Dhaka Univ. J. Sci. 73(1): 1-11, 2025 (January)

ISSN 1022 - 2502, E-ISSN 2408-8528
DOI: https://doi.org/ 10.3329/dujs.v73i1.81279

The Influence of Mother's Use of Technological Devices on Child's Early Childhood Development in Bangladesh

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(Received: 22 February 2024 ; Accepted: 19 December 2024)

Abstract

The study aims to explore the association between maternal ICT use and child development in Bangladesh along with examining other important factors influencing the outcome. Early childhood development (ECD) helps children to achieve their full potential providing strong foundations throughout the life. But, Bangladesh often faces challenges with ECD. On the other hand, the country has been progressively embracing ICT use due to rapid urbanization and drastic economic growth. However, the study includes 8726 recent births aged three to four years from Multiple Indicators Cluster Survey (MICS) 2019 data in Bangladesh considering ECD as a binary outcome variable and several background characteristics of respondents as predictors. 73.1% children are found developmentally on track. The main finding of the study is that the use of ICT by mothers keeps the ECD on track. From multivariate analysis, we found that children of mothers not using computer have 69.7% higher odds of delayed development than the children of mothers who used computer (p-value: 0.032). The children of mothers, who were not in touch with the internet experienced 49.9% higher odds of delayed development than the children of the ones who were in touch (p-value < 0.001). It is also noticed that the risk of delayed development is significantly 18.6% higher (p-value = 0.005) in the children, whose mothers did not own a mobile than the mothers who owned. Other factors like maternal education, media exposure, age and sex of child, division, child has something to play or read and ECD program attendance also influence the study outcomes. However, it is recommended, when preparing initiatives pertaining to children's cognitive and physical development, the policymakers should take the study's findings into consideration. These findings can also be utilized to achieve SDG target 4.2, which is to guarantee that all girls and boys have access to high-quality pre-primary education so that they are prepared for primary school by 2030.

Keywords: Early childhood development (ECD), Technology, Multiple Indicator Cluster Survey (MICS), Binary logistic regression model

I. Introduction

The formative years of childhood are recognized as the most critical developmental stages of the entire life span for physical and erudite wellbeing. Early Childhood Development (ECD) encompasses the physical, subjective, socioemotional, and motor skills development throughout the productive years[1]. In accordance with the Sustainable Development Goals (SDGs) target 4.2 by United Nations, member countries like Bangladesh should guarantee that every child has access to high-quality early childhood development to get them prepared adequately for primary school[2].

In Bangladesh, government and non-government organizations have allied with enormous child development centers in recent years to assure that all the children, parents, and caregivers receive the rights they are entitled to[3]. According to Multiple Indicator Cluster Survey (MICS) conducted in Bangladesh, the percentage of children who were developmentally on track was 74.4% in 2019 and 70% in 2012[4], which demonstrates that child development had marginally upgraded in this country during these years. However, there is only 6% relative increase in this indicator in the 7-year time-span, which is quite alarming.

In recent years, ICT sector has been progressed remarkably in Bangladesh propelled by the initiatives undertaken by the current administration. The government created a nationwide web gateway consisting of 46,500 government offices and 5,875 Digital Centers to guarantee that citizens can easily access public services[5]. Even individuals residing in rural areas can access many internet services which is facilitated by the 4,571 Union Digital Centers[7]. The MICS data of 2019 showed that 95.9% of households are equipped with at least one of the ICT devices from computer and mobile phone. In addition, 37.6% of household have access to the internet within their home. It is perceived that, alongside mass media and other technological devices, ICT exerts a profound influence on child health and their cognitive development[5]. Yeonkyu Lee and Mikyung Moon found that the likelihood of using applications for pregnancy, childbirth, and/or child care increased for women who had used smartphones for a longer period of time[6]. Because of recent advancements and prevailing trends, ICT seems to be a relatable issue in the context of education in general and ECD in particular[7,8]. Moreover, investigating potential relationships between ECD and ICT usage of mothers is essential.

Previous studies disclosed that mothers who utilize technology may have access to information and educational opportunities that helps them improving their parenting quality in the long run[9]. In a study, Islam showed that, the likelihood that children would be on track in their ECD is

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positively correlated with the number and frequency of the several media categories used by mothers[10]. A growing trend in these relationships indicate that the percentage of children who are developmentally on track rises along with the access to devices their mothers have[10].

Nevertheless, no study has been found in Bangladesh that delved into the association of mother's use of technological devices and the potential impact on their children's overall growth. Assessing the adjusted association between mother's use of technology and developmental outcomes of children is the main objective of this study.

II. Methodology

Data

The data for this study is extracted from Multiple Indicator Cluster Survey (MICS) 2019, Bangladesh[11]. The sample comprising 64400 households included in 3220 primary sampling units is selected following two-stage stratified cluster sampling method to offer estimates for numerous indicators on women and child health at the national level. The main sampling strata are the urban and rural areas within each district and then the sample of households are chosen in two stages. A specified number of census enumeration zones are selected systematically within each stratum with a probability proportional to size. After listing the households, a selection of 20 households is carried out following random systematic selection procedures for each enumeration area[11]. The study focuses on the mother-child's pair of recent children of age 3 and 4 years. In MICS 2019 data, there are 9226 children aged between 3 and 4 years. As we consider only the recent births and children having complete information on the considered characteristics, hence, we incorporated 8726 children for the study.

Variables

Early Childhood Development (ECD) is divided into "On Track" and "Delayed" categories. Children are assessed "On track" or "Delayed" based on their mothers'/caregivers' responses to ten questions[11]. These are subsequently grouped into four domains, which are listed as literacy- numeracy, physical, social-emotional, and learning. Finally, a child is regarded to be developmentally on track if he or she is on track in at least three of the four domains[11]. In this study, the major independent variable of interest is mothers' use of ICT equipment, denoting the use of computer, internet, and mobile by mothers. Each of these variables are categorized into "Yes" and "No" inquiring if she used that specific device or not. Besides, other covariates, which are considered in this study are explained in table 1.

Table 1. List of independent variables with their categories

Characteristics	Categories	Labels
ICT Related Characteristics		
Ever Used Computer	Yes/ No	If the mother used computer
Ever Used Internet	Yes/ No	If the mother used internet
Mobile Ownership	Yes/ No	If the mother used mobile phone
Exposure to Media	Exposed/ Not Exposed	Mother's exposure to radio, television or newspaper
Household Characteristics		
Area	Urban/ Rural	Area of residence of child
Division	Barisal/ Chattogram/ Dhaka/ Khulna/ Mymensingh/ Rajshahi/ Rangpur/ Sylhet	Division of residence of child
Migration Status	Non-Migrant/ Migrant	Migrant if the duration of current residence was less than 5 years
Mother's Characteristics		
Mother's Education	Pre-Primary or None/ Primary/ Secondary/ Higher Secondary	Mother's last level of education
Mother's Functional Difficultly	Yes/ No	If mother had functional difficulty or not
Mother's age at childbirth (In Years)	20 or less/ More than 20	Age of mother in years at the time of childbirth
Child's Characteristics		
Age of Child (In Years)	¾	Age of child in years

Table 1. Continued

Characteristics	Categories	Labels
Sex of Child	Male/ Female	Sex of child
Child attended Early Childhood Education Program	Yes/ No	If child attended early childhood education program or not
Birth Order	First/ Other	Birth order of the child
Punishment Given to Child	Yes/ No	Any disciplinary measures taken to address a behavior problem of child
Child Left Alone	Yes/ No	If child was left alone
Have Toys or Books	Yes/ No	If child had toys or books
Child's BMI	Underweight	Child's BMI < 18.5
	Normal	Child's BMI between 18.5 and 24.9
	Overweight	Child's BMI > 25
Spent Time with Parents	Yes/ No	If child drew things, played, went outside, sang song, told stories and read books by parents

Statistical Analysis

Bangladesh MICS 2019 Data is extracted in SPSS format. IBM SPSS Statistics (Version 20) is used for univariate and bivariate analysis while multivariate analysis is conducted using STATA-MP-64 and MS Word 2016 is used to write the report and visualization of data. Extracting data from Bangladesh MICS 2019, the profile of the mother and children's background traits is first reported. The merged dataset later is used to display the percentage distribution of ECD by a number of attributes. Since the variables are categorical, the association between ECD and the included independent variables is assessed using the chi-square test suggested by Karl Pearson[12,13].

The test statistic is,

$$\chi^2=\sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(n_{ij}-E_{ij})^2}{E_{ij}}\sim\chi^2_{(r-1)(c-1)} \text{ under } H_o$$

Binary logistic regression model is applied to ascertain the adjusted effect of covariates on dependent variable since the response variable is binary. We suppose that Y_{ij} denotes the binary response for j^{th} individual of i^{th} cluster where $Y_{ij} = 1$ denotes that the child has delayed development and $Y_{ij} = 0$ otherwise. Considering $P(Y_{ji} = 1|u_i) = \pi_{ij}$, the model can be written as

$$ln\left[\frac{\pi(x)}{1-\pi(x)}\right]=\beta_0+\beta_1x_{ij1}+\beta_2x_{ij2}+\ \dots\ +\beta_kx_{ijk}+u_i$$

where u_i is the random effect term having a normal distribution with mean 0 and variance σ^2.

III. Results

Univariate Analysis

To analyze the characteristics of the binary variables, frequency distribution table is employed. Table 2 illustrates that almost three-quarters of the children are developmentally on track.

Table 2. Percentage distribution of ECD by domains

Early Childhood Development Index	On Track (%)	Delayed (%)
Literacy-Numeracy	29.0	71.0
Socio-Emotional	71.7	28.3
Physical	98.7	1.3
Learning	90.6	9.4
ECD Score	**73.1**	**26.9**

A comparative study from Table 3 illustrates that mothers barely uses computer (2.2%) and internet (11.3%) but mobile phone is widely used (77.6%) among them. More than half (57.5%) of the mothers are exposed to other mass media. 81.5% data is based on rural area with a scant portion of respondents (18.5%) from urban. From the distribution of respondents from 8 divisions, highest is observed from Chattogram (21.0%) and that of lowest from Mymensingh

(5.8%) with a substantial quantity of migrants (80.8%). Visibly half of the mothers are educated up to the secondary level and only 13.6% completes higher secondary. Only a trace of mothers (1.7%) is noticed to face functional difficulty while majority of the mothers are older than 20 years at the childbirth. Among the children, half were 3 years old while other half were 4 years. Throughout the study, nearly equal number of male (51.6%) and female (48.4%) children have been analyzed with an alarming concern that only 18.8% children got the privilege of early childhood education. 36.5% of them were the first child and unfortunately majority of the children (96%) are subjected to punishment in various ways within the family. However, the practice of leaving child alone is less frequent (13%). Most of the children are provided with toys or books (97.5%) and can spend time with their parents (89.7%). It is also concerning that half of the children are underweight with 4.3% overweight cases with 44.9% normal weighted ones.

Table 3. Percentage distribution of selected variables in the study

Covariates	Frequency *(n)*	Percentage (%)
Ever used Computer		
Yes	188	2.2
No	8538	97.8
Ever used Internet		
Yes	985	11.3
No	7741	88.7
Mobile Ownership		
Yes	6772	77.6
No	1954	22.4
Exposure to Media		
Not exposed	3708	42.5
Exposed	5018	57.5
Area		
Urban	1615	18.5
Rural	7111	81.5
Division		
Barisal	776	8.9
Chattogram	1836	21.0
Dhaka	1646	18.9
Khulna	1258	14.4
Mymensingh	504	5.8
Rajshahi	978	11.2
Rangpur	987	11.3
Sylhet	741	8.5
Migration Status		
Non- Migrant	1672	19.2
Migrant	7054	80.8
Mother's Education		
Pre-primary or None	1027	11.8
Primary	2174	24.9
Secondary	4341	49.7
Higher secondary	1184	13.6
Mother's Functional Difficulty		
Yes	146	1.7
No	8580	98.3
Mother's Age at Childbirth (In Years)		
20 or Less	2302	26.4
More than 20	6424	73.6
Age of Child (In Years)		
3	4421	50.7
4	4305	49.3

Table 3. Continued

Covariates	Frequency *(n)*	Percentage (%)
Sex of Child (In Years)		
Male	4506	51.6
Female	4220	48.4
Child Attended Early Childhood Education Program		
Yes	1641	18.8
No	7085	81.2
Birth Order		
First	3184	36.5
Other	5542	63.5
Punishment Given to Child		
Yes	8379	96.0
No	347	4.0
Child Left Alone		
Yes	1133	13.0
No	7593	87.0
Have Toys or Books		
Yes	8504	97.5
No	222	2.5
Child's BMI		
Underweight	4429	50.8
Normal	3921	44.9
Overweight	376	4.3
Spent Time with Parents		
Yes	7825	89.7
No	901	10.3
Total	8726	

Bivariate Analysis

A variable is considered significant at 5% at a *p*-value less than 0.05 in Chi-square test. Fig. 1 reveals that the percentage of delayed ECD among children whose mothers are exposed to computers is fairly low (11.2%). Development of 84.2% children, of the mothers using internet is on pace and further it also emerged that only one-fourth (25.1%) of the children had delayed development among the mothers who own a mobile phone.

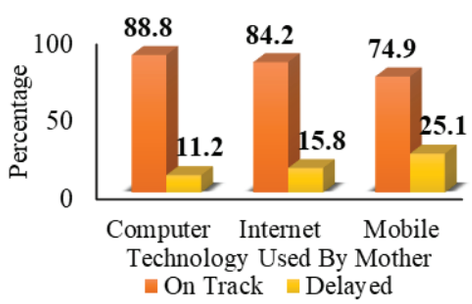

Fig. 1. ECD in children having mothers exposed to ICT

From Table 4, the outcome of bivariate analysis shows that the engagement of mothers with computer, internet, mobile and mass media holds a highly significant effect (*p*-value<0.001) on early childhood development (ECD). Division (*p*-value<0.001) and migration (*p*-value: 0.013) have a substantial impact as well. Moreover, among other covariates, strong significant relationship of ECD is found with mother's education, age and sex of child, participation of child in early childhood education, birth order, possessing toys or books, and having time with parents (*p*-value<0.001). Besides, child's body mass index (BMI) is also found significant (p-value: 0.045). Moreover, association of area of residence, mother's functional difficulty, mother's age at childbirth, punishment given to child, and child left alone with ECD is insignificant. Furthermore, involving the significant variables, a binary logistic regression model is incorporated to measure their adjusted effects, which is portrayed in the multivariate analysis section.

Table 4. Percentage distribution of ECD by different socio-demographic characteristics with *p*-values

Covariates	*n*	On Track (%)	Delayed (%)	*p*-value
Used Computer				
Yes	188	88.8	11.2	**<0.001**
No	8538	72.8	27.2	
Used Internet				
Yes	985	84.2	15.8	**<0.001**
No	7741	71.7	28.3	
Mobile Ownership				
Yes	6772	74.9	25.1	**<0.001**
No	1954	66.8	33.2	
Exposure to Media				
Exposed	5018	75.9	24.1	**<0.001**
Not Exposed	3708	69.4	30.6	
Area				
Urban	1615	74.6	25.4	0.130
Rural	7111	72.8	27.2	
Division				
Barisal	776	67.3	32.7	**<0.001**
Chattogram	1836	75.8	24.2	
Dhaka	1646	80.6	19.4	
Khulna	1258	68.6	31.4	
Mymensingh	504	61.7	38.3	
Rajshahi	978	70.0	30.0	
Rangpur	987	81.8	18.2	
Sylhet	741	63.7	36.3	
Migration Status				
Non-Migrant	1672	75.5	24.5	**0.013**
Migrant	7054	72.5	27.5	
Mother's Education				
Pre-primary or none	1027	68.0	32.0	**<0.001**
Primary	2174	68.4	31.6	
Secondary	4341	74.5	25.5	
Higher secondary	1184	80.9	19.1	
Mother's Functional Difficulty				
Yes	146	66.4	33.6	0.067
No	8580	73.2	26.8	
Mother's Age at Childbirth (In Years)				
20 or less	2302	74.5	25.5	0.088
More than 20	6424	72.6	27.4	
Age of Child (in years)				
3	4421	66.4	33.6	**<0.001**
4	4305	80.0	20.0	
Sex of Child				
Male	4506	70.2	29.8	**<0.001**
Female	4220	76.2	23.8	
Child Attended Early Childhood Education Program				
Yes	1641	84.7	15.3	**<0.001**
No	7085	70.4	29.6	
Birth Order				
First	3184	75.4	24.6	**<0.001**
Other	5542	71.8	28.2	
Punishment Given to Child				
Yes	8379	73.0	27.0	0.303
No	347	75.5	24.5	

Table 4. Continued

Covariates	*n*	On Track (%)	Delayed (%)	*p*-value
Child Left Alone				
Yes	1133	71.8	28.2	0.273
No	7593	73.3	26.7	
Have Toys or Books				
Yes	8504	73.4	26.6	**<0.001**
No	222	61.7	38.3	
Child's BMI				
Underweight	4429	74.3	25.7	0.045
Normal	3921	72.0	28.0	
Overweight	376	71.3	28.7	
Spent Time with Parents				
Yes	7825	73.8	26.2	**<0.001**
No	901	67.0	33.0	
Total	8726			

Multivariate Analysis

Odds ratios (ORs) are illustrated in Table 5 defining the adjusted effects along with their standard error (S.E.) and P-value from binary logistic regression model. It is evident that using communicating devices and mass media shows significant positive effect on ECD. The odds of delayed development of children is 69.7% more in case of mothers devoid using computer, almost 50% more when mothers avoid internet and 18.8% more when mothers do not have access to mobile phone. Similar scenario is observed where children of woman facilitated with mass media have 12.6% lower odds of delayed development than those who do not get such facilities.

It is noticeable that divisional variation of Barisal, Khulna, Mymensingh and Rajshahi are significant where only Mymensingh, has higher odds, leaving other division with lower odds of delayed development compared to Sylhet. Migration has been found to have an adverse effect on ECD since the odds of delayed development is 1.154 times more in migrants. Besides, the corresponding odds of delayed development shows a lower trend as the mother's education level goes higher showing 64.9% lower odds of delayed development in mothers completing higher secondary education. As anticipated, the 4 years old children have significantly 46.2% lower odds than that of 3 years and also female children are found to be more developed with 28.7% lower odds of delayed development than male. It is evident that early childhood education program plays significant role on ECD with a surprisingly 1.686 times higher odds of delayed development in children who are unable to receive this opportunity. Child's involvement with toys and books is also significant in ECD and not having such things increases the odds of delayed development to 44.1%. Child's BMI and spending time with parents are found to be insignificant in the model. Also, collinearity diagnostics were performed and the values of variance inflation factor (VIF) suggests there is no severe multicollinearity among the independent variables.

Table 5. Adjusted odds ratio (OR) of earily child development (ECD) obtained from logistic regression

Covariates	OR	S. E.	*p-value*
Constant	0.213	0.063	**<0.001**
Used Computer			
Yes	1	-	-
No	1.697	0.419	**0.032**
Used Internet			
Yes	1	-	-
No	1.497	0.148	**<0.001**
Mobile Ownership			
Yes	1	-	-
No	1.188	0.072	**0.005**
Exposed to Media			
Exposed	0.874	0.047	**0.012**
Not Exposed	1	-	-

Table 5. Continued

Covariates	OR	S. E.	*p-value*
Division			
Barisal	0.946	0.108	0.695
Chattogram	0.647	0.063	**<0.001**
Dhaka	0.498	0.051	**<0.001**
Khulna	0.964	0.099	0.721
Mymensingh	1.164	0.144	0.220
Rajshahi	0.882	0.097	0.252
Rangpur	0.420	0.049	**<0.001**
Sylhet	1	-	-
Migration Status			
Non-Migrant	1		
Migrant	1.154		**0.030**
Mother's Education			
Pre-Primary or None	1	-	-
Primary	0.978	0.083	0.797
Secondary	0.792	0.066	**0.005**
Higher Secondary	0.649	0.074	**<0.001**
Mother's Age at Childbirth (In Years)			
20 or less	1	-	
More than 20	1.023	0.074	0.752
Age of Child (In Years)			
3	1	-	-
4	0.538	0.029	**<0.001**
Sex of Child			
Male	1	-	**-**
Female	0.713	0.036	**<0.001**
Child Attended Early Childhood Education Program			
Yes	1	-	**-**
No	1.686	0.133	**<0.001**
Birth Order			
First	1	-	-
Other	1.046	0.071	0.511
Have Toys or Books			
Yes	1	-	-
No	1.441	0.214	**0.014**
Child's BMI			
Underweight	0.980	0.051	0.704
Normal	1	-	-
Overweight	1.044	0.131	0.730
Spent Time with Parents			
Yes	1	-	-
No	1.065	0.087	0.435

IV. Discussion

The study identified the association between mother's use of technological devices and the overall development of their children aged 3-4 years. Our study disclosed that, mother's use of computers, the internet, and owning mobile phones are significantly associated with their children's ECD. The study also revealed that covariates such as, mother's exposure to media, mother's education, division, age of child, sex of child, child attended early childhood education program, having toys or books also are important predictors of ECD.

On the basis of the findings of our study, using mobile phone, computer, and internet by mothers were positively associated with the children's ECD being on track. It is likely that, mothers, who utilize technology may have access to informations and opportunities for education that helps them improve their parenting quality[10]. For example, the possibility exists for technology to provide much-needed parenting information. Thus, mothers may educate themselves, practice mindfulness, and maintain relationships with their children[10]. Access to mobile phones enhances population wellbeing and expands women's chances for healthcare[14,15]. Thus, enhanced knowledge on parenting, better mental health of parents due to stress relief and improved parenting quality due to use of technology may encourage the ECD of children being on track.

Besides these main factors, the study found some confounders that were also responsible for ECD outcomes. A study confirms that, it is more likely that children will develop normally when their caregivers have access to media[16]. Access to the development programming of children at home may be made simpler for parents as they advertise many cautionary shows through media, which helps them enhance knowledge about ECD[17]. According to our study, compared to Sylhet division, all of the divisions were leading in terms of ECD, except Mymensingh. There is evidence in a literature that children living in metropolitan areas such as, Chittagong and Dhaka were developmentally on track, whereas children in remote areas were comparatively delayed[18]. This study finds that the migrant children have comparatively delayed development. Previously, it was discovered that maternal migration affects child development negatively[19]. An important risk factor for non-optimal migrant family functioning is the experience of economic and acculturation stress, which results in keeping both parents and kids at risk for physical and mental health issues[15]. Age is found to have a significant association with ECD in this study. A previous literature showed that 4-year-old children had higher levels of cognitive and socio-emotional development than 3-year-old[20] because when taking into account brain growth, white matter volume rises linearly with age and has an impact on learning and motor abilities[21,22], which ultimately affects ECD. Gender is also found to be a significant determinant of ECD. A study conducted in Canada examined that the ECD measures fundamental social or self-control related skills and females typically develop these abilities more quickly than boys do[23], which eventually affects their ECD. It was revealed from a Bangladeshi study that children, who participated in early childhood education programs, were substantially more on track with their development as it supports their mental and physical health[16]. In terms of mother's education, children of more educated mothers are found more developed. It was observed earlier that since a child is solely taken care by their mother during their early years, educated moms have superior communication and learning skills, which in turn, promotes better development[24], thus, it has an impact on ECD.

To the best of our knowledge, there has never been any research done on the issue that mother's using technological devices is responsible for their children's overall growth. We used a dataset from a national level survey to forecast the whole population of Bangladesh. Using the most recent MICS data, this is the first study involving Bangladeshi children to evaluate development using ECD index in association of mother's use of ICT devices. However, there are certain limitations too. There may be some recall bias in information related to mother and child characteristics. The information on ECD of children is available for 3-4 years only which may affect the overall estimates of ECD due to the narrow range of age groups. Moreover, the influence of mother's use of technological devices on early childhood development is conceptually complex in Bangladesh context, as it can be advantageous as well as detrimental. In a previous study, it has been demonstrated that parent-child interactions are disrupted by parental media use[25], with parents responding to their kids less quickly, more passively, and with less attention[26]. Furthermore, research from earlier cross-sectional studies has shown that parents' usage has a significant mediating role on the media habits of preschool-aged children[27, 28]. But we do not have available data on the mentioned factors to analyze the drawbacks.

Government, non-government, international organizations, and public health specialists working to enhance ECD, should consider the findings while planning interventions

regarding child's mental and physical growth. Those women, who do not use ICT, can be encouraged to use and informed about its inevitable benefits. But, mothers who cannot afford technological devices, can be educated in terms of ECD. Government can also help them with providing subsidies so that mothers can afford the access to technology.

V. Conclusion

The study demonstrated some factors related to mother and child that influence the early childhood development of their children aged 3-4 years. Our study reflects that ICT use of mothers could serve as a strong predictor of ECD progress. The research also identified early childhood education programs, mother's educational attainment and their exposure to mass media, age, and sex of child etc. as significant determinants of ECD. The policymakers can use our findings to meet target 4.2 of SDG, which is to ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education, by 2030. We believe that our findings will help public health initiatives in Bangladesh to improve their ECD programs.

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