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Factors Associated with Early Childhood Development in Bangladesh: Evidence from the 2019 Multiple Indicator Cluster Survey

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Abstract: Early childhood development (ECD) is fundamental to health, cognitive ability, and social and economic productivity throughout life. This study evaluated the nutritional, socio-economic, care giving and child related factors related to ECD among children (3-4 years) of Bangladesh. The nationally representative Bangladesh Multiple Indicator Cluster Survey (MICS) for 2019 was used to gather the data. A survey-weighted partial proportional odds model (PPOM) was used to take into account the complex sampling design while preserving the ordered nature of the developmental status and the possibility of different effects of the predictors across the thresholds for developmental status. Of the 8,752 children included in the multivariable analysis, 3.2% were not on track, 23.6% were partially on track, and 73.3% were developmentally on track. Children with no functional difficulties had significantly higher odds for better developmental attainment. Higher maternal education levels were associated with increased odds for ECD, with those children having a mother with secondary education or above. Attendance in an early childhood education program was positively associated with developmental attainment (AOR = 1.53, 95% CI: 1.28–1.84). Girls had higher odds of better developmental outcomes than boys (AOR = 1.45, 95% CI: 1.30–1.62), and increasing age was also positively associated with ECD (AOR = 1.05, 95% CI: 1.04–1.06). Significant regional and socioeconomic differences were also observed. The use of the PPOM provides a more flexible assessment of ECD by identifying factors whose associations differ across levels of developmental attainment, which may be obscured when the outcome is treated as binary or when the proportional odds assumption is imposed. These findings highlight the importance of early childhood education, maternal education, socioeconomic equity, and disability-inclusive support for improving ECD in Bangladesh.

Keywords: Early childhood development; Child development; Bangladesh; Partial proportional odds model; Ordinal regression; Survey-weighted analysis

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1. Introduction

Early childhood development encompasses rapid physical, cognitive, social, and emotional growth, forming the foundation for future success. Positive experiences and supportive relationships are crucial for healthy development, while adverse conditions may hinder progress. The UN's Sustainable Development Goal (SDG) 4.2 underscores the importance of early childhood development in promoting equal education and well-being by 2030.

Early childhood development (ECD) is closely linked to child nutritional status, with studies indicating that stunting and underweight are associated with delays in key ECD domains like fine motor, gross motor, and problem-solving skills (Delbiso et al., 2024; Lu et al., 2020). Due to variables like poverty and hunger, children in low- and middle-income countries (LMICs) have poor developmental outcomes. However, interventions such as

nutrition programs and early education can improve these outcomes (Engle et al., 2011; Grantham-McGregor et al., 2007).

Nursing plays a vital role in enhancing linguistic proficiency and lessening behavioral problems, positively affecting cognitive and non-cognitive development (Girard et al., 2017; Woldehanna, 2011). High-quality early childhood care education (ECCE) is critical as it shapes cognitive, social, and emotional development, contributing to human capital, social cohesion, and national stability (Isaac, 2024; Hahn & Barnett, 2023; Bornstein et al., 2021). Furthermore, preschool education of the highest caliber fosters children's growth and continues into adulthood (Black et al., 2017; Yoshikawa et al., 2013).

Early brain development is influenced by factors like preterm birth and socioeconomic status, which affect brain structure and cognitive skills, particularly in areas like visual reception and language (Alex et al., 2024). While global ECD initiatives aim to improve brain development in the global South, they often overlook critical cultural insights from anthropology and related fields (Scheidecker et al., 2023; Lansford & Bornstein, 2011).

Parenting interventions are effective in promoting ECD through responsive parent-child relationships (Mohzana & Murcahyanto, 2023; Jeong et al., 2021; Yang et al., 2021; Baumrind, 1991). Research indicates that children's interactions with their environments significantly influence their development and long-term outcomes (Schiariti et al., 2021).

Therefore, this study aimed to examine the associations of nutritional, socioeconomic, caregiving, and child-related characteristics with early childhood development among children aged 3–4 years in Bangladesh, using nationally representative data from the 2019 Bangladesh Multiple Indicator Cluster Survey (MICS).

2. Data and Methods

2.1. Study Area and Data Source

This study used data from the 2019 Bangladesh Multiple Indicator Cluster Survey (MICS), a nationally representative household survey conducted by the Bangladesh Bureau of Statistics (BBS) in collaboration with UNICEF. The survey used a two-stage stratified cluster sampling design. Information on children's early childhood development, nutritional status, caregiving environment, and other child and household characteristics was obtained from mothers or primary caregivers. Among the children assessed in the survey, 9,455 children aged 3–4 years were initially eligible for the present analysis.

2.2. Outcome Variable: Early Childhood Development

The primary outcome was overall early childhood development (ECD), assessed using the Early Childhood Development Index (ECDI). The ECDI covers four developmental domains: literacy-numeracy, physical development, social-emotional development, and learning. Based on the number of domains in which a child was considered developmentally on track, children were classified into three ordered categories: not on track, partially on track, and on track. Children who were on track in none or one of the four domains were classified as not on track; those who were on track in two domains were classified as partially on track; and those who were on track in three or four domains were classified as on track. The three-level ordinal outcome was coded sequentially from the lowest to the highest level of developmental attainment. This ordering was used for the ordinal regression analyses.

2.3. Explanatory Variables

The explanatory variables were selected based on their relevance to child development and availability in the MICS dataset. They represented child, maternal, household, nutritional, caregiving, and socioeconomic characteristics. Nutritional indicators included stunting and body mass index-related measures where applicable. Child-related characteristics included functional difficulties, age, sex, and participation in early childhood education. Caregiving-related variables included reported experiences of physical abuse

and caregiver-related characteristics. Maternal education, household wealth, and geographic division were included as socioeconomic and contextual characteristics.

Child nutritional status was assessed using anthropometric indicators based on the relevant World Health Organization growth standards. Household socioeconomic position was represented by the MICS household wealth index. Functional difficulties were based on caregiver-reported information concerning difficulties in relevant functional domains.

2.4. Statistical Analysis

Descriptive analyses were first conducted to summarize the distribution of the study variables. Because the outcome variable had three ordered categories, ordinal logistic regression was considered appropriate. Unlike multinomial logistic regression, ordinal logistic regression incorporates the natural ordering of the outcome categories and can therefore use information contained in that ordering.

The conventional proportional odds model assumes that the effect of each explanatory variable is constant across the cumulative logits formed by the ordered outcome categories. Specifically, for an ordinal outcome Y with J ordered categories, the cumulative logit model can be expressed as:

$$logit\big(P(Y \leq j|X)\big) = \alpha_j - X\beta, j = 1, \dots, J-1 \quad (1)$$

where α_j represents the cut-point-specific intercept and β represents the regression coefficients. Under the proportional odds assumption, the coefficient for a given predictor is the same across all cumulative logits.

Because the proportional odds assumption may not hold for every explanatory variable, a partial proportional odds model (PPOM) was used. The PPOM extends the proportional odds model by allowing selected predictors to have different coefficients across cumulative logits while retaining common coefficients for predictors that satisfy the proportional odds assumption. This approach was originally described by Peterson and Harrell and permits the ordinal outcome to be modeled without imposing proportionality on variables for which the assumption is not supported.

For the present three-category outcome, two cumulative logits were considered:

$$logit\{P(Y \leq 0 \mid X)\} = \alpha_1 - X_P\beta_P - X_{NP}\gamma_1 \quad (2)$$

And

$$logit\{P(Y \leq 1 \mid X)\} = \alpha_2 - X_P\beta_P - X_{NP}\gamma_2 \quad (3)$$

where X_P denotes predictors satisfying the proportional odds assumption and X_{NP} denotes predictors for which the effect was allowed to vary across cumulative logits. Thus, predictors satisfying the proportional odds assumption have one common coefficient, whereas predictors violating the assumption have separate coefficients for the two cumulative logits.

The proportional odds assumption was assessed during model development. Predictors that did not satisfy the assumption were modeled with non-proportional effects, while the remaining predictors were constrained to have proportional effects. In the final survey-adjusted PPOM specification, functional difficulty and the Rangpur category of geographic division were permitted to vary across the cumulative logits, while the remaining covariates were constrained to proportional effects.

2.5. Complex Survey Design

All regression analyses accounted for the complex sampling design of the 2019 Bangladesh MICS. Sampling weights were incorporated using the child-level sampling weight (chweight), the primary sampling unit/cluster was specified using UF1, and the sampling strata were specified using HH6. The survey design was therefore specified as:

svyset UF1 [pw=chweight], strata(HH6).

Survey-adjusted standard errors and design-based statistical tests were used in the regression analyses to account for clustering, stratification, and unequal probabilities of selection.

2.6. Sensitivity Analysis Using Binary Logistic Regression

As a sensitivity analysis, the three-level ECD outcome was additionally collapsed into a binary outcome distinguishing children who were on track in three or four developmental domains from those who were not on track, defined as being on track in zero, one, or two domains. Survey-adjusted binary logistic regression was then fitted using the same set of explanatory variables.

The binary analysis was conducted to provide an additional assessment of the robustness of the observed associations when developmental attainment was considered as a dichotomous outcome. Because dichotomization discards information contained in the ordered outcome categories, the binary model was treated as a sensitivity analysis rather than as the primary analysis.

3. Results

3.1 Bivariate Analysis

The following bivariate table analysis presents the relationships between the identified predictors and early childhood development outcomes.

Table 1. Distribution of early childhood development status by selected characteristics among children aged 3–4 years

Characteristics	Category	Not on track, n (%)	Partially on track, n (%)	On track, n (%)	Total, n	Pearson χ^2	p-value
Age of child	3 years	11 (0.2)	1,484 (31.0)	3,285 (68.7)	4,781	195.84	<.001
	4 years	4 (0.1)	855 (18.7)	3,726 (81.3)	4,585		
Sex	Male	6 (0.1)	1,374 (28.3)	3,467 (71.5)	4,848	61.22	<.001
	Female	8 (0.2)	964 (21.4)	3,544 (78.5)	4,517		
Division	Barishal	2 (0.4)	169 (31.9)	359 (67.8)	529	293.89	<.001
	Chattogram	1 (0.0)	445 (21.7)	1,605 (78.3)	2,051		
	Dhaka	5 (0.2)	388 (17.9)	1,771 (81.9)	2,163		
	Khulna	2 (0.2)	261 (26.7)	714 (73.0)	978		
	Mymensingh	2 (0.3)	267 (38.4)	426 (61.2)	696		
	Rajshahi	0 (0.0)	359 (30.5)	820 (69.6)	1,179		
	Rangpur	4 (0.4)	161 (15.8)	850 (83.7)	1,016		
	Sylhet	1 (0.1)	287 (38.2)	464 (61.7)	752		
Mother's education	Pre-primary or none	3 (0.2)	383 (31.1)	843 (68.5)	1,230	121.13	<.001
	Primary	4 (0.2)	694 (30.4)	1,582 (69.4)	2,281		
	Secondary	7 (0.2)	1,034 (23.0)	3,463 (76.9)	4,504		
	Higher secondary or above	1 (0.1)	227 (16.8)	1,123 (83.1)	1,351		
Wealth index	Poorest	3 (0.1)	657 (31.5)	1,426 (68.4)	2,086	147.84	<.001
	Poorer	3 (0.2)	529 (28.3)	1,336 (71.5)	1,868		
	Middle	1 (0.1)	428 (24.5)	1,318 (75.5)	1,747		
	Richer	6 (0.3)	431 (23.8)	1,373 (75.9)	1,810		
	Richest	3 (0.2)	293 (15.8)	1,558 (84.1)	1,854		
Ethnicity	Others	0 (0.0)	30 (27.3)	80 (72.7)	110	0.50	.727
	Bengali	14 (0.2)	2,309 (24.9)	6,931 (74.9)	9,255		
Child functional difficulties	Yes	10 (4.0)	138 (54.9)	103 (40.9)	252	372.26	<.001

	No	5 (0.1)	2,201 (24.1)	6,908 (75.8)	9,113		
Caregiver functional difficulties	Yes	0 (0.0)	57 (36.8)	99 (63.9)	155	11.14	.005
	No	11 (0.1)	2,244 (24.9)	6,763 (75.0)	9,019		
Stunting	No	5 (0.1)	1,484 (23.2)	4,923 (76.8)	6,411	42.59	<.001
	Yes	5 (0.2)	749 (29.5)	1,787 (70.3)	2,541		
Underweight	No	6 (0.1)	1,629 (23.9)	5,168 (76.0)	6,803	15.25	.005
	Yes	3 (0.1)	627 (28.0)	1,608 (71.8)	2,238		
Ever attended ECE program	No	15 (0.2)	2,085 (27.6)	5,450 (72.2)	7,550	148.32	<.001
	Yes	1 (0.1)	254 (14.0)	1,561 (85.9)	1,815		
Ever physically abused	No	6 (1.0)	139 (22.2)	486 (77.6)	626	24.95	<.001
	Yes	10 (0.1)	2,203 (25.2)	6,515 (74.6)	8,728		

Table 1 shows the distribution of the children's development status across a few chosen independent factors is shown in the table, along with the total number of kids in each group and the counts for no development, moderate development, and complete development. To evaluate the correlation between each variable and development state, it also provides the p-value and Pearson Chi-square statistic. The development status of children is significantly correlated with all variables except "Ethnicity."

3.2. Model Fitting

We have used PPOM (partial proportional odds model) to determine the significant factors that affect the development of children at early ages. The most common ordinal logistic regression is POM (Proportional odds model) which assumes that the effect of the independent variables on the odds of an outcome is proportional across all levels of the dependent variable. This assumption was violated and that is the reason for using the PPOM (Partial Proportional odds model).

Table 2. Survey-adjusted partial proportional odds model for early childhood development

Characteristics	**Category**	**AOR**	**95% CI**	**p-value**
Child age	4 years vs. 3 years	1.97	1.65–2.35	<.001
Sex	Female vs. male	1.45	1.29–1.62	<.001
Division	Chattogram vs. Barishal	1.34	1.08–1.67	.009
	Dhaka vs. Barishal	1.78	1.43–2.21	<.001
	Khulna vs. Barishal	1.05	0.84–1.29	.690
	Mymensingh vs. Barishal	0.70	0.53–0.91	.008
	Rajshahi vs. Barishal	0.91	0.72–1.14	.413
	Rangpur vs. Barishal	0.07†	0.01–0.41†	.003†
		2.26‡	1.79–2.85‡	<.001‡
	Sylhet vs. Barishal	0.67	0.52–0.86	.002
Mother's education	Primary vs. pre-primary/none	1.05	0.86–1.27	.643
	Secondary vs. pre-primary/none	1.39	1.15–1.67	.001
	Higher secondary or above vs. pre-primary/none	1.65	1.27–2.14	<.001
Household wealth	Poorest	Reference	—	—
	Poorer	1.03	0.87–1.22	.750
	Middle	1.18	0.99–1.41	.069
	Richer	1.14	0.95–1.38	.163

	Richest	1.71	1.37–2.14	<.001
Ethnicity	Bengali vs. other	1.04	0.73–1.49	.816
Child functional difficulties	Yes	Reference	—	—
	No†	97.48†	16.02–592.0†	<.001†
	No‡	4.54‡	3.23–6.39‡	<.001‡
Caregiver functional difficulties	Yes	Reference	—	—
	No	1.38	0.93–2.03	.106
Stunting	No	Reference	—	—
	Yes	0.91	0.81–1.03	.155
Early childhood education	No	Reference	—	—
	Yes	1.53	1.28–1.84	<.001
Physical abuse	No	Reference	—	—
	Yes	0.87	0.69–1.11	.264

Notes. AOR = adjusted odds ratio; CI = confidence interval. The model was adjusted for all characteristics shown in the table and accounted for the complex survey design. †First cumulative logit: not on track vs. partially/on track. ‡Second cumulative logit: not on track/partially on track vs. on track. For predictors satisfying the proportional odds assumption, a single AOR applies to both cumulative logits. Child functional difficulties and Rangpur division were modeled with non-proportional effects

This table 2 shows the results of various PPOMs (Partial proportional odds models) of the development status of children on three ordered categories (no development, partially developed, and developed). Several characteristics have their coefficient, odds ratio, p-value and 95% confidence interval included in the table.

The survey-adjusted partial proportional odds model showed several factors associated with children's developmental status. Female children had higher odds of being in a higher developmental category than male children (AOR = 1.45, 95% CI: 1.30–1.63). Child age was also positively associated with developmental status, with older children showing higher odds of being in a higher developmental category than younger children.

Maternal education showed a graded association with childhood development. Compared with children whose mothers had no or pre-primary education, children whose mothers had completed secondary education had 39% higher odds of being in a higher developmental category (AOR = 1.39, 95% CI: 1.15–1.67), while those whose mothers had completed higher secondary education or above had 65% higher odds (AOR = 1.65, 95% CI: 1.28–2.14). The association for primary education was not statistically significant (AOR = 1.05, 95% CI: 0.86–1.27).

Developmental status was also related to the household wealth. Children from the poorest, poorer, middle and richer wealth groups had fewer odds of being in a higher developmental group, 0.58, 0.60, 0.69 and 0.67 respectively, compared with children from the richest households. This trend indicates that there is a socioeconomic gradient in children's development. Significant associations were found with functional difficulties, and this association was more pronounced for the developmental logit than for the other. The odds of children being in a higher developmental category than children with functional difficulties were significantly higher in children who were not functionally impaired (AOR = 97.48, 95% CI: 16.02–592.00, for the first cut-point; AOR = 4.54, 95% CI: 3.23–6.39, for the second cut-point). The extremely broad confidence interval of the first estimate should be taken with a grain of salt, as it may simply be due to the low number of children in the lowest developmental grouping who have functional difficulties.

Higher odds of being in a higher developmental category (AOR = 1.53, 95% CI: 1.28–1.84) were also found among children who had ever attended an early childhood education programme. In the same way, increased age of the child was correlated to increased likelihood of being categorized at a higher level. Adjustment for other variables in the model did not result in statistical significance for the physical abuse variable, nor for caregiver functional difficulties, nor for ethnicity nor for stunting.

Differences were also observed between administrative divisions and Barishal. Children in higher developmental categories in Chattogram (AOR = 1.34) and Dhaka (AOR = 1.78) had greater odds of being in higher developmental categories, while the odds of being in higher developmental categories in Mymensingh (AOR = 0.70) and Sylhet (AOR = 0.67) were lower. Association of Khulna and Rajshahi were not statistically significant. Rangpur had a non-proportional association with the odds ratios being different for both cumulative logits (AOR = 0.07 for the first cut-point; AOR = 2.26 for the second cut-point).

Table 3. Survey-adjusted binary logistic regression model for early childhood development

Variables	Adjusted Odds Ratio (AOR)	95% CI	p-value
Physical abuse	0.87	0.68–1.10	0.248
Caregiver functional difficulties	1.38	0.94–2.04	0.102
Mother's education			
Primary	1.05	0.86–1.27	0.650
Secondary	1.39	1.15–1.67	0.001
Higher secondary or above	1.65	1.27–2.14	<0.001
Child functional difficulties			
No difficulties	4.57	3.25–6.44	<0.001
Household wealth index			
Poorer	1.03	0.87–1.22	0.762
Middle	1.18	0.99–1.41	0.070
Richer	1.14	0.95–1.38	0.158
Richest	1.71	1.37–2.14	<0.001
Stunting	0.91	0.81–1.03	0.146
Ever attended early childhood education	1.53	1.28–1.84	<0.001
Sex			
Female	1.45	1.30–1.63	<0.001
Child age	1.05	1.04–1.06	<0.001
Ethnicity	1.04	0.73–1.49	0.816
Division			
Chattogram	1.34	1.08–1.67	0.009
Dhaka	1.77	1.43–2.21	<0.001
Khulna	1.04	0.84–1.29	0.702
Mymensingh	0.69	0.53–0.91	0.008
Rajshahi	0.91	0.72–1.14	0.406
Rangpur	2.26	1.79–2.86	<0.001
Sylhet	0.67	0.52–0.86	0.002

Table 3 presents the results of a binary logistic regression model with childhood development status (i.e., whether a child is developmentally on track or not). For sensitivity analysis purposes the three-level developmental outcome was subsequently dichotomized, with children on track in three or more domains counted as on track, and children on track in less than three domains as not on track. A binary logistic regression model was subsequently fitted to the same set of explanatory variables, with the results from the survey. The results of the binary logistic regression were generally similar to the results of the PPOM. The odds of being on track was higher for female children as compared to male children (AOR = 1.45, 95% CI: 1.30–1.63). Children had greater odds of being on track if their mothers had secondary or higher secondary education than if they had no or pre-primary education. There was also significant positive association between attendance at ECE programme and being on track (AOR = 1.53, 95% CI: 1.28–1.84). Children who did not have functional difficulties had significantly greater odds of being on track than those with functional difficulties (AOR = 4.57, 95% CI: 3.25–6.44). The binary outcome was also

associated with household wealth, geographic division and age of children, but not with physical abuse, functional difficulties of caregivers, stunting or ethnicity.

4. Discussion

This study employed Bangladesh's 2019 MICS data to look at factors associated with early childhood development (ECD) in children ages 3-4. The results indicate that a child's developmental outcomes is influenced by a multi-faceted mix of individual, family, socioeconomic, educational and geographic factors. The odds for females to be in a higher developmental category than males and for older children to have higher developmental outcomes were higher. The results are consistent with the fact that children grow up very quickly in their early years, but cannot be explained by the cross-sectional design.

A similar socioeconomic pattern was observed with household wealth, with children in the lowest socio-economic status having lower chances of higher developmental attainment than children in the highest socio-economic status. The results of this study help to bring to light the significance of the wider family context in providing opportunities for children to learn, engage and grow.

Functional problems was most strongly correlated with developmental status. In the binary model, children with no functional difficulties were much more likely to be developmentally on track (AOR = 4.57, 95% CI: 3.25–6.44). It was also shown that this association was different at each developmental threshold by the PPOM. The extremely high PPOM estimate at the first threshold needs to be interpreted with caution, however, since relatively few children with functional difficulties were observed in the lowest developmental threshold.

Development was also positively related to attendance in early childhood education. The odds of being in a higher developmental category (AOR = 1.53, 95% CI: 1.28–1.84) were 53% greater for children who had participated in an early childhood programme. This discovery reinforces the need to give children enriching chances for learning and socializing at an early age. There was also a finding of differences between divisions and Barishal, as developmental outcomes differed between the two. These disparities could be due to socioeconomic and service delivery and/or early learning experiences. Interestingly the variables of stunting were not statistically significant in the final adjusted models. This does not imply that nutrition is not important in children's development; it indicates that the nutrition association may be mixed in with other factors used in the analysis. The results of the binary model were similar, although it did not supply information on the variables whose effects varied by developmental level as did the PPOM. There are a number of limitations in this study. The "cross-sectionality" of the MICS data prohibits establishing causal relationships (1st limitation). Secondly, certain information was provided by mothers or carers, and may thus have been subject to recall or reporting bias. Third, some factors of importance were not sufficiently measured in these data, such as parenting quality, home stimulation, quality of early childhood education and access to healthcare, which may have left residual confounding. In some developmental categories, there were only a few children with functional difficulties, thus leading to imprecise estimates. Longitudinal data could be used to better understand the developmental trajectory over time of socioeconomic factors, nutrition, early education, and functional difficulties. Further research also could be conducted in each of the four developmental domains and the quality of early childhood education and parenting/learning environments

5. Conclusion

This study explored the factors associated with child development in early childhood (3-4 years) in Bangladesh, based on nationally representative data from the 2019 Bangladesh Multiple Indicator Cluster Survey (BMICS). The study accounted for the complex survey design and used a survey adjusted partial proportional odds model to model developmental status as an ordered outcome, enabling the study to allow selected predictors

to have different associations across developmental thresholds. The results suggest that there were a number of child and household features that were related to developmental attainment. Older children and girls had higher odds of being at higher levels of developmental attainment. The developmental status was positively associated with maternal secondary or higher secondary education while children in children in several higher wealth categories exhibited different developmental patterns than the reference category. Being enrolled in early childhood education was also positively related to developmental achievement. The connection between child functional difficulties was especially strong and differed by the two developmental thresholds, thus underscoring the need to explore disability and functional limitations in relation to inequalities in ECD.

There was also variation in developmental outcomes across divisions of Bangladesh, with geographic differences observed. Stunting, physical abuse, caregiver functional difficulties, and ethnicity were not statistically associated with developmental status after adjusting in final models, however. Again, the comparison to the survey-adjusted binary logistic sensitivity analysis illustrates that such a collapsing of an ordered developmental outcome into two categories can mask the differences between developmental thresholds. The PPOM thus offers more details on the differences that can be observed between associations in terms of developmental attainment. In general, the results suggest that socioeconomic factors, maternal education, early childhood education, functional capacity and wider geographical context are essential to understand early childhood development in Bangladesh. It is important to note however, that the associations that are observed in the study should not be interpreted as causal relationships since the study is cross-sectional. Longitudinal data would be needed with other factors, including parenting practices, quality of home stimulation, quality of early childhood education, and access to health and developmental services, to gain a deeper understanding of the pathways that contribute to inequalities in ECD. The results may however guide the identification of children and situations that may need more support and improve equitable early childhood development in Bangladesh.

Declarations

Ethics and Guidelines: Not Applicable.

Consent to participate: Not Applicable.

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Declaration of using generative AI: During the preparation of this work the author(s) used ChatGPT in order to correct the grammatical errors. After using this tool/service, the author(s) reviewed and edited the content as needed and take full responsibility for the content of the published article.

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