Characteristics** | | **Developmental Status** | | **P-value** | **Developmental Status** | | **P-value** |
| **On track** | **Delay** | **On track** | **Delay** |
| **N (%)** | **N (%)** | **N (%)** | **N (%)** |
| **Child age** | 3 | 2392 (59.46) | 1649(40.54) | <0.001 | 3166 (68.72) | 1584 (31.28) | <0.001 |
| 4 | 2909 (71.40) | 1198 (28.60) | 3680 (81.26) | 916 (18.74) |
| **Child sex** | Male | 2669 (63.41) | 1565 (36.59) | 0.002 | 3383 (71.51) | 1440 (28.49) | <0.001 |
| Female | 2632 (67.65) | 1282 (32.35) | 3463 (78.46) | 1060 (21.54) |
| **Area** | Urban | 4388(63.72) | 2467 (36.28) | <0.001 | 1305 (78.15) | 430 (21.85) | <0.001 |
| Rural | 913 (72.17) | 380 (27.83) | 5541 (73.99) | 2070 (26.01) |
| **Division** | Barishal | 526 (67.86) | 262 (32.14) | <0.001 | 552 (67.8) | 269 (32.20) | <0.001 |
| Chattogram | 940 (55.04) | 682 (44.96) | 1479 (78.26) | 470 (21.74) |
| Dhaka | 1286 (67.45) | 674 (32.55) | 1453 (81.85) | 343 (18.15) |
| Khulna | 740 (71.70) | 326 (28.30) | 895 (73.07) | 409 (26.93) |
| Mymensingh | - | - | 347 (61.26) | 209 (38.74) |
| Rajshahi | 527 (66.76) | 263 (33.24) | 720 (69.57) | 307 (30.43) |
| Rangpur | 866 (78.38) | 262 (21.62) | 896 (83.71) | 207 (16.29) |
| Sylhet | 416 (54.15) | 378 (45.85) | 504 (61.73) | 286 (38.27) |
| **Mother’s education** | Primary incomplete | 2076 (58.80) | 1462 (41.20) | <0.001 | 847 (68.53) | 389 (31.47) | <0.001 |
| Primary complete | 772 (62.73) | 447 (37.27) | 1590 (68.62) | 727 (31.38) |
| Secondary incomplete | 1800 (70.01) | 760 (29.99) | 3363 (74.63) | 1143 (25.37) |
| Secondary complete or Higher | 653 (79.46) | 178 (20.54) | 1046 (81.27) | 241(18.73) |
| **Wealth Index** | Poorest | 1503 (58.34) | 1039 (41.66) | <0.001 | 1625 (68.35) | 750 (31.65) | <0.001 |
| Second | 1118 (62.85) | 657 (37.15) | 1401 (71.50) | 581 (28.5) |
| Middle | 954 (65.97) | 479 (35.03) | 1287 (75.45) | 462 (24.55) |
| Fourth | 885 (67.20) | 407 (32.80) | 1287 (75.86) | 442 (24.14) |
| Richest | 841 (77.55) | 265 (22.45) | 1246 (84.05) | 264 (15.95) |
| **Religion** | Islam | 4486 (66.08) | 2384 (33.92) | 0.044 | 6165 (74.90) | 2250 (25.10) | 0.790 |
| Others | 534 (61.42) | 321 (38.58) | 681(74.44) | 250(25.56) |
| **Sex of household head** | Male | 4411 (65.67) | 2348 (34.33) | 0.852 | 6223 (73.02) | 2299 (26.98) | 0.367 |
| Female | 609 (65.26) | 357 (34.74) | 623 (75.61) | 201 (24.39) |
| **Ethnicity of household head** | Bengali | 4865 (65.58) | 2620 (34.42) | 0.798 | 6684 (74.89) | 2438 (25.11) | 0.474 |
| Others | 155 (66.60) | 85 (33.40) | 162 (72.70) | 62 (27.30) |
| **Total** |  | 5301 (65.46) | 2847 (34.54) |  | 6846 (74.86) | 2500 (25.14) | - |

**Table.3 Factors associated with developmental status of children, MICS 2012 and 2019.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **MICS- 2012** | | | | **MICS- 2019** | | | |
| **Univariate** | | **Multi-variate** | | **Univariate** | | **Multi-variate** | |
| **Variables** | **Unadjusted**  **OR (95% CI)** | **P-value** | **Adjusted**  **OR (95% CI)** | **P-value** | **Unadjusted**  **OR (95% CI)** | **P-value** | **Adjusted**  **OR (95% CI)** | **P-value** |
| **Age of child** |  |  |  |  |  |  |  |  |
| 4 | 1.70 (1.52-1.91) | <0.001 | 1.78 (1.58-2.01) | <0.001 | 1.97 (1.77-2.20) | <0.001 | 2.08 (1.85-2.32) | <0.001 |
| 3 | Reference | - | Reference | - | Reference | - | Reference | - |
| **Child’s sex** |  |  |  |  |  |  |  |  |
| Female | 1.21 (1.07-1.36) | 0.002 | 1.27 (1.12-1.44) | <0.001 | 1.45 (1.31-1.61) | <0.001 | 1.47 (1.32-1.63) | <0.001 |
| Male | Reference | - | Reference | - | Reference | - | Reference | - |
| **Area** |  |  |  |  |  |  |  |  |
| Rural | 1.48 (1.21-1.79) | <0.001 | 1.28 (1.05-1.57) | 0.013 | 1.26 (1.09-1.44) | <0.001 | 0.89 (0.77-1.03) | 0.125 |
| Urban | Reference | - | Reference |  | Reference | - | Reference | - |
| **Division** |  |  |  |  |  |  |  |  |
| Chattogram | 0.58 (0.47-0.71) | <0.001 | 0.49 (0.39-0.62) | <0.001 | 1.71 (1.43 - 2.05) | <0.001 | 1.55 (1.27-1.89) | <0.001 |
| Dhaka | 0.98 (0.80-1.20) | 0.859 | 0.87 (0.70-1.08) | 0.217 | 2.14 (1.77 -2.60) | <0.001 | 1.91 (1.56-2.34) | <0.001 |
| Khulna | 1.20 (0.97-1.49) | 0.097 | 1.07 (0.84-1.36) | 0.553 | 1.29 (1.07-1.55) | 0.008 | 1.18 (0.96-1.43) | 0.101 |
| Mymensingh | - | - | - | - | 0.75 (0.59 - 0.95) | 0.017 | 0.77 (0.60-0.98) | 0.035 |
| Rajshahi | 0.95 (0.75-1.20) | 0.675 | 0.92 (0.71-1.18) | 0.514 | 1.09 (0.88-1.33) | 0.430 | 1.04 (0.84-1.29) | 0.719 |
| Rangpur | 1.72 (1.38-2.13) | <0.001 | 1.71 (1.36-2.14) | <0.001 | 2.44 (0.62-0.95) | <0.001 | 2.59 (2.10-3.19) | <0.001 |
| Sylhet | 0.56 (0.44-0.71) | <0.001 | 0.59 (0.46-0.75) | <0.001 | 0.77 (0.62-0.95) | 0.015 | 0.75 (0.60-0.93) | 0.010 |
| Barishal | Reference | - | Reference |  | Reference | - | Reference | - |
| **Mother’s education level** |  |  |  |  |  |  |  |  |
| Secondary complete or Higher | 2.71 (2.14-3.43) | <0.001 | 1.89 (1.46-2.46) | <0.001 | 2.26 (1.82-2.79) | <0.001 | 1.76 (1.38-2.23) | <0.001 |
| Secondary incomplete | 1.64 (1.43-1.87) | <0.001 | 1.43 (1.22-1.68) | <0.001 | 1.53 (1.31-1.78) | <0.001 | 1.37 (1.16-1.62) | <0.001 |
| Primary complete | 1.17 (0.99-1.40) | 0.062 | 1.16 (0.96-1.39) | 0.117 | 1.04 (0.88-1.23) | 0.651 | 1.04 (0.87-1.23) | 0.689 |
| Primary incomplete | Reference | - | Reference | - | Reference | - | Reference | - |
| **Wealth Index** |  |  |  |  |  |  |  |  |
| Richest | 2.47 (1.98-3.08) | <0.001 | 1.82 (1.38-2.40) | <0.001 | 2.44 (2.04 -2.93) | <0.001 | 1.85 (1.47-2.31) | <0.001 |
| Fourth | 1.46 (1.22-1.75) | <0.001 | 1.24 (1.01-1.52) | 0.040 | 1.45 (1.24-1.70) | <0.001 | 1.17 (0.98-1.40) | 0.084 |
| Middle | 1.32 (1.12-1.56) | 0.001 | 1.22 (1.01-1.47) | 0.036 | 1.42 (1.22-1.66) | <0.001 | 1.22 (1.03-1.46) | 0.019 |
| Second | 1.21 (1.04-1.41) | 0.014 | 1.06 (0.90-1.26) | 0.482 | 1.16 (1.00-1.35) | 0.051 | 1.07 (0.91-1.25) | 0.412 |
| Poorest | Reference | - | Reference | - | Reference | - | Reference | - |
| **Religion** |  |  |  |  |  |  |  |  |
| Islam | 1.22 (1.01-1.49) | 0.045 | 1.29 (1.03-1.62) | 0.029 | 1.02 (0.86-1.22) | 0.790 | 1.08 (0.88-1.33) | 0.451 |
| Others | Reference | - | Reference | - | Reference | - | Reference | - |
| **Sex of household** |  |  |  |  |  |  |  |  |
| Female | 0.98 (0.81-1.19) | 0.852 | 1.04 (0.86-1.26) | 0.656 | 1.08 (0.91-1.29) | 0.368 | 0.95 (0.79-1.14) | 0.551 |
| Male | Reference | - | Reference | - | Reference | - | Reference | - |
| **Ethnicity of household sex** |  |  |  |  |  |  |  |  |
| Bengali | 0.96 (0.67-1.35) | 0.799 | 0.72 (0.48-1.06) | 0.095 | 1.12 (0.82-1.53) | 0.474 | 0.93 (0.63-1.39) | 0.735 |
| Others | Reference | - | Reference | - | Reference | - | Reference | - |