Impact of Adolescent Motherhood, Poverty, and Childrearing on Developmental Outcomes in Early Childhood: Cross-sectional Analysis of Household Surveys from Latin America and the Caribbean

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Abstract

Background: Adolescent pregnancy poses significant challenges for their children's health and developmental outcomes. We sought to understand how adolescent motherhood and the combined effects of poverty and childrearing practices affect early childhood development (ECD) across Latin America and the Caribbean. We had three study aims: 1) confirm the association between adolescent motherhood and ECD; 2) determine if using violent discipline is more frequent among adolescent mothers than among older mothers; and 3) analyze the impact of mothers' beliefs about physically punishing children and partner violence on ECD, considering the mother's adolescent status.

Methods: We conducted a secondary analysis of MICS data from 15 countries with rounds 5 and 6 surveys.

Findings: In most countries, children of adolescent mothers have lower ECD scores than other children, and the association's significance varies when controlling for the child's age and sex, wealth quintile, and mother's education. We found a trend toward more negative discipline practices among adolescent mothers. Finally, a mother's beliefs in physically punishing children and justifying partner violence, more prevalent among adolescent mothers in most countries, are associated with lower ECD scores.

Interpretation: Our findings support the hypothesis that it is a combination of poverty and violent childrearing that accounts for ECD delay among children of adolescent mothers and that strategies aimed at delaying the age of motherhood need to address the socioeconomic context in which adolescent motherhood occurs.

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Keywords

Adolescent motherhood; early childhood development; poverty; childrearing practices; violent discipline; Latin America and the Caribbean.

Abstract in Spanish

Antecedentes: El embarazo adolescente plantea desafíos significativos para la salud y el desarrollo de sus hijos. Buscamos comprender cómo la maternidad adolescente y el efecto combinado de la pobreza y las prácticas de crianza afectan el desarrollo infantil temprano (DIT) en América Latina y el Caribe. Tuvimos tres objetivos de estudio: 1) confirmar la asociación

entre la maternidad adolescente y el DIT; 2) determinar si el uso de la disciplina violenta es más frecuente en las madres adolescentes que en las madres de mayor edad; y 3) analizar el impacto de las creencias de las madres sobre el castigo físico de los niños y la violencia de la pareja en el DIT, considerando el estado adolescente de la madre.

Métodos: Realizamos un análisis secundario de los datos de la encuesta MICS de 15 países con las rondas 5 y 6 de encuestas.

Resultados: En la mayoría de los países, los hijos e hijas de madres adolescentes tienen puntuaciones más bajas en el DIT que otros niños, y la importancia de la asociación varía cuando se controla la edad y el sexo del niño, el quintil de riqueza y la educación de la madre. Encontramos una tendencia hacia las prácticas disciplinarias más negativas en las madres adolescentes. Por último, las creencias de la madre en castigar físicamente a los hijos y justificar la violencia de la pareja, más prevalentes en las madres adolescentes en la mayoría de los países, se asocian con puntuaciones más bajas en el desarrollo infantil temprano.

Interpretación: Nuestros hallazgos respaldan la hipótesis de que es una combinación de pobreza y crianza violenta la que explica el retraso en el desarrollo infantil temprano en los hijos e hijas de madres adolescentes y que las estrategias dirigidas a retrasar la edad de la maternidad deben abordar el contexto socioeconómico en el que ocurre la maternidad adolescente.

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Research in context

Evidence before this study: We searched PubMed, EBSCOhost, EMBASE, and SciSpace online databases for “early childhood development” and “adolescent pregnancy.” We included publications in any language between 2015 and 2024 and screened 283 studies, plus 23 earlier studies cited in these publications; we excluded all other publications. We found four recent observational studies conducted in single countries that analyzed the associations between adolescent motherhood, poverty, and ECD.

Added value of this study: This is the first cross-national study to analyze the differential impact of socioeconomic and childrearing factors on early childhood development according to the adolescent status of the mother. We provide evidence that both poverty and childrearing practices impact the association between adolescent motherhood and early childhood development delay.

Implications of all the available evidence: The findings underscore the potential benefits of policies that improve educational and employment opportunities for adolescents and help delay the age of motherhood.

Introduction

In this paper, we analyze the impact of adolescent motherhood on early childhood development (ECD) by drawing from multi-country household survey data from Latin America and the Caribbean. Adolescent pregnancy is a complex phenomenon that became a topic of global health interest in 1994 during the International Conference on Population and Development [1]. The complexity of adolescent pregnancy results from intertwined socioeconomic and educational factors that constrain life opportunities for adolescents [2, 3] and have significant consequences for the health and developmental outcomes of their children. Several studies have found that children of adolescent mothers may be at greater risk than children of older mothers of a) poor infant health outcomes, including low birth weight and preterm birth [4-13], undernutrition [14-17], perinatal, neonatal, post-neonatal, and child mortality [18-21], and poor physical and mental health [22]; b) developmental delay [23-26]; c) limited nurturing care [27] and greater physical assault and psychological aggression from their mothers [28]; and d) lower language development, educational attainment, life satisfaction, and personal income [2, 29-32]. Other studies have shown that these challenges are not solely attributable to the mother's age; they are heavily marked by socioeconomic factors [32-35], limited educational opportunities [36], and greater exposure to gender-based violence [37], which can impact the mother's caregiving abilities [14, 38, 39].

Adolescent pregnancy presents a challenge in Latin America and the Caribbean. According to the United Nations World Population Prospects, it was the second region in the world in 2021 with its highest prevalence after Sub-Saharan Africa, both in terms of fertility rates (266 births per 1,000 women under the age of 20) and concentration of children born to mothers aged 15 to 19 (14·3% of children or 1·4 million), compared to 9·6% of children (12·8 million) worldwide [40]. There is a great diversity in the concentration of adolescent pregnancy within the region [41, 42], ranging from 23·9% in Venezuela to 2·3% in Guadeloupe [40].

In this study, we sought to understand how adolescent motherhood and the combined effects of poverty and childrearing practices affect early childhood development across diverse contexts in Latin American and Caribbean countries. We had three study aims: 1) confirm the association between adolescent motherhood and ECD; 2) determine if the use of violent discipline is more frequent among adolescent mothers than among older ones; and 3) analyze the impact of mothers' beliefs about the physical punishment of children and partner violence on ECD, considering the mother's adolescent status. The goal is to inform effective interventions and policy-making that can improve adolescents' well-being and alleviate the negative impacts of adolescent motherhood on child development, thereby helping to break the cycle of disadvantage across generations.

Methods

This is a cross-sectional study from a secondary analysis of the Multiple Indicator Cluster Surveys (MICS) [43] of fifteen Latin American and Caribbean countries with rounds 5 (MICS5) and 6 (MICS6) surveys. The study methodology followed the STROBE guidelines for cross-sectional studies [44]. MICS are international household surveys implemented by countries under the guidance of UNICEF designed to collect internationally comparable data on a wide

range of health, education, child protection, ECD, and other indicators primarily used to assess the situation of children, women, and their families. The MICS surveys have been conducted in multiple rounds since their inception in 1995. In Latin America and the Caribbean, MICS5 surveys were collected between 2013 and 2016, and MICS6 between 2018 and 2020; round 7 surveys are ongoing and still need to be completed.

We included the surveys from Argentina (MICS6 2019-20), Belize (MICS5 2015-16), Costa Rica (MICS6 2018), Cuba (MICS6 2019), Dominican Republic (MICS6 2019), El Salvador (MICS5 2014), Guyana (MICS6 2019-20), Honduras (MICS6 2019), Jamaica (MICS6 2022), Mexico (MICS5 2015), Panama (MICS5 2013), Paraguay (MICS5 2016), Suriname (MICS6 2018), Trinidad and Tobago (MICS6 2022), and Turks and Caicos (MICS6 2019-20). [43] These countries represent a diverse prevalence of children born to adolescent mothers and include countries with a lower prevalence than the regional average, such as Turks and Caicos (4·3%), Trinidad and Tobago (10·2%), Argentina (10·5%), Costa Rica (11·0%), Jamaica (11·2%), and Suriname (13·7%), and those above the average such as Guyana (14·7%), Paraguay (14·9%), Cuba (15·0%), Dominican Republic (15·3%), Belize (15·3%), Mexico (15·6%), El Salvador (15·7%), Panama (15·9%), and Honduras (17·4%), all in 2021 [40].

For each country, we first merged three datasets derived from three MICS questionnaires: the Household Questionnaire, the Questionnaire for Individual Women, and the Questionnaire for Children Under Five. We excluded children who did not have data on early childhood development or the mother's age at the time of birth. We then obtained descriptive statistics on early childhood development and disaggregated the data by mother's age (adolescent vs. adult mothers), child's sex at birth, age, family wealth quintile, and mother's educational level. Finally, we compared children whose mothers were under the age of 20 versus those aged 20 or older. The variables used are included in **Table 1**.

Table 1: MICS variables used in the analysis

Household Questionnaire	
Child's age	This variable is expressed in months. Missing data: 0%.
Child's sex	The scoring of this variable was 0 for females, 1 for males. Missing data: 0%.
Mother's age	This variable is extracted from the family members' age list. Although this variable is measured as a continuum, to compare adolescents vs. non-adolescents, we created two categories: under the age of 20 and aged 20 and above. Missing data: 0%.
Family socioeconomic position	This variable categorizes families into five wealth quintiles from 1 (poorest) to 5 (richest). Missing data: 0%.
Mother's education level	This variable assigns an ordinal value to maternal education: 1 = less than primary; 2 = primary; 3 = lower secondary; 4 = secondary; 5 = tertiary / higher / university. For ANCOVA, we used grades achieved from 0 to up to 12 (depending on the country) as a continuous variable. Missing data: 2·9%.
Questionnaire for Individual Women	
Mother's justification of partner violence	This module asks women if a husband is justified in hitting or beating his wife if she goes out without telling him in five circumstances: "[A] If she goes out without telling him?, [B] If she neglects the children?, [C] If she argues with him?, [D] If she refuses to have sex with him?, [E] If she burns the food?" Missing data: 1·0%.

Questionnaire for Children Under Five	
Early childhood development index	The Early Childhood Development Index (ECDI) was introduced in the fourth round of MICS (MICS4) and is collected in MICS5 and MICS6 . [45] It is formed by ten yes/no statements regarding the child's observed behaviors administered to the mother or primary caregiver. Observed behaviors obtained a score of 1 and not observed behaviors obtained a score of 0. The behaviors included: (a) literacy and numeracy statements (the child identifies at least ten letters of the alphabet; the child reads at least four simple, popular words; the child knows the name and recognizes the symbol of all numbers from 1-10); (b) physical development (the child picks up small objects with two fingers; the child is sometimes too sick to play); (c) social and emotional development (the child gets along well with other children; the child kicks, bites or hits other children or adults; the child gets distracted easily); (d) and approaches to learning (the child follows simple directions, the child does something independently). The answers for negative statements (the child is sometimes too sick to play; the child kicks, bites of hits other children or adults; and the child gets distracted easily) were reversed to keep the scoring valence consistent. The childhood development index was computed by averaging all childhood development scores for each answer. The index ranges from 0 to 1. Missing data were excluded from calculating the index. Missing data: 0%. The Early Childhood Development Index 2030 (ECDI2030) is an updated version with 20 questions that allows countries to measure SDG indicator 4.2.1, "Proportion of children aged 24-59 months who are developmentally on track in health, learning and psychosocial well-being, by sex" and monitor progress of SDG Target 4.2. [45] The ECDI2030 measures three domains: (a) health (gross motor development, fine motor development and self-care), (b) learning (expressive language, literacy, numeracy, pre-writing, and executive functioning), and (c) psychosocial well-being (emotional skills, social skills, internalizing behavior, and externalizing behavior). The questions are collected from the mother or primary caregiver and are used to generate one single indicator based on the number of children aged 24 to 59 months who have achieved the minimum number of milestones expected for their age group out of the total number of children aged 24 to 59 months. [45] The Jamaica MICS6 2022 was the only dataset in our sample that collected ECD data based on the ECDI2030. Missing data: 0%.
Child discipline module: The module consists of eleven statements regarding methods of child discipline and is an adapted version from the Parent-Child Conflict Tactics Scale [46]. The adult participant was asked to indicate whether they have used any of the discipline methods during the past month. For this study, we categorized the methods into two categories: positive discipline and negative discipline.	
Positive discipline	Averaging answers to the following statements computed this variable: took away privileges, explained why the behavior was wrong, and gave the child something else to do. The positive discipline variable scores ranged from 0 to 1. Missing data: 13·5%.
Negative discipline	Averaging answers to the following statements computed this variable: shook the child; shouted, yelled or screamed at the child; spanked, hit or slapped child on the bottom with bare hands; hit the child on the bottom or elsewhere with a belt, brush, stick, etc.; called child dumb, lazy or another name; hit or slapped the child on the face, head or ears; hit or slapped the child on the hand, arm or leg; and beat child up as hard as one could. The negative discipline variable ranged from 0 to 1. Missing data: 14·0%.
Beliefs about physical punishment	The childhood discipline module asks mothers if they consider physical punishment as an appropriate strategy to correctly discipline a child. The variable was coded as 0 if mother does not agree with physical punishment, 1 if mother agrees with physical punishment, and 8 if she doesn't know. Missing data: 38·6%.

This study used de-identified secondary data that are publicly available and cannot be re-identified. Therefore, it poses no violation of confidentiality. After registration in the MICS database, the authors obtained permission from UNICEF to download and use the database for research purposes. The MICS survey responds to local regulations and protocols regarding data

collection and fieldwork. The MICS protocol requires that the interviewer obtain appropriate informed consent from survey respondents and that all data be kept strictly confidential, including secure storage of records and databases with no identifiers.

For the first study aim, we employed an ANCOVA test by country to assess the impact of maternal adolescence on child development, controlling for the child's age and sex at birth. We then employed another ANCOVA, introducing family wealth quintile and maternal educational level as control variables, to investigate the relationship between these variables and adolescent status. For the second study aim, we used Student's t-tests to determine differences in positive and negative parenting practices between adolescent mothers and those aged 20 and above. For the third study aim, we analyzed frequency distributions among mothers under 20 and at least 20 regarding their perspectives on the physical punishment of children and justification of violence in relationships, using the Chi-Square test to identify differences based on the mother's age. Finally, we calculated average child development scores between mothers that justify or do not justify both behaviors, distinguishing between those under 20 and at least 20. We utilized Student's t-tests to explore potential relationships between child development levels and beliefs in physical punishment or justification of violence in relationships.

To guide our theoretical framework for data analysis and interpretation, we searched PubMed, EBSCOhost, EMBASE, and SciSpace online databases for "early childhood development" and "adolescent pregnancy." We included publications in any language between 2015 and 2024 and screened 283 studies, plus 23 earlier studies cited in these publications; we excluded all other publications.

Results

The combined sample size was n=26,004 children, of whom 20·2% had adolescent mothers. The distribution by country is shown in **Table 2**. We found that, although ECD mean scores vary between countries, children's sex, age, wealth quintile, and maternal education levels are associated with ECD scores across countries. Female children have higher ECD scores across countries—except among children born to mothers aged 20 and above in Panama—and, as expected, children aged 4 have higher ECD index scores than children aged 3 across countries. ECD index scores improve with higher wealth quintiles and maternal education levels, indicating a positive correlation between socioeconomic position, educational attainment, and early childhood development, and children born to mothers aged 20 or above tend to have higher ECD index scores across all countries compared to children born to adolescent mothers.

Table 2: Descriptive statistics of early childhood development index by country, child's sex at birth, child's age, mother's wealth quintile, and mother's educational level. Latin American and Caribbean MICS Household Surveys, 2013-2022

Country (sample size)	Mother's age (%)	ECD mean		Sex		Age		Wealth quintile					Educational level				
				M	F	3	4	1	2	3	4	5	1	2	3	4	5
Argentina n=2,352	<20 (16·2%)	6·88	%	55·5	44·5	47·9	52·1	39·3	22·0	21·7	12·6	4·5	0	15·8	-	73·1	10·8
			x̄	6·84	6·94	6·72	7·04	6·55	7·17	7·20	6·85	7·00	-	6·6	-	6·88	7·29

	≥20 (83·8%)	7·18	%	52·1	47·9	48·7	51·3	24·4	19·5	19·6	18·4	18·1	0·1	13·9	-	51·2	34·7
			x	7·08	7·28	6·86	7·48	6·82	7·03	7·22	7·34	7·61	7	6·82	-	7·10	7·43
Belize n=955	<20 (21·8%)	7·32	%	49·0	51·0	52·4	47·6	22·6	23·1	27·9	18·8	7·7	0	46·1	-	44·2	8·7
			x	7·24	7·41	6·87	7·82	7·11	7·10	7·33	7·36	8·50	-	6·96	-	7·64	7·61
	≥20 (78·2%)	7·24	%	51·4	48·6	48·1	51·9	24·5	20·9	19·0	19·4	16·2	1	49·0	-	29·7	19·4
			x	7·00	7·50	6·88	7·58	6·79	7·10	7·11	7·61	7·84	6·57	6·96	-	7·56	7·71
Costa Rica n=1,395	<20 (19·7%)	6·55	%	50·5	49·5	49·1	50·9	42·9	25·5	16·7	9·5	5·5	0	19·4	-	70·3	10·3
			x	6·30	6·80	6·46	6·64	6·22	6·71	6·48	7·00	7·80	-	6·47	-	6·48	7·18
	≥20 (80·3)	6·71	%	53·0	47·0	49·2	50·8	30·9	20·9	19·1	16·8	12·3	0·2	27·4	-	46·4	26·0
			x	6·58	6·86	6·62	6·80	6·27	6·63	6·91	6·97	7·31	6	6·34	-	6·74	7·13
Cuba n=2,087	<20 (13·6%)	6·89	%	51·1	48·9	54·6	45·4	29·6	24·3	19·4	16·2	10·6	0	1·0	-	76·4	21·8
			x	6·88	6·91	6·73	7·09	6·60	6·77	7·22	6·98	7·30	-	6·2	-	6·85	7·1
	≥20 (86·4%)	7·07	%	48·9	51·1	53·1	46·9	17·5	18·1	20·9	21·5	22·0	0	1·0	-	53·1	45·9
			x	7·01	7·12	6·89	7·27	6·63	6·89	7·19	7·20	7·34	-	7·17	-	6·99	7·16
Dominican Republic n=2,870	<20 (22·9%)	6·62	%	46·4	53·6	52·0	48·0	39·4	27·2	18·6	10·4	4·4	0	25·3	-	53·6	20·9
			x	6·47	6·76	6·40	6·87	6·27	6·68	6·84	7·26	7·07	-	5·97	-	6·72	7·24
	≥20 (77·1%)	6·88	%	49·5	50·5	47·0	53·0	26·9	21·3	19·9	16·7	15·2	0	22·1	-	36·9	40·7
			x	6·78	6·98	6·69	7·05	6·44	6·73	7·03	7·09	7·45	-	6·43	-	6·84	7·23
El Salvador n=2,700	<20 (23·8%)	6·27	%	47·4	52·6	46·7	53·3	26·8	24·5	20·2	17·3	11·2	0·5	36·0	34	26·5	3·0
			x	6·06	6·46	6·17	6·36	6·01	6·17	6·14	6·60	6·88	6·67	6·03	6·26	6·57	6·95
	≥20 (76·2%)	6·47	%	51·0	49·0	48·2	51·8	22·3	20·1	19·9	18·7	19·1	0,5	36·7	22	27·2	13·7
			x	6·41	6·53	6·25	6·68	6·00	6·13	6·44	6·76	7·12	5·89	6·15	6·50	6·67	7·26
Guyana n=960	<20 (23·4%)	7·37	%	51·6	48·4	50·7	49·3	45·8	19·6	16·9	12·4	45·8	0	5·9	27·7	60·9	4·5
			x	7·21	7·54	7·15	7·59	6·89	7·43	7·50	8·68	6·89	-	6·38	6·97	7·62	8·80
	≥20 (76·6%)	7·48	%	51·6	48·4	50·4	49·6	34·3	18·5	15·5	15·6	34·3	0	11·4	21·9	51·4	13·9
			x	7·32	7·66	7·17	7·80	6·82	7·47	7·74	8·09	6·82	-	6·83	7·29	7·59	8·21
Honduras n=3,134	<20 (22·6%)	5·86	%	49·3	50·7	51·2	48·8	33·2	24·0	21·8	13·3	33·2	0·1	76·1	-	21·1	2·6
			x	5·80	5·92	5·60	6·14	5·62	5·94	5·76	6·22	5·62	5	5·83	-	5·98	6·33
	≥20 (77·4%)	5·97	%	51·9	48·1	52·7	47·3	31·3	22·1	19·9	15·4	31·3	0	72·6	-	19·1	8·2
			x	5·90	6·03	5·76	6·20	5·65	5·84	5·97	6·27	5·65	-	5·81	-	6·29	6·79
Jamaica n=602	<20 (13·5%)	19·7*	%	56·8	43·2	46·6	53·4	34·6	30·9	18·5	11·1	4·9	0	1·2	12·3	66·7	18·5
			x	19·50	19·97	20·11	21·26	20·29	18·76	20·80	20·0	16·75		24·0	20·40	19·57	19·53
	≥20 (86·5%)	20·04*	%	49·1	50·9	47·2	52·8	22·5	24·6	18·2	19·8	15·0	0	0·8	11·6	54·1	-
			x	19·3	20·34	20·20	21·59	19·53	20·08	20·45	20·04	20·26		18·0	20·03	19·97	20·24
Mexico n=3,034	<20 (24·6%)	6·54	%	49·9	50·1	41·6	58·4	29·2	30·1	20·7	13·8	6·2	0	16·6	52·2	26·4	4·8
			x	6·36	6·72	6·19	6·80	6·29	6·52	6·68	6·78	6·91	-	6·24	6·42	6·88	7·08
	≥20 (75·4%)	6·57	%	51·6	48·4	45·0	55·0	29·0	24·3	19·7	17·2	9,9	0·1	24·4	38·4	24·4	12·7
			x	6·45	6·71	6·31	6·79	6·25	6·58	6·62	6·71	7,16	7	6·29	6·52	6·51	7·07
Panama n=1,985	<20 (22·9%)	6·15	%	57·7	42·3	51·2	48·8	55·5	22·2	15·6	4·6	55·5	0	38·7	-	52·2	9·1
			x	6·10	6·21	5·92	6·38	5·88	6·26	6·61	6·86	5·88	-	5·80	-	6·34	6·78
	≥20 (77·1%)	6·32	%	53·2	46·8	52·0	48·0	50·2	16·7	12·3	11·7	50·2	0	43·1	-	34·9	22·1
			x	6·35	6·27	6·11	6·54	5·81	6·42	6·77	7·12	5·81	-	5·94	-	6·54	7·15
Paraguay n=1,567	<20 (20·7%)	6·10	%	53·1	46·9	51·2	48·8	29·6	29·0	24·7	11·4	29·6	0	27·4	30·2	28·6	13·8
			x	6·08	6·13	5·97	6·24	5·91	6·10	5·99	6·57	5·91	-	5·76	6·22	6·13	6·61
	≥20 (79·3%)	6·54	%	51·8	48·2	47·1	52·9	24·4	19·4	16·9	21·3	24·4	0·2	34	13·6	21·9	30·3
			x	6·48	6·60	6·29	6·76	5·85	6·31	6·59	6·78	5·85	5·50	6·04	6·27	6·73	7·12
Suriname n=1,377	<20 (13.4%)	6.46	%	50·3	49·7	50·8	49·2	34·1	27·6	17·3	16·8	4·3	0·5	18·1	52·7	26·4	1·1
			x	6·14	6·79	6·22	6·71	5·63	6·41	7·28	7·16	7·38	4·00	5·55	6·65	6·88	7·50
	≥20	6.93	%	52·6	47·4	51·4	48·6	23·9	22·0	20·4	18·1	15·6	0·4	21·1	39·1	25·1	12·3

	(86.6%)		x̄	6·86	7·01	6·77	7·10	6·22	6·79	7·11	7·32	7·54	7·25	6·31	6·88	7·27	7·84
Trinidad and Tobago n=860	<20 (8·1%)	15·06	%	42·9	57·1	53·4	46·6	37·1	28·6	21·4	8·6	4·3	0	1·5	10·3	83·8	4·4
			x̄	14·40	15·55	15·29	16·26	14·92	15·00	15·07	15·00	16·67	-	17·0	15·14	14·93	16·0
	≥20 (91·9%)	15·44	%	46·7	53·3	43·3	56·7	23·8	20·8	21·0	17·7	16·7	0·1	5·3	4·5	63·2	26·9
			x̄	15·28	15·57	15·05	16·53	14·91	15·52	15·25	15·73	16·0	18·0	14·56	15·31	15·37	15·79
Turks and Caicos n=126	<20 (4·8%)	7·83	q	66·7	33·3	66·7	33·3	33·3	33·3	16·7	16·7	0	0	0	0	66·7	33·3
			x̄	7·5	8·5	7·5	8·5	8·5	6·5	9·0	8·0	-	-	-	-	8·50	6·50
	≥20 (95·2%)	7·87	%	51·7	48·3	43·7	56·3	13·3	15·8	2·0	26·7	24·2	0	0·8	0·8	35	63·3
			x̄	7·65	8·1	7·87	7·9	6·75	7·74	7·63	8·41	8·17	-	5·0	9·0	7·4	8·14

Notes: * The Jamaica MICS6 2022 collected ECD data based on the ECDI2030, which includes 20 items; all other countries used the ECDI, which includes 10 items. Missing data: the educational level had 756 (2·9%) missing data.

As shown in **Table 2** and confirmed in **Table 3** with means comparison, adolescent mothers were poorer and reached lower educational attainment than mothers aged 20 and above in most countries. The differences in wealth quintile are statistically significant across all countries (except Belize). In contrast, those in education levels are less consistent, with ten countries showing significant effect sizes and five countries not showing differences.

Table 3: Means comparison of wealth quintile and education by adolescent status when giving birth. Latin American MICS Household Surveys, 2013-2022

Country	Wealth quintile			Education		
	Mother <20 x̄ (SD)	Mother ≥20 x̄ (SD)	Effect Size (*r*)	Mother <20 x̄ (SD)	Mother ≥20 x̄ (SD)	Effect Size (*r*)
Argentina	2·21 (1·21)	2·86 (1·43)	·27***	2·80 (·84)	3·07 (·95)	·21***
Belize	2·66 (1·23)	2·82 (1·41)	-	2·18 (1·14)	2·20 (1·28)	-
Costa Rica	2·09 (1·21)	2·59 (1·39)	·20***	2·71 (·89)	2·71 (1·13)	-
Cuba	2·54 (1·34)	3·12 (1·40)	·23***	3·18 (·51)	3·44 (·54)	·24***
Dominican Republic	2·13 (1·17)	2·72 (1·41)	·23***	2·70 (1·07)	2·97 (1·14)	·17***
El Salvador	2·62 (1·34)	2·92 (1·43)	·12***	1·96 (·87)	2·17 (1·08)	·10***
Guyana	2·12 (1·26)	2·61 (1·48)	·18***	2·67 (·70)	2·72 (·89)	-
Honduras	2·38 (1·28)	2·53 (1·37)	·06*	1·50 (·91)	1·63 (1·05)	·05*
Mexico	2·38 (1·21)	2·54 (1·33)	·06**	2·19 (·76)	2·25 (·97)	-
Jamaica	2·21 (1·18)	2·80 (1·38)	·44***	3·04 (·60)	3·20 (·66)	·25*
Panama	1·75 (1·01)	2·13 (1·38)	·12***	2·34 (1·07)	2·42 (1·19)	·06*
Paraguay	2·34 (1·17)	2·89 (1·45)	·21***	2·29 (1·02)	2·48 (1·24)	·09*
Suriname	2.28 (1.22)	2.73 (1.43)	·18***	2.12 (.72)	2.43 (1.01)	·17***
Trinidad and Tobago	2·14 (1·15)	2·83 (1·41)	·49***	2·91 (·45)	3·11 (·72)	·29**
Turks and Caicos	2·17 (1·17)	3·32 (1·35)	·47*	3·33 (·52)	3·61 (·55)	-

Notes: **p<0·01 in Student's t-test *** p<0·001 in Student's t-test. Missing data: the educational level had 756 (2·9%) missing data.

Table 4 presents an ANCOVA examining the impact of adolescent maternal status on early childhood development in two models. The first model, which controls for the child's age and sex, shows that all models for each country are statistically significant at $p < ·001$, except Turks and Caicos, which is significant at $p < ·05$. The second model, which also includes wealth quintile and maternal educational level as control variables, also shows that all models are statistically significant at $p < ·001$, except Turks and Caicos, which was significant at $p < ·01$.

Table 4: Analysis of covariance examining the impact of adolescent status at the time of giving birth in early childhood development. In Model 1, controlling for the child's age and sex at birth. In Model 2, controlling

for the child's age and sex at birth, wealth quintile, and maternal educational level. Latin American and Caribbean MICS Household Surveys, 2013-2022

Country	ANCOVA	η^2 Children's Age (control variable)	η^2 Sex (control variable)	η^2 Wealth quintile (control variable)	η^2 Educational level (control variable)	η^2 Mother's adolescent status (independent variable)
Model 1						
Argentina	F(3,2351)=42·885***	·043***	·003**			·005**
Belize	F(3,954)=27·314***	·063***	·019***			-
Costa Rica	F(3,1394)=9·477***	·006**	·012***			-
Cuba	F(3,2086)=20·340***	·025***	-			·002*
Dominican Republic	F(3,2869)=32·920***	·023***	·006***			·005***
El Salvador	F(3,2699)=32·151***	·028***	·003**			·003**
Guyana	F(3,959)=16·954***	·041***	·011**			-
Honduras	F(3,3133)=43·945***	·038***	·002*			-
Jamaica	F(3,601)=81·456***	·28***	·015**			-
Mexico	F(3,3036)=61·384***	·048***	·01***			-
Panama	F(3,1984)=19·472***	·027***	-			·002*
Paraguay	F(3,1566)=24·515***	·030***	-			·013***
Suriname	F(3,1376)=14·080***	·018***	·004*			·009***
Trinidad and Tobago	F(3,859)=163·966***	·36***	·018***			-
Turks and Caicos	F(3,125)=1·500*	-	-			-
Model 2						
Argentina	F(5,2218)=44·549***	·052***	·003**	·033***	·002*	·002*
Belize	F(5,916)=23·894***	·059***	·017***	·040***	-	-
Costa Rica	F(5,1372)=22·266***	·008***	·011***	·055***	-	-
Cuba	F(5,2085)=28·921***	·026***	-	·031***	-	-
Dominican Republic	F(5,2771)=50·820***	·027***	·006***	·050***	-	-
El Salvador	F(5,2526)=67·404***	·033***	·005***	·018***	·019***	·002*
Guyana	F(5,940)=26·380***	·048***	·008**	·077***	-	-
Honduras	F(5,3002)=52·282***	·09***	·002*	·040***	-	-
Jamaica	F(5,599)=49·322***	·28***	·014**	-	-	-
Mexico	F(5,2969)=53·357***	·048***	·011***	·024***	-	-
Panama	F(5,1815)=53·569***	·032***	-	-·098***	-	-
Paraguay	F(5,1533)=46·148***	·030***	-	·089***	-	·004*
Suriname	F(5,1313)=30·692***	·019***	·004*	·070***	·006**	·004*
Trinidad and Tobago	F(5,858)=103·437***	·359***	·018***	.019***	-	-
Turks and Caicos	F(5,125)=3·876**	-	·045*	·10***	-	-

Notes: * p<0·05, **p <0·01, *** p<0·001. Missing data: the educational level had 756 (2·9%) missing data.

In Model 1, the child's age is a significant predictor of ECD across all countries, with effect sizes ranging from eta-squared $\eta^2 = \cdot006$ to $\eta^2 = \cdot36$, indicating that as age increases, ECD scores improve. The effect is the largest in Trinidad and Tobago, with $\eta^2 = 0{\cdot}36$ ($p < \cdot001$). The child's sex is associated with ECD, but where it is significant (in Argentina, Belize, Costa Rica, Dominican Republic, El Salvador, Guyana, Honduras, Jamaica, Mexico, Suriname, and Trinidad and Tobago), the effect sizes are very small ($\eta^2 = \cdot002$ to $\eta^2 = \cdot019$). The adolescent status of the mother shows a small but significant effect on ECD scores in Argentina, Cuba, the Dominican Republic, El Salvador, Panama, Paraguay, and Suriname. Paraguay shows the largest effect among these, with $\eta^2 = 0{\cdot}013$ ($p < \cdot001$). In the other eight countries, the adolescent status of the mother does not significantly impact ECD scores after controlling for the child's age and sex.

Model 2 shows that, when wealth quintile and maternal education are included, the significance of the child's age and sex remains consistent with Model 1. The children's age significantly affects ECD scores, with η^2 values indicating a small to moderate effect size across the countries. Sex at birth has a small significant effect in all countries except Cuba, Panama, and Paraguay. Wealth quintile consistently shows an effect on ECD in all 15 countries at $p < \cdot001$ except in

Jamaica, although in Panama it shows a negative effect size. Maternal educational level significantly impacts ECD in Argentina, El Salvador, and Suriname. The adolescent maternal status remains significant when controlling for wealth quintile and education in Argentina, El Salvador, Paraguay, and Suriname.

Table 5 compares the mean scores for positive and negative discipline practices by adolescent status when giving birth in various countries, with significance levels determined by Student's t-test. Mean scores for positive discipline show no significant difference between mothers under 20 and those 20 and above in ten countries. El Salvador, Panama, and Paraguay show a slight, yet significant, higher frequency of positive discipline among mothers aged 20 and above than among adolescent mothers, whereas the Dominican Republic and Jamaica show a higher mean score for positive discipline among mothers under 20 compared to mothers aged 20 or above, with a small but significant effect size (*Cohen's d = 0·12, p<0·001* in the Dominican Republic and *0·20, p<0·05* in Jamaica). Regarding the use of negative discipline, the differences between the two age groups are more striking. In ten countries, adolescent mothers use more negative discipline than those aged 20 and above, and the differences are significant in Argentina, Costa Rica, the Dominican Republic, Guyana, Honduras, Jamaica, and Trinidad and Tobago. Trinidad and Tobago, Jamaica, and the Dominican Republic show the largest significant difference in negative discipline, with *Cohen's d* effect sizes of 0·34 (*p<·01*), 0·21 (*p<·05*), and 0·20 (*p<·001*), respectively.

Table 5: Comparison of mean scores for positive and negative discipline by adolescent status when giving birth. Latin American MICS Household Surveys, 2013-2022

Country	Positive discipline			Negative discipline		
	Mother <20 $\bar{x}$(SD)	Mother ≥20 $\bar{x}$(SD)	Effect Size (Cohen's d)	Mother <20 $\bar{x}$(SD)	Mother ≥20 $\bar{x}$(SD)	Effect Size (Cohen's d)
Argentina	·59 (·36)	·58 (·37)	-	·17 (·19)	·14 (·17)	·17***
Belize	·53 (·34)	·54 (·36)	-	·19 (·19)	·18 (·19)	-
Costa Rica	·61 (·30)	·61 (·31)	-	·15 (·16)	·12 (·15)	·17***
Cuba	·35 (·34)	·37 (·34)	-	·09 (·13)	·09 (·14)	-
Dominican Republic	·47 (·35)	·43 (·35)	·12***	·20 (·19)	·16 (·17)	·20***
El Salvador	·44 (·31)	·46 (·32)	-·08*	·14 (·16)	·14 (·16)	-
Guyana	·51 (·36)	·52 (·36)	-	·24 (·21)	·22 (·20)	·12*
Honduras	·42 (·32)	·42 (·33)	-	·20 (·20)	·18 (·19)	·13***
Mexico	·57 (·32)	·56 (·32)	-	·17 (·18)	·17 (·18)	-
Jamaica	·58 (·37)	·51 (·37)	·20*	·23 (·17)	·20 (·16)	·21*
Panama	·43 (·36)	·46 (·38)	-·10*	·09 (·14)	·10 (·15)	-
Paraguay	·46 (·29)	·51 (·31)	-·17***	·13 (·15)	·14 (·16)	-
Suriname	.65 (.33)	.66 (.33)	-	.33 (.19)	.31 (.20)	-
Trinidad and Tobago	·73 (·29)	·73 (·31)	-	·28 (·18)	·22 (·18)	·34**
Turks and Caicos	·70 (·37)	·67 (·34)	-	·24 (·24)	·21 (·17)	-

Notes: * p<0·05, **p<0·01, and *** p<0·001 in Student's t-test. Missing data: positive discipline had 3,509 (13·5%) missing data and negative discipline had 3,632 (14·0%) missing data.

Table 6 analyzes the impact of mothers' beliefs about physical punishment and partner violence on ECD, considering the mother's adolescent status. In Costa Rica, Honduras, Suriname, and Turks and Caicos, more than one in five women of any age and those aged 20 and above in Turks and Caicos believe in the physical punishment of children. Adolescent mothers believe in

physically punishing their children more frequently than mothers aged 20 and above in twelve countries, although the differences are only significant in Argentina ($p<\cdot001$). Costa Rica, Suriname, and Trinidad and Tobago show the opposite association, with significant differences in Costa Rica and Trinidad and Tobago, both at the $p<\cdot05$ level. Among women of any age, justifying their partner's violence occurs less frequently than believing in physically punishing their child in most countries, except in Guyana, Mexico, and Panama, and among women aged 20 and above in Argentina and adolescent mothers in Jamaica. Adolescent mothers also justify their partner's violence more frequently than non-adolescent mothers in twelve countries, with statistically significant differences in El Salvador ($p<\cdot05$), Guyana ($p<\cdot001$), Jamaica ($p<\cdot05$), and Paraguay ($p<\cdot05$). In Argentina, the Dominican Republic, and Honduras show the opposite association, with no significant differences.

Table 6: Effect of mother's justification of physical punishment of children and partner violence on early childhood development by mother's adolescent status. Latin American MICS Household Surveys, 2013-2022

Country	ECD mean	Mother's age group (%)	ECD by age group (mean)	Mother believes in physical punishment of child (%)	Mother believes in physical punishment of child (T-test)	Mother does not believe in physical punishment of child (T-test)	Effect Size (Cohen's d)	Mother justifies partner's violence (%)	Mother justifies partner's violence (T-test)	Mother does not justify partner's violence (T-test)	Effect Size (Cohen's d)
Argentina n=2,220	7·13	<20 (14·8%)	6·88	4·7%***	6·33	6·92*	·41	3·4%	6·75	6·89	-
		≥20 (85·2%)	7·18	1·3%	7·20	7·28	-	3·8%	6·85	7·29*	·30
Belize n=955	7·26	<20 (21·8%)	7·32	13·5%	7·11	7·13	-	7·2%	7·00	7·14	-
		≥20 (78·2%)	7·24	11·2%	7·52	7·41	-	5·4%	7·19	7·45	-
Costa Rica n=1,395	6·68	<20 (19·7%)	6·55	21·1%	6·43	6·60	-	4·4%	7·08	6·54	-
		≥20 (80·3%)	6·71	27·8%*	6·64	6·74	-	4·2%	6·61	6·72	-
Cuba n=2,087	7·05	<20 (13·6%)	6·89	5·3%	6·87	6·93	-	3·2%	7·37	6·91	-
		≥20 (86·4%)	7·07	2·8%	6·64	7·12**	·37	2·1%	7·11	7·09	-
Dominican Republic n=2,870	6·82	<20 (22·9%)	6·62	8·7%	5·91	6·70***	·24	2·4%	6·47	6·62	-
		≥20 (77·1%)	6·88	4·5%	6·57	6·92*	·50	2·5%	6·78	6·89	-
El Salvador n=2,700	6·42	<20 (23·8%)	6·27	13·1%	6·24	6·31	-	9·5%*	5·93	6·33*	·28
		≥20 (76·2%)	6·47	10·3%	6·60	6·52	-	6·6%	6·25	6·55	-
Guyana n=960	7·46	<20 (23·4%)	7·37	13·8%	7·06	7·58	-	24·9%***	7·05	7·61*	·30
		≥20 (76·6%)	7·48	7·5%	7·45	7·51	-	14·4%	6·82	7·60**	·44
Honduras n=3,134	5·94	<20 (22·6%)	5·86	34·3%	5·71	5·99**	·21	5·5%	5·97	5·86	-
		≥20 (77·4%)	5·97	21·3%	5·90	6·09*	·13	6·5%	5·64	6·03*	·27
Jamaica n=602	20	<20 (13·5·%)	19·7	13·6%	20·36	19·45	-	18·5%*	19·93	19·65	-
		≥20 (86·5·%)	20·04	10·0%	19.88	20·12	-	9·2%	20·33	20·01	-

Mexico n=3,037	6·57	<20 (24·6%)	6·54	5·2%	5·90	6·74***	·58	7·2%	6·57	6·67	-
		≥20 (75·4%)	6·57	3·7%	6·58	6·60	-	5·5%	6·24	6·62*	·27
Panama n=1,985	6·28	<20 (22·9%)	6·15	4·0%	6·11	6·25	-	11·9%	5·80	6·28	-
		≥20 (77·1%)	6·32	3·5%	6·13	6·63*	·32	10·7%	5·53	6·66***	·75
Paraguay n=1,567	6·45	<20 (20·7%)	6·10	11·7%	5·84	6·34*	·35	9·3%*	6·12	6·25	-
		≥20 (79·3%)	6·54	8·5%	6·52	6·70	-	6%	6·16	6·70*	·36
Suriname n=1,377	6·87	<20 (13·4%)	6.46	22·0%	5.59	6.74***	.67	5.7%	6.90	6.44	-
		≥20 (86·6%)	6.93	23.8%	6.62	7.03**	.24	3.3%	6.49	6.95	-
Trinidad and Tobago n=860		<20 (8·1%)	15·06	7·7%	14·75	14·92	-	-	-	-	-
		≥20 (91·9%)	15·44	21·7%*	15·17	15·37	-	-	-	-	-
Turks and Caicos n=126	7·96	<20 (4·8%)	7·83	33·3%	7·00	8·25	-	16·7%	5	8·40**	6·21
		≥20 (95·2%)	7·87	27·5%	7·58	8·27*	·53	11·7%	7·91	7·98	-

Notes: In Chi-squared tests, * p<0·05, **p <0·01, *** p<0·001. Chi-squared yes/no mother believes in physical punishment of child: $X^2(1)=15·150$*** in Argentina and $X^2(1)=4·934$* in Costa Rica. The Trinidad and Tobago household survey does not include data on partner violence. Missing data: belief in physical punishment of child: 10,039 (38·6%) missing data; justification of partner violence: 271 missing data (1·0%, all from Mexico).

Adolescent mothers who do not believe in physically punishing children have children with higher ECD scores in all countries except in Jamaica. The differences are significant in Argentina (6·33 vs. 6·92, *p< ·05*), the Dominican Republic (5·91 vs. 6·70, *p< ·001*), Honduras (5·71 vs. 5·99, *p <·01*), Mexico (5·90 vs. 6·74, *p<·001*), Paraguay (5·84 vs 6·34, *p<·05*), and Suriname (5·59 vs. 6·74, *p<·001*). Among mothers aged 20 and above, there is a similar finding in Cuba (6·64 vs. 7·12, *p <·01*), the Dominican Republic (6·57 vs. 6·92, *p<·05*), Honduras (5·90 vs. 6·09, *p<·05*), Panama (6·13 vs. 6·63, *p<·05*), Suriname (6·62 vs. 7·03, *p<·01*), and Turks and Caicos (7·58 vs. 8·27, *p<·05*). The effect sizes were significant, ranging from modest to moderate. This effect is also observed significantly among children of mothers aged 20 and above in Cuba (6·64 vs. 7·12, *p< ·001*), the Dominican Republic (6·57 vs. 6·92, *p< ·005*), Honduras (5·90 vs. 6·09, *p< ·005*), Panama (6·13 vs. 6·63, *p< ·005*), Suriname (6·62 vs. 7·03, *p< ·001*), and Turks and Caicos (7·58 vs. 8·27, *p< ·005*).

Adolescent mothers who do not justify their partner's violence have children with significantly higher ECD scores in El Salvador (5·93 vs. 6·33, *p<·05*), Guyana (6·82 vs. 7·60, *p<0·001*), and Turks and Caicos (5·00 vs. 8·40, *p <·01*), all of them with a significant effect size (Cohen's d). Among mothers aged 20 and above, there is a similar finding in Argentina (6·75 vs. 6·89, *p<·05*), Guyana (6·82 vs. 7·60, *p <·01*), Honduras (5·64 vs. 6·03, *p<·05*), Mexico (6·24 vs. 6·62, *p<·05*), Panama (5·53 vs. 6·66, *p<·001*), and Paraguay (6·16 vs. 6·70, *p<·05*), all of them with a significant effect size (Cohen's d).

Discussion

In this paper, we have examined factors associated with early childhood development across 15

Latin American and Caribbean countries. In most countries, children of adolescent mothers have lower ECD scores than other children, but the significance of the association varies when controlling for the child's age and sex, wealth quintile, and mother's education. While the child's age consistently predicts ECD scores across countries, the association between the child's sex at birth and ECD was consistent across countries except in Panama. This finding is similar to those from a prior study in which females scored higher than males in Argentina and Belize and males higher than females in Guyana and Trinidad and Tobago [47]. More research is needed to find if sex differences in ECD could be explained by cultural factors that favor greater stimulation and discipline depending on the child's sex.

A central finding of our study is the association between the mother's adolescent status at the time of a child's birth, poverty, and lower ECD scores. The wealth quintile had a consistent and significant effect on ECD in all 15 countries, although it had a negative association in Panama that warrants additional investigation for potential data anomalies. The effect of maternal education showed significance in only three countries, which could be explained because the effect of poverty outweighs the effect of education, and that adolescents have fewer chances of attaining greater education levels given that they are younger. Still, the adolescent maternal status remains significant when controlling for wealth quintile and education in Argentina, El Salvador, Paraguay, and Suriname, indicating that, in the other eleven countries, wealth and education may mediate the relationship between maternal age and ECD. This finding is similar to those from other studies that have associated economic and educational disadvantages with adolescent pregnancy [2, 3, 23, 26].

Our findings are consistent with three observational studies published between 2015 and 2024 [23, 24, 26]. A birth cohort study of 99,530 children conducted in Australia with data from 2009 to 2012 found that, among children born to mothers aged 15 and younger, between 13% and 19% were delayed in the five developmental domains measured and 40% in at least one domain, which was greater than among children of older mothers; they were also more likely to belong to the poorest wealth quintiles, and, moreover, the risk of developmental delay was mostly explained by socioeconomic disadvantage [23]. A study conducted in Mexico with the 2015 MICS survey—included in our study—found that children of adolescent mothers had a lower prevalence of adequate development compared to children of older mothers (83.9% vs. 75.0%) and a 40% decrease in the likelihood of adequate ECD (OR=0.6, 95% CI [0.5-0.9]) compared to children of older mothers; they were also more likely to belong to the poorest wealth quintiles [26]. A cross-sectional study of 64 children aged 3 to 5 conducted in East Java between 2019 and 2021 found that children born to mothers under the age of 20 were more likely to experience an emotional developmental delay (76·6% vs. 4·7%, *p<·001)*; lower family income was significantly associated with this delay [24]. Although these findings may reflect that mothers aged 20 and older have more mature psychological development and are better able to provide more nurturing parenting, economic stability provided by a greater income may facilitate optimal child development among all children regardless of their mother's age.

However, a cross-sectional study conducted in Brazil in 2017-18 found no significant differences in ECD among children aged 0 to 2 born to mothers aged 13-19 compared to those born to mothers 20-24 [36]. This could be explained by two factors. One, the adolescent mothers in Brazil were compared to mothers aged 20-24, whereas, in our study, we compared them with

mothers aged 20 and above, therefore including more psychologically mature women. Two, the research in Brazil studied children under 2, whereas we studied children ages 3 and 4. A birth cohort study conducted with 8,400 children born in 2001 in the United States found that differences in ECD between children born to adolescent mothers compared to older mothers were not statistically significant by 9 months, began to emerge at 24 months, and were well established by 54 months [3]. These findings suggest that the impact of maternal age on ECD becomes measurable with screening tools as children grow older, although changes in the child's brain may occur at earlier stages.

We found that adolescent mothers, compared to women aged 20 and above, tended to use more negative discipline practices with their children and that, in most countries, they believed more frequently in physically punishing their child and justifying their partner's violence against them. Adolescent mothers use more negative discipline compared to older mothers in Argentina, Costa Rica, the Dominican Republic, Guyana, Honduras, Jamaica, and Trinidad and Tobago. Despite the significant differences in negative discipline, the overall effect sizes are modest, suggesting that while the mother's age is associated with disciplinary approaches, the differences are small. Our findings highlight the significant associations between maternal beliefs in violence and ECD, emphasizing the detrimental impact of physical punishment and partner violence justification on children's development, particularly among adolescent mothers. Several studies have shown that adolescent mothers have fewer skills than older women in self-regulating, coping with stress, being more patient, affectionate, and interactive with their children, providing stimulating opportunities, and understanding their children's needs—all of which may lead to less responsive, stimulating, and affectionate care [26, 48-50]. They may also experience greater psychological distress [51], anxiety, and depression, and their stress may be heightened in cultures where early marriage and pregnancy are not normative [48]. Whereas some scholars have argued that the poverty of adolescent mothers is the most important explanatory variable of ECD delay among their children [35], others have emphasized that parenting practices compounded with preexisting and ongoing social disadvantages help explain the association between adolescent motherhood and lower ECD outcomes among their children [3]. Our findings collected from fifteen countries support the hypothesis that it is a combination of poverty and violent childrearing that accounts for ECD delay among children of adolescent mothers.

The study's limitations include the cross-sectional nature of the MICS surveys, which precludes causal inferences, and the varying observed effect sizes. Therefore, it is not possible to determine the temporal sequence between pregnancy and ending schooling; it is possible that some adolescents had abandoned their education before becoming pregnant, as found in a study conducted in Paraguay and Peru [52]. Also, we cannot discern if becoming an adolescent mother has aggravated social disadvantage in addition to the initial disadvantage [3]. Another limitation is that cultural variations across countries, which are not captured in the MICS surveys, may impact the interpretation and reporting of child disciplinary practices and beliefs about violence, suggesting a need for culturally sensitive approaches in data collection and intervention design.

Our study's findings underscore that strategies aimed at delaying the age of motherhood need to address the socioeconomic context in which adolescent motherhood occurs—in addition to making available sexual education, reproductive health services, and contraceptive methods that are accessible to youth [53]. Consequently, policies that improve educational and employment

opportunities for adolescents, particularly those living in poverty, can mitigate some of the disadvantages they face—such as unfulfilled educational aspirations and unstable housing [48]—that predispose adolescents to start childrearing and, when they do, intensify their disadvantage [2]. For adolescents with children, providing resources and knowledge that promote nurturing parenting practices [25, 54] and non-violent family environments is instrumental, in addition to socioeconomic measures, for improving the well-being of both adolescents and their children and reducing existing inequity gaps in early childhood development outcomes.

Ethics committee approval

For this study, we used de-identified secondary household survey data that are publicly available and that cannot be reidentified. As such, it did not involve human subjects research and, therefore, did not require ethics committee approval.

Data sharing statement

The raw data are available at http://mics.unicef.org/surveys after registration at http://mics.unicef.org/ by entering a username and password and requesting access to conduct secondary data analysis of childhood development indicators of the Multiple Indicator Cluster Surveys. Any researcher can access these data in the same manner as the authors, who did not have any special access privileges that others would not have.

References

1. Decker, M.R., et al., *Early adolescent childbearing in low- and middle-income countries: associations with income inequity, human development and gender equality.* Health Policy Plan, 2017. **32**(2): p. 277-282.
2. SmithBattle, L., et al., *Untangling risky discourse with evidence: A scoping review of outcomes for teen mothers' offspring.* Children and Youth Services Review, 2024. **161**.
3. Mollborn, S. and J.A. Dennis, *Explaining the Early Development and Health of Teen Mothers' Children.* Sociol Forum (Randolph N J), 2012. **27**(4): p. 1010-1036.
4. Gibbs, C.M., et al., *The impact of early age at first childbirth on maternal and infant health.* Paediatr Perinat Epidemiol, 2012. **26 Suppl 1**(0 1): p. 259-84.
5. Ganchimeg, T., et al., *Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study.* Bjog, 2014. **121 Suppl 1**: p. 40-8.
6. Goldenberg, R.L., et al., *Research results from a registry supporting efforts to improve maternal and child health in low and middle income countries.* Reprod Health, 2015. **12**: p. 54.
7. Althabe, F., et al., *Adverse maternal and perinatal outcomes in adolescent pregnancies: The Global Network's Maternal Newborn Health Registry study.* Reprod Health, 2015. **12 Suppl 2**(Suppl 2): p. S8.
8. Trichal, M., *A Systematic Review of Risk Factors, Obstetric and Perinatal Outcomes in Teenage Pregnancy: Evidence Base for Policy Recommendations.* Tanzania Journal for Population studies and Development, 2023. **30**(1): p. 105-126.

9. Harrison, A., et al., *ECD - Pregnancy outcomes of a birth cohort. Are adolescent mothers really at more risk?* Psychol Health Med, 2024. **29**(6): p. 1142-1154.
10. Goossens, G., C. Kadji, and V. Delvenne, *Teenage pregnancy: a psychopathological risk for mothers and babies?* Psychiatr Danub, 2015. **27 Suppl 1**: p. S499-503.
11. Mendoza T., L.A., M. Arias G., and L.I. Mendoza T., *Hijo de madre adolescente: riesgos, morbilidad y mortalidad neonatal [Child of an adolescent mother: Risks, morbidity, and neonatal mortality].* Rev Child Obstet Ginecol, 2012. **77**(5): p. 375-382.
12. Lawlor, D.A., L. Mortensen, and A.M. Andersen, *Mechanisms underlying the associations of maternal age with adverse perinatal outcomes: a sibling study of 264 695 Danish women and their firstborn offspring.* Int J Epidemiol, 2011. **40**(5): p. 1205-14.
13. Fall, C.H., et al., *Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration).* Lancet Glob Health, 2015. **3**(7): p. e366-77.
14. Nguyen, P.H., et al., *Social, biological, and programmatic factors linking adolescent pregnancy and early childhood undernutrition: a path analysis of India's 2016 National Family and Health Survey.* Lancet Child Adolesc Health, 2019. **3**(7): p. 463-473.
15. Welch, C., et al., *Adolescent pregnancy is associated with child undernutrition: Systematic review and meta-analysis.* Matern Child Nutr, 2024. **20**(1): p. e13569.
16. Antiporta D, et al., *Adolescent pregnancy correlates on offspring nutritional status from childhood to early adolescence: Longitudinal evidence from Peru.* Paediatr Perinat Epidemiol, 2021. **35 Suppl 2**: p. 55.
17. Pangaribuan, I.K., et al., *Relationship between early marriage and teenager pregnancy to stunting in toddler at Bangun Rejo Village, Tanjung Morawa District, Tanjung Morawa, Deli Serdang 2019.* Enfermería Clínica, 2020. **30**: p. 88-91.
18. Venzor Strader, A., et al., *A biosocial analysis of perinatal and late neonatal mortality among Indigenous Maya Kaqchikel communities in Tecpan, Guatemala: a mixed-methods study.* BMJ Glob Health, 2024. **9**(4).
19. Adeyinka, D.A., et al., *Inequities in child survival in Nigerian communities during the Sustainable Development Goal era: insights from analysis of 2016/2017 Multiple Indicator Cluster Survey.* BMC Public Health, 2020. **20**(1): p. 1613.
20. Yussif, A.S., et al., *The long-term effects of adolescent pregnancies in a community in Northern Ghana on subsequent pregnancies and births of the young mothers.* Reprod Health, 2017. **14**(1): p. 178.
21. Jutte, D.P., et al., *The ripples of adolescent motherhood: social, educational, and medical outcomes for children of teen and prior teen mothers.* Acad Pediatr, 2010. **10**(5): p. 293-301.
22. Kumar, M. and K.Y. Huang, *Impact of being an adolescent mother on subsequent maternal health, parenting, and child development in Kenyan low-income and high adversity informal settlement context.* PLoS One, 2021. **16**(4): p. e0248836.
23. Falster, K., et al., *Maternal age and offspring developmental vulnerability at age five: A population-based cohort study of Australian children.* PLoS Med, 2018. **15**(4): p. e1002558.
24. Ariyani, R.A., et al., *The Relationship between Mother Pregnancy at a Young Age and the Emotional Development of Children Aged 3-5 Years.* Health and Technology Journal (HTechJ), 2023. **1**(2): p. 125-131.
25. Buccini, G., et al., *Nurturing care indicators for the Brazilian Early Childhood Friendly Municipal Index (IMAPI).* Matern Child Nutr, 2022. **18 Suppl 2**(Suppl 2): p. e13155.

26. Hubert, C., et al., *Diferenciales en desarrollo infantil temprano por edad de la madre, Encuesta Nacional de Niños, Niñas y Mujeres 2015 [Differentials in early childhood development by mother's age, National Survey of Girls, Boys and Women 2015].* Salud Publica Mex, 2021. **63**(4): p. 509-520.
27. Sumiati, T., Sabarinah, and A. Kusumayati, *Nurturing care among adolescent mothers.* J Public Health Afr, 2023. **14**(9): p. 2606.
28. Buzi, R.S., et al., *Pregnant Adolescents As Perpetrators and Victims of Intimate Partner Violence.* J Interpers Violence, 2020. **35**(13-14): p. 2492-2510.
29. Tang, S., et al., *Adolescent Pregnancy's Intergenerational Effects: Does an Adolescent Mother's Education Have Consequences for Her Children's Achievement?* Journal of Research on Adolescence, 2014. **26**(1): p. 180-193.
30. Lipman, E.L., K. Georgiades, and M.H. Boyle, *Young adult outcomes of children born to teen mothers: effects of being born during their teen or later years.* J Am Acad Child Adolesc Psychiatry, 2011. **50**(3): p. 232-241 e4.
31. Keown, L.J., L.J. Woodward, and J. Field, *Language development of pre-school children born to teenage mothers.* Infant and Child Development, 2001. **10**(3): p. 129-145.
32. Aizer, A., P. Devereux, and K. Salvanes, *Grandparents, Moms, or Dads? Why Children of Teen Mothers Do Worse in Life.* Journal of Human Resources, 2022. **57**(6): p. 2012-2047.
33. Martins, P.C., C.D. Matos, and A.I. Sani, *Parental stress and risk of child abuse: The role of socioeconomic status.* Children and Youth Services Review, 2023. **148**.
34. Sánchez-Vincitore, L.V. and A. Castro, *The role of sociodemographic and psychosocial variables in early childhood development: A secondary data analysis of the 2014 and 2019 Multiple Indicator Cluster Surveys in the Dominican Republic.* PLOS Glob Public Health, 2022. **2**(7): p. e0000465.
35. Geronimus, A.T., S. Korenman, and M.M. Hillemeier, *Does Young Maternal Age Adversely Affect Child Development? Evidence from Cousin Comparisons in the United States.* Population and Development Review, 1994. **20**(3): p. 585-609.
36. Kofke, L., et al., *Socio-demographic, maternal, and infant characteristics associated with early childhood development delays among children of young mothers in Brasilia, Brazil.* PLoS One, 2022. **17**(3): p. e0266018.
37. Coll, C.V.N., et al., *Cross-National Associations between Age at Marriage and Intimate Partner Violence among Young Women: An Analysis of Demographic and Health Surveys from 48 Countries.* Int J Environ Res Public Health, 2023. **20**(4).
38. Islam, M.M. and M.N. Khan, *Early childhood development and its association with maternal parity.* Child Care Health Dev, 2023. **49**(1): p. 80-89.
39. Telias, A., M. Narea, and A. Abufhele, *A mediation analysis to disentangle relations between maternal education and early child development.* International Journal of Behavioral Development, 2022. **46**(6): p. 568-575.
40. United Nations, *World Population Prospects 2022, Online Edition*. 2022, New York: UN Department of Economic and Social Affairs, Population Division.
41. Caffe, S., et al., *Looking back and moving forward: can we accelerate progress on adolescent pregnancy in the Americas?* Reprod Health, 2017. **14**(1): p. 83.
42. Sanhueza, A., et al., *Trends and inequities in adolescent childbearing in Latin American and Caribbean countries across generations and over time: a population-based study.* Lancet Child Adolesc Health, 2023. **7**(6): p. 392-404.

43. United Nations Children's Fund, *Multiple Indicator Cluster Surveys. Available at https://mics.unicef.org/surveys.*
44. von Elm, E., et al., *The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies.* J Clin Epidemiol, 2008. **61**(4): p. 344-9.
45. United Nations Children's Fund, *The Early Childhood Development Index 2030: A new measure of early childhood development*. 2023, New York: UNICEF.
46. Straus, M.A., et al., *Identification of child maltreatment with the Parent-Child Conflict Tactics Scales: development and psychometric data for a national sample of American parents.* Child Abuse Negl, 1998. **22**(4): p. 249-70.
47. Etchell, A., et al., *A systematic literature review of sex differences in childhood language and brain development.* Neuropsychologia, 2018. **114**: p. 19-31.
48. Wuermli, A.J., H. Yoshikawa, and P.D. Hastings, *A bioecocultural approach to supporting adolescent mothers and their young children in conflict-affected contexts.* Dev Psychopathol, 2021. **33**(2): p. 714-726.
49. Britto, P.R., et al., *Nurturing care: promoting early childhood development.* Lancet, 2017. **389**(10064): p. 91-102.
50. de Souza, K., et al., *Gravidez na adolescência e impactos no desenvolvimento infantil [Impact of adolescent pregnancy on child development].* Adolescência & Saúde, 2007. **4**(1): p. 11 pp.
51. Shaw, M., D.A. Lawlor, and J.M. Najman, *Teenage children of teenage mothers: psychological, behavioural and health outcomes from an Australian prospective longitudinal study.* Soc Sci Med, 2006. **62**(10): p. 2526-39.
52. Näslund-Hadley, E. and G. Binstock, *The Miseducation of Latin American Girls: Poor Schooling Makes Pregnancy a Rational Choice*. 2010, Washington, DC: Inter-American Development Bank.
53. Vignoli, J.R., *Fecundidad no deseada entre las adolescentes latinoamericanas: Un aumento que desafía la salud sexual y reproductiva y el ejercicio de derechos*. 2017, Santiago: Economic Commission for Latin America and the Caribbean.
54. Black, M.M., et al., *The principles of Nurturing Care promote human capital and mitigate adversities from preconception through adolescence.* BMJ Glob Health, 2021. **6**(4).