Abstract

Background

This study was to describe and quantify the relationships among family poverty, parents' caregiving practices, access to education and the development of children living in low- and middle-income countries (LAMIC).

Methods

We conducted a secondary analysis of data collected in UNICEF's Multiple Indicator Cluster Surveys (MICS). Early childhood development was assessed in four domains: language-cognitive, physical, socio-emotional, and approaches to learning. Countries were classified into three groups on the basis of the Human Development Index (HDI).

Results

Overall, data from 97,731 children aged 36 to 59 months from 35 LAMIC were included in the after analyses. The mean child development scale score was 4.93 out of a maximum score of 10 (95%CI 4.90 to 4.97) in low-HDI countries and 7.08 (95%CI 7.05 to 7.12) in high-HDI countries. Family poverty was associated with lower child development scores in all countries. The total indirect effect of family poverty on child development score via attending early childhood education, care for the child at home, and use of harsh punishments at home was -0.13 SD (77.8% of the total effect) in low-HDI countries, -0.09 SD (23.8% of the total effect) in medium-HDI countries, and -0.02 SD (6.9% of the total effect) in high-HDI countries.

Conclusions

Children in the most disadvantaged position in their societies and children living in low-HDI countries are at the greatest risk of failing to reach their developmental potential. Optimizing care for child development at home is essential to reduce the adverse effects of poverty on children's early development and subsequent life.

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Introduction

Early childhood development, which is generally conceptualized as comprising several domains, is a strong predictor of adult health and productivity (Grantham-McGregor *et al.* 2007, Victora *et al.* 2008, Black and Hurley 2014). The 2007 and 2011 Series on Child Development in The Lancet concluded that more than 200 million children under the age of five years fail to reach their development potential each year and most of them are living in resource-constrained settings (Grantham-McGregor *et al.* 2007). The Series postulated the links between poverty and inequalities in childhood development which are mediated via biological factors including intrauterine growth restriction, child undernutrition, micronutrient deficiencies, infectious diseases, and environmental exposures; and psychosocial factors including early childhood education, parenting practices and exposure to violence (Walker *et al.* 2011, Walker *et al.* 2007). However, there is as yet a lack of empirical evidence of the mechanisms of the effect of poverty on early childhood development within and between countries.

The Multiple Indicator Cluster Surveys (MICS) (United Nations Children's Fund (UNICEF) 2015) are household surveys initiated by the United Nations Children's Fund (UNICEF) and implemented in up to five rounds in 108 low- and middle-income countries. The MICS' primary goal is to monitor indicators of progress towards the Millennium Development Goals related to women's and children's health in these countries from the mid-1990s to 2015. Since the fourth round (in 2010-2012), an early childhood development indicator has been collected along with information about caregiving practices for young children and household

wealth. Together these provide unique data to examine the effects of family poverty on early childhood development in diverse settings.

The aim of this analysis is to assess the links among family poverty, caregiving practices and early childhood development using Multiple Indicator Cluster Survey Round Four data using the model proposed in the 2011 Lancet Series on Child Development that family poverty affects biological and psychosocial factors, which in turn influence inequalities in child development (Walker *et al.* 2011).

Methods

Study design and participants

In MICS Round Four (2010 – 2012), a large nationally representative sample of between 5,000 and 40,000 households was selected in each country using a multistage, cluster-sampling technique. Early childhood development data were collected for all children aged 36 to 59 months in the selected households. Only these children were included in this study.

Study measures

Child development as the main outcome measure was assessed by a 10- binary fixed choice item scale (Bornstein *et al.* 2012) encompassing four developmental domains including *language-cognitive* (Can (*name*) identify or name at least ten letters of the alphabet? Can (*name*) read at least four simple, popular words? Does (*name*) know the name and recognize the symbol of all numbers from 1 to 10?); *physical* (Can (*name*) pick up a small object with two fingers, like a stick or a rock from the ground? Is (*name*) sometimes too sick to play?);

socio-emotional (Does (*name*) get along well with other children? Does (*name*) kick, bite, or hit other children or adults? Does (*name*) get distracted easily?); and *approaches to learning* (Does (*name*) follow simple directions on how to do something correctly? When given something to do, is (*name*) able to do it independently?). These questions were derived from a broad set of indicators of child development developed by UNICEF in 2007 and pilot-tested in Jordan, the Philippines and Kenya (United Nations Children's Fund (UNICEF) 2011). Each item is scored 1 if the child can achieve the task and 0 if they are not able to. This yields a total score ranging from 0 (the least optimal) to 10 (the most optimal) development.

Household economic status, our main exposure of interest, was assessed using questions about household characteristics including the main materials of the dwelling's floor, roof, and exterior walls; main type(s) of fuel used for cooking; source of drinking water; type of sanitation facility; and 12 durable household assets. An index of household wealth was constructed on the basis of these items using the World Bank's techniques for measuring living standards using household survey data (O'Donnell *et al.* 2008).

Psychosocial factors including caregiving practices and early childhood education consisted of information about (1) Whether the child was attending an organized early childhood education programme; (2) Whether in the past three days, the mother or the father had engaged in any of six early learning activities with the child including reading books; telling stories; singing; naming, counting, and drawing; taking the child outside or playing with the child; (3) The number of children's books in the household; (4) Whether there were toys bought from stores or manufactured available in the household; (5) Harsh punishments were

assessed for a randomly-selected child aged 2 to 14 years in the household. Five questions adapted from the Parent-Child Conflict Tactics Scale (Straus *et al.* 1998) were asked in relation to the selected child in the past month. Types of punishments include spanking, hitting, or slapping on the bottom with a bare hand; hitting on the bottom or elsewhere on the body with a hard object; hitting or slapping on the face, head or ears; hitting or slapping on the hand, arm, or leg; and beating the child up. Along with engaging in learning activities, making books and other learning material available for the child and avoiding harsh disciplinary are the main responsibilities of the caregiver (Bornstein *et al.* 2012).

Demographic characteristics of each household member were collected using structured questions. Among these, child sex and age, living in a rural or an urban area, the number of children aged under five years in the household, maternal and paternal education levels, and whether or not the mother and / or father were living at home were used in this study.

A nation's Human Development Index (HDI) is a proxy indicator developed by the United Nations Development Program (UNDP) (UNDP 2015). Each country's HDI was obtained from the UNDP's Human Development Reports 2011 (United Nations Development Programme (UNDP) 2011). The HDI ranges from 0 (the lowest) to 1 (the highest) and is classified into very high (>0.790), high (>0.698 to 0.790), medium (>0.510 to 0.698), and low categories (0.510 or less).

MICS procedures

The MICS data collection protocols are described in detail elsewhere (United Nations Children's Fund (UNICEF) 2011, Tran *et al.* 2016). In short, all MICS data used in this study

were collected through face-to-face structured interviews conducted during home visits by national data collection teams. Data about a child and caregiving practices were normally obtained from the mother or primary caregiver of the child.

Statistical analysis

The estimations of means and percentages were calculated using Stata's survey commands in STATA Version 12 (Stata Corp 2011) taking into account cluster effects and sampling weights.

The hypothesized model of household wealth, caregiving practices, and child development (Figure 1) were tested simultaneously using structural equation modelling in Mplus Version 7.3 (Muthén & Muthén 2013). In the structural equation model, the composite index of care for the child at home is generated from the number of early learning activities engaged in by the mother and the father, having 3+ children books at home, having learning materials bought from shops. The effect of family poverty on early childhood development via unmeasured factors such as biological factors were treated as the direct pathway from family poverty to the child outcome in that model. Covariates were added into that model including child sex and age, living in a rural or an urban area, the number of children aged under five years in the household, maternal and paternal education levels, and whether or not the mother and / or father were living at home.

Structural equation modelling using multiple group analysis with subgroups of HDI (low-HDI, medium-HDI, and high-HDI countries) was conducted to construct the same structural equation model for each HDI group. The model coefficients are interpreted as linear

regression coefficients for the paths to continuous outcomes. Model coefficients of the paths to binary outcomes are odds ratios which were derived from original probit regression coefficients for more straightforward interpretation. Please see Supplementary File 1 for further information about the structural equation modelling.

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Results

Sample

Data on child development were collected in 44 countries at MICS Round Four, but for 9 countries data were not available for public use by 1st April 2016. Overall, 97,731 children aged 36 to 59 months from 35 countries in low, medium, and high-HDI groups were included in this study (Table 1). Of these, the mean age was 47.1 months (standard deviation, SD, 6.8 months) and 49.2% were girls.

Child development

Mean child development scores in the 35 countries are presented in Figure 2. The mean child development scale score was 4.93 out of a maximum score of 10 (95% CI 4.90 to 4.97; SD 1.86) in the 12 low-HDI countries, 5.97 (95% CI 5.94 to 6.02, SD 1.75) in 10 medium-HDI countries, and 7.08 (95% CI 7.05 to 7.12, SD 1.56) in 13 high-HDI countries. The median of the gaps between mean scores of child development in the richest quintile and that of children in the poorest quintile was 1.03 scores in the low-HDI countries, 1.08 in the medium-HDI countries, and 0.86 in the high-HDI countries.

Care for children

Overall, the proportions of children attending early childhood education programs in the past 7 days varied widely between and within HDI groups (Figure 3 and Table 2). Less than 20% of children attended in 8/12 low-HDI countries, 2/10 medium-HDI countries, and 2/13 high-HDI countries. The highest attendance among low-HDI countries was 46.1% in Kenya,

among medium-HDI countries was 72.0% in Vietnam, and among high-HDI countries was 92.4% in Jamaica. There were large gaps between proportions attending from the highest and the lowest household wealth groups within all countries, including 74.5% in Nigeria (low-HDI country), 67.5% in Laos (medium-HDI country), and 68.9% in Tunisia (high-HDI country).

The mean numbers of early learning activities participated in by the mother and the father in the past three days by country are presented in Figures 4 and 5. Overall, mothers engaged in more activities than fathers in every country, except in Pakistan where there was no difference between mothers and fathers. Mothers and fathers participated in the fewest activities in Madagascar and in the largest number in Bosnia and Herzegovina. The differences between low-HDI and high-HDI countries were considerable for both mothers and fathers (Table 2). The mean numbers of activities engaged in by parents was larger in the highest than the lowest household wealth groups in almost all countries. The exception was Sierra Leone.

There were major disparities in the proportions of households having at least 3 children's book across HDI groups (Table 2) and between the highest and the lowest wealth groups in most countries (Figure 6). The range was from less than 2% of households in Chad, DR Congo, Madagascar, CAR, and Somalia, to more than 97% in Barbados, Ukraine, and Belarus. The differences in this factor between the highest and the lowest household wealth groups were more than 70% in Vietnam, Suriname, and Costa Rica.

The proportions of children having toys from a shop was clearly different between the low-HDI and high-HDI countries (Table 2). This varied from less than 20% in Somalia, Madagascar, DG Congo, and Chad, to more than 90% in 12/13 high-HDI countries (Figure 7). The gaps between the highest and the lowest household wealth groups are very large in low-HDI and some medium-HDI countries.

Harsh punishment of children at home was widespread in many countries in all three HDI groups. The prevalence of households in which a caregiver acknowledged that corporal punishment of a child had been used in the past month ranged from 31.6% in Mongolia to more than 80% in Kenya, CAR, and DR Congo in the low-HDI group, Palestine in the medium-HDI, and Tunisia in the high-HDI (Figure 8). Overall however, it was a more common practice in low- and medium-HDI countries than in high-HDI countries (Table 2). The prevalence among the least wealthy households was higher than among the wealthiest in most countries, but was similar in some (Kenya, CAR, Mongolia, and Ukraine) or in the opposite direction in others (Mauritania, Palestine, and Laos).

Structural Equation Model

The final structural equation model includes three linear regression models predicting (1) Child development scale score, (2) number of early learning activities engaged in by the mother, and (3) number of early learning activities engaged in by the father; three probit models predicting (1) attending early childhood education program, (2) having 3+ children books at home, and (3) having toys bought from shops or manufactured; and a confirmatory factor analysis generating the 'care for child development at home' index. The total effect

size, direct effect, and indirect effect of household poverty on child development were calculated in the structural equation model. In total, 16 variables were included in the structural equation model. The main paths of this model are presented in Table 3 (Please see the full details in Supplementary Table 1). All of the fit indices are within the range indicating that the model fits the data well.

The composite index of care for the child at home was positively associated with child development scores in all three HDI groups. An increase in the care for child at home index of one standard deviation (SD) was associated with an increase in the child development score of 0.41 SD (95% CI 0.27 to 0.55) in low-HDI countries, 0.37 SD (95% CI 0.25 to 0.49) in medium-HDI, and 0.49 SD (95% CI 0.35 to 0.63) in high-HDI (Table 3). Attending early childhood education was associated with higher child development scores in low and medium-HDI countries, but not in high-HDI countries. In low-HDI countries, children living in households where harsh punishments had been used in the past month had a lower mean score of child development than children living in households where this was not practiced.

The structural equation model shows that family poverty (being in the lowest household wealth quintile) was associated with lower child development scores in all countries. The total effect (including direct and indirect effects) of poverty on child development was -0.18 SD (95% CI -0.27 to -0.08) in low-HDI countries, -0.26 SD (95% CI -0.30 to -0.21) in medium-HDI countries, and -0.29 SD (95% CI -0.37 to -0.21) in high-HDI countries. The total indirect effect of family poverty on child development score via attending early childhood education, care for the child at home, and use of harsh punishments at home was -

0.13 SD (77.8% of the total effect) in low-HDI countries, -0.09 SD (23.8% of the total effect) in medium-HDI countries, and -0.02 SD (6.9% of the total effect) in high-HDI countries.

Discussion

This study used data describing 97,731 children from 35 large nationally representative samples and provides for the first time precise estimates of the associations among poverty, parental caregiving, and early childhood development. The 35 countries are geographically diverse and distributed along the Human Development Index spectrum and thus permit comparisons between groups of countries of varying HDI. Every aspect of the MICS4 survey including survey design and procedure was standardised, and implemented with technical support and supervision from UNICEF. We are confident that the findings of this study are robust and generalizable to countries with low and high HDI.

This study partially demonstrated the model proposed in the 2011 Lancet Series on Child Development (Walker *et al.* 2011) in which it was postulated that family poverty affects early childhood development via biological and psychosocial mediators. This study included as psychosocial mediators participation in early childhood education programs, engagement of parents in child development activities, availability of children's books and learning materials at home, and whether or not harsh punishments of a child aged 2 – 14 years were used in the household. The potential mediating effects of biological factors were treated as a direct pathway in the model. Bivariate analyses revealed a consistent gradient between household wealth quintiles and early childhood development in all countries, regardless of HDI. Multivariable analyses confirmed the significant total effect of family poverty on early

childhood development in all three HDI groups (Engle and Black 2008, Wehby and McCarthy 2013, Blair and Raver 2012, Bergen 2008, Tran *et al.* 2013). The indirect effect via the psychosocial factors of participation in early childhood education, care for the child at home, and whether or not harsh punishments of children were used in the household was highest in low-HDI countries (77.8% of the total effect, compared with 23.8% in medium-HDI countries and 6.9% in high-HDI countries). This indicates that caregiving practices explain a large proportion of the disparity in early development between children from the least -resourced families and the rest in lower HDI countries. There are smaller disparities within higher HDI countries, and suggest that overall quality of caregiving is more consistent and that they are attributable to other factors not measured in this study.

The data provide strong evidence that psychosocial factors including quality of care for children at home and attending early childhood education are important determinants of early childhood development. Care for child development at home is highly positively associated with early childhood development scores in every country with an effect size of 0.41 in low-HDI, 0.37 in medium-HDI, and 0.49 in high-HDI countries. Attending early childhood education programs is related to higher early childhood development scores in low-HDI countries (0.32 SD) and medium-HDI countries (0.23), but not in high-HDI countries.

A strong relationship between HDI, a country-level proxy indicator of human development, and early childhood development was revealed. The mean child development scale score among 3 to 4 year-old children in low-HDI countries was 1.37 SD lower than that in high-HDI countries. This is the first study to date to demonstrate the disparity in an early childhood development index among countries by HDI. The inequality found in this study

confirms the association between less optimal care for child development in lower HDI countries and child development outcomes that has been shown in previous studies (Houweling and Kunst 2010, Lansford and Deater-Deckard 2012, Bornstein and Putnick 2012, Tran *et al.* 2014). All aspects of caregiving, including engagement of parents in child development activities, availability of children's books and learning materials at home, use of harsh punishments and access to pre-school education program were substantially worse in lower HDI countries.

The findings of this study have implications for governments, international agencies, non-government organisations and public health professionals who are working to improve early childhood development. Children in the poorest group in every country and children in low-HDI countries in general are the most in need of assistance to reach their full development potential. Interventions which address multiple risks factors have a superior effect on child outcomes (Engle *et al.* 2011). However, these programs usually require more human and material resources and effective management skills that are not always available in socioeconomically disadvantaged settings. A compact integrated, well implemented intervention program addressing the key modifiable factors might be more effective and may be more cost-effective. Poverty alleviation is an essential strategy, but is generally slow and incremental and therefore unlikely to lead on its own to sufficient change in a short period of time. These data indicate that even in the context of poverty the quality of care provided to a young child at home including the engagement of the mother and father in play and learning activities with their children, the availability of children's book and learning materials, substitution of harsh punishments with positive behaviour management strategies and

attending pre-school education programs can have a large effect on early childhood development. National advancement relies on a population that has achieved developmental capacity, interventions, especially in low- and medium HDI countries, which target these factors directly are likely to benefit individuals, families, communities and whole societies.

We acknowledge that early childhood development was one of many indicators collected in a large scale survey. It was not possible to use a diagnostic assessment of child development in MICS4. However, the study-specific child development assessment tool in MICS4 was developed and tested by a technical group of UNICEF through a standardized procedure to include all main domains of early childhood development and shown to be appropriate for use in all settings. Another limitation of this study is that there were no biological factors directly included in the analyses. Future longitudinal studies examining the effects of comprehensive social and biological factors on child development are warranted.

In summary, poverty, within and between countries, is associated significantly with marked inequalities in early childhood development. Care for child development at home including the engagement of the mother and father in specific activities to provide cognitive stimulation and sensitive, responsive care, access to children's books and learning materials and avoidance of harsh and humiliating punishments is crucial for child development in every setting. Pre-school education programs play an important role for early childhood development in low- and medium HDI countries. Optimizing care for child development at home and providing pre-school education programs can reduce the adverse effects of poverty and improve children's early development and subsequent life trajectories.

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Conflict of Interest: We declare no competing interests.

Key messages

- Children in the most disadvantaged group of their societies and children living in low-HDI countries are at the greatest risk of failing to reach their developmental potential.
- Family poverty undermines early childhood development in all countries.
- Large proportions of the effect of family poverty on early childhood development are mediated by less engagement by parents in early learning activities for the child and use of harsh punishments at home, and lack of early childhood education in low- and medium HDI countries, but not in high-HDI countries.
- Optimising care for child development at home and providing pre-school education programs have appreciable positive effects on children's early development that can overcome the adverse effects of family poverty.
- Improving parenting and pre-school education programs can help children living in disadvantage settings to reach their potential in development.

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Table 1 Numbers of participants, child age (mean, SD), and child sex (% girls) by countries

Country	Number of children	Age (months) Mean (SD)	Girls (%)
Low-HDI			
CAR	3,747	46.1 (6.6)	52.0
Chad	7,029	48.0 (7.0)	50.3
DR Congo	4,045	46.2 (6.9)	50.0
Kenya	2,313	46.9 (6.8)	48.6
Madagascar	1,218	46.4 (6.6)	49.5
Mauritania	3,700	47.1 (6.8)	48.7
Nepal	1,550	46.7 (6.7)	48.5
Nigeria	10,204	47.4 (7.0)	48.9
Pakistan	4,909	47.4 (7.0)	45.2
Sierra Leone	3,673	46.7 (6.7)	49.9
Somalia	3,994	45.6 (6.7)	49.5
Togo	1,807	46.6 (6.9)	48.8
Sub-total	48,189	47.0 (6.9)	49.2
Medium-HDI			
Bhutan	2,423	46.7 (6.7)	48.9
Ghana	3,075	47.0 (6.9)	49.3
Iraq	13,964	46.9 (6.9)	49.3
Lao	4,482	47.2 (6.8)	48.4
Moldova	732	47.4 (7.0)	46.6
Mongolia	1,322	47.3 (6.9)	50.6
Palestine	3,993	49.3 (6.1)	49.0
Suriname	1,278	47.2 (6.8)	51.3
Swaziland	1,076	47.3 (6.6)	51.4
Vietnam	1,462	46.9 (6.9)	49.7
Sub-total	33,807	47.3 (6.8)	49.3
High-HDI			
Argentina	3,612	47.3 (6.9)	48.3
Barbados	202	48.8 (6.7)	44.6
Belarus	1,411	47.7 (7.1)	50.6
Belize	785	48.1 (6.9)	50.7
Bosnia Herzegovina	1,033	46.9 (6.8)	51.6
Costa Rica	915	47.0 (6.9)	52.1
Jamaica	668	47.7 (6.6)	47.3
Kazakhstan	1,961	47.1 (6.9)	47.8
Macedonia	557	48.1 (6.9)	49.9
Serbia	1,406	47.6 (7.1)	50.2

StLucia	122	47.7 (6.8)	50.8
Tunisia	1,164	46.8 (6.8)	45.9
Ukraine	1,899	47.5 (6.9)	49.4
Sub-total	15,735	47.4 (6.9)	49.1

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Table 2 – Care for children in the 35 countries by HDI group

	Low-HDI	Medium-HDI	High-HDI
Attending early childhood education programs, % (95% CI)	17.8 (16.9 to 18.7)	22.9 (21.9 to 24.0)	50.7 (49.2 to 52.2)
Early learning activities engaged in by the mother in the past three days, mean (95% CI)	1.74 (1.71 to 1.78)	2.14 (2.10 to 2.18)	4.25 (4.19 to 4.30)
Early learning activities engaged in by the father in the past three days, mean (95% CI)	0.79 (0.76 to 0.81)	1.13 (1.10 to 1.16)	1.90 (1.85 to 1.96)
Having 3+ children's books in the household, % (95% CI)	4.7 (4.3 to 5.1)	16.1 (15.3 to 16.8)	75.3 (74.1 to 76.5)
Having toys bought from shops, % (95% CI)	33.3 (32.2 to 34.4)	77.5 (76.5 to 78.4)	96.0 (85.4 to 96.5)
Physical punishment of a young child aged 2-14 years at home in the last month, % (95% CI)	76.3 (75.6 to 77.0)	65.3 (64.4 to 66.2)	51.1 (49.8 to 52.4)

Table 3 – Structural Equation Model^(a) predicting Child Development Scale Score

Parameter estimates ^(b)	Low-HDI	Medium-HDI	High-HDI
Child development scale score (Standardized linear regression coefficient (95% CI))			
Attending an early childhood education program (1: yes; 0: no)	0.32 (0.21 to 0.43)	0.23 (0.18 to 0.27)	0.05 (-0.06 to 0.16)
Care for child development at home (Standardized score)	0.41 (0.27 to 0.55)	0.37 (0.25 to 0.49)	0.49 (0.35 to 0.63)
Family uses physical punishment of their young children (1: yeas; 0: no)	-0.03 (-0.06 to -0.01)	-0.07 (-0.16 to 0.01)	-0.03 (-0.09 to 0.02)
Care for child development at home defined by (linear regression coefficient (95% CI))			
Number of early learning activities engaged in by the mother	0.39 (0.29 to 0.49)	0.68 (0.57 to 0.80)	0.74 (0.64 to 0.84)
Number of early learning activities engaged in by the father	0.28 (0.22 to 0.35)	0.49 (0.43 to 0.55)	0.53 (0.44 to 0.61)
Having 3+ children's books at home	0.10 (0.07 to 0.13)	0.18 (0.13 to 0.23)	0.2 (0.14 to 0.25)
Having toys bought from shops	0.33 (0.24 to 0.42)	0.57 (0.44 to 0.71)	0.62 (0.51 to 0.74)
Attending early childhood education program (odds ratio (95% CI))			
Household wealth (1: poorest 20%; 0: other)	0.43 (0.29 to 0.64)	0.49 (0.35 to 0.67)	0.45 (0.40 to 0.52)
Number of early learning activities engaged in by the mother (linear regression coefficient (95% CI))			
Household wealth (1: poorest 20%; 0: other)	-0.17 (-0.48 to 0.15)	-0.38 (-0.58 to -0.18)	-0.68 (-0.89 to -0.48)
Number of early learning activities engaged in by the father (linear regression coefficient (95% CI))			
Household wealth (1: poorest 20%; 0: other)	-0.07 (-0.19 to 0.05)	-0.25 (-0.32 to -0.18)	-0.55 (-0.80 to -0.30)
Having 3+ children books at home (odds ratio (95% CI))			
Household wealth (1: poorest 20%; 0: other)	0.97 (0.93 to 1.01)	0.85 (0.75 to 0.98)	0.66 (0.47 to 0.89)
Having toys bought from shops or manufactured (odds ratio (95% CI))			

Household wealth (1: poorest 20%; 0: other)	0.49 (0.36 to 0.65)	0.50 (0.36 to 0.68)	0.33 (0.24 to 0.43)
Family with physical punishments for a child aged 2-14 years at home in the last month (odds ratio (95% CI))			
Household wealth (1: poorest 20%; 0: other)	1.04 (0.92 to 1.18)	1.05 (0.9 to 1.23)	0.97 (0.86 to 1.09)
Covariance			
‘Care for child development at home’ WITH ‘Attending early childhood education program,	0.17 (0.1 to 0.25)	0.32 (0.13 to 0.51)	0.29 (0.14 to 0.43)
‘Care for child development at home’ WITH ‘Family with physical punishments for children’	-0.01 (-0.03 to 0.01)	-0.04 (-0.09 to 0.01)	-0.13 (-0.21 to -0.06)
‘Number of early learning activities engaging by mother’ WITH ‘Number of early learning activities engaging by father’	0.59 (0.44 to 0.74)	0.58 (0.42 to 0.74)	0.59 (0.34 to 0.84)
Effect of household wealth (1: poorest 20%; 0: other) on Child development scale score			
Total effect size	-0.18 (-0.27 to -0.08)	-0.26 (-0.30 to -0.21)	-0.29 (-0.37 to -0.21)
Direct effect	-0.05 (-0.09 to -0.01)	-0.17 (-0.22 to -0.12)	-0.27 (-0.36 to -0.18)
Indirect effect via ‘care for child development at home’ index	-0.13 (-0.21 to -0.05)	-0.09 (-0.13 to -0.05)	-0.02 (-0.06 to 0.02)
Fit indices			
RMSEA (Probability RMSEA ,= .05)	0.002 (p=1.0)		
Comparative Fit Index	0.995		
Tucker-Lewis Index	0.976		

^(a) The main paths of this model are presented in this table. Other variables included in the model are Child sex, child age, urban/rural, number of children in the family, maternal education, paternal education, mother at home, and father at home. Please see the full details in Supplementary Table 1; ^(b) All of these parameters were calculated in a structural equation model simultaneously.

Figure 1. Hypothesized model predicting Child Development Scale Score

All of the variables in the diagram (presented in rectangular boxes) are observed except for the unmeasured (latent) variable ‘Care for child development at home’ (represented as an ellipse). Single-headed solid arrows represent directional paths, dashed lines indicate the latent variable are defined by the variables, and double-headed arrows indicate the variables that are assumed to be correlated.

Figure 2. Mean child development scores in the 20% richest, 20% poorest and whole sample by countries

Figure 3. Percentages of children having access to early childhood education programs in the 20% richest, 20% poorest and whole sample by countries

Figure 4. Mean of the numbers of early learning activities engaged in by mothers in the 20% richest, 20% poorest and whole sample by countries

Figure 5. Mean of the numbers of early learning activities engaged in by fathers in the 20% richest, 20% poorest and whole sample by countries

Figure 6. Percentages of children having at least 3 children’s books in the home in the 20% richest, 20% poorest and whole sample by countries

Figure 7. Percentages of children having toys bought from shops in the 20% richest, 20% poorest and whole sample by countries

Figure 8. Percentages of households using harsh punishments for children at home in the last month by in the 20% richest, 20% poorest and whole sample by countries

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Early childhood development: impact of national human development, family poverty, parenting practices, and access to early childhood education

Short title: Early childhood development in developing countries

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