Supplemental Information

ECDI on Track

Ten questions in the MICS4 and MICS5 Questionnaire for Children Under Five are on whether target milestones of child development have been observed. These 10 questions, collectively called the ECDI, were developed by UNICEF specifically to assess development in children aged 36 to 59 months in 4 developmental domains, including literacy and numeracy, socioemotional development, physical health, and approaches to learning. On the basis of the 10 questions, UNICEF ECDI scoring guidelines were developed and, on that basis, scores for the Early Childhood Development Index–Literacy and Numeracy (ECDI-LN) (3 items), Early Childhood Development Index–Socioemotional Health (ECDI-SE) (3 items), Early Childhood Development Index–Physical Health (ECDI-PH) (2 items), and Early Childhood Development Index–Approaches to Learning (ECDI-AL) (2 items) subindices were calculated. Furthermore, according to UN criteria, children on track in their literacy and numeracy development must demonstrate at least 2 of the 3 behaviors, children on track in their socioemotional development must demonstrate at least 2 of the 3 behaviors, children on track in their physical health development must demonstrate at least 1 of the 2 behaviors, children on track in their approaches to learning development must demonstrate at least 1 of the 2 behaviors, and children on track in their overall development must demonstrate on-track development in at least 3 of the 4 ECDI-LN, ECDI-SE, ECDI-PH, and ECDI-AL developmental domains.

Simultaneous Associations Between All Demographic Characteristics and ECDIs in a Linear Regression Framework

Child and maternal sociodemographic characteristics and household and country demographic characteristics correlate with child development indices. Supplemental Table 3 shows regression models in which all sociodemographic and demographic characteristics are simultaneously used to predict child development scores. The total variance explained (R^2) in ECDI scores was calculated by the combination of all sociodemographic and demographic characteristics and is reported in the top row of Supplemental Table 3. So, for instance, the model that used all demographic characteristics to predict total ECDI scores predicted 23.7% of the variance in ECDI scores. The change in R^2 (ΔR^2) in each model when a specific predictor was excluded was also calculated. So, for instance, the left-hand corner of Supplemental Table 3 reveals that, by removing the HDI score from the model predicting overall ECDI scores, the model explains 4.9% less variance in ECDI scores. Therefore, HDI scores uniquely explain 4.9% of variance in ECDI scores, even after we control for the effects of all other sociodemographic and demographic variables. The ΔR^2 values do not completely add up to the total R^2 reported in the top row because the predictors are correlated with one another (eg, number of people in household is correlated with number of children in household, and both are correlated with child development indices). The ΔR^2 controls for such correlations, and therefore all ΔR^2 values, when added, can differ from the total R^2. Results for each ECDI are described below.

Taken together, sociodemographic and demographic characteristics predicted 23.7% of the variance in overall ECDI scores. This amount of variance explained by sociodemographic and demographic characteristics alone falls between medium ($R^2 = 0.13$) and large ($R^2 = 0.26$) effect size.[15] Only 3 demographic predictors exceed the $R^2 = 0.02$ threshold, which indicates even a small effect on ECDI scores. These 3 predictors are the HDI score ($\Delta R^2 = 0.05$), maternal education ($\Delta R^2 = 0.03$), and child age ($\Delta R^2 = 0.03$). Specifically, countries with higher HDI scores, mothers with higher levels of education, and older children had higher ECDI scores, even after we controlled for all other demographic variables.

Sociodemographic and demographic characteristics predicted 15.5% of the variance in overall child literacy and numeracy development index scores (ECDI-LN), which is a medium effect. Only 2 sociodemographic predictors exceed the $R^2 = 0.02$ threshold, which indicates even a small effect on ECDI scores. These 2 predictors are child age ($\Delta R^2 = 0.04$) and maternal education ($\Delta R^2 = 0.04$). Specifically, older children and countries with mothers with higher levels of education had higher overall child literacy and numeracy development scores, even after we controlled for demographic variables.

Sociodemographic and demographic characteristics predicted only 4.0% of the variance in overall child socioemotional development index scores (ECDI-SE), which is considered a small effect.[15] No demographic predictors exceeded the $R^2 = 0.02$ threshold for even a small effect (the HDI score came the closest at $\Delta R^2 = 0.02$).

Sociodemographic and demographic characteristics predicted 6.6% of the variance in overall child physical health development index scores (ECDI-PH), which is considered a small effect.[15] The HDI score ($\Delta R^2 = 0.02$) is the 1 demographic predictor to exceed the $R^2 = 0.02$ threshold for a small effect. In nations where HDI scores are higher, child physical

health development scores are also higher.

Sociodemographic and demographic characteristics predicted 12.6% of the variance in child approaches to learning index scores (ECDI-AL), which falls between the small (R^2 = 0.02) and medium (R^2 = 0.13) effect-size categories.[15] The HDI score (ΔR^2 = 0.05) is once again the sole predictor to exceed the R^2 = 0.02 threshold. Higher HDI scores predict higher child approaches to learning scores.

Child and Maternal Sociodemographic Associations and Household Demographic Associations With Child Development

In addition to country (HDI) demographic predictors of child development, the predictive power of 2 child (sex and age) and 2 maternal (age and education) sociodemographic predictors and 4 household (number of people in the household, number of children aged <18 in the household, number of children aged <5 in the household, and household crowding) demographic predictors were examined. With respect to child predictors, child age was the stronger and more robust predictor of child development. Of course, this association is expected: as children grow older, they more readily identify letters and numbers and generally display more sophisticated levels of socioemotional, physical, and cognitive and learning development.[31] Nevertheless, the result is useful and supports the validity of MICS data to document that child aging, even in so short a time period as 2 years, conveys clear developmental power across a variety of heretofore understudied LMICs. In contrast to the robust effects of child age, associations of child sex with child development were weak and negligible. In the 51 LMICs examined here, child development in girls and boys in this age range does not differ much. These results replicate the general pattern of sex similarities" findings from >45 meta-analyses that have repeatedly revealed that effects of sex on most child developmental domains, including literacy and numeracy, socioemotional development, physical development, and approaches to learning, are small.[32] These results also replicate and comport with those reported for child development and parental caregiving and discipline in 41 LMICs on the basis of MICS3 data.[33] However, these results expand on past largely high-income country (HIC) sample findings and past MICS child development and parenting findings by revealing that boys and girls appear to differ little on more contemporaneous child development scores in LMICs as well.

With respect to maternal sociodemographic characteristics, maternal age was only weakly associated with child development scores. This finding is somewhat surprising given that numerous meta-analyses, systematic reviews, and nationally representative studies in HICs reveal that, generally, mothers who delay birth in those nations have children who demonstrate greater cognitive, socioemotional, and physical development and fewer school or behavioral problems.[34–37] At least 2 explanations may elucidate the relatively small role that maternal age plays in child development in the current sample. First, and perhaps counter to expectations, mothers in this sample are not particularly young. The average maternal age was 32 years, and only 7.7% of the sample had their children at age 18 or younger, when children suffer the greatest maladaptive developmental effects from early pregnancy and poorer parenting.[38] The later childbearing age in our sample reflects global trends; teen-aged birth rates have fallen in virtually every world region since 2000–2005 and are especially pronounced in LMICs.[38] This decline in teen-aged birth rates may itself reflect increases in global education and sex education and widespread availability of affordable birth control. A second possible explanation for weak maternal age effects may relate to the second parenting demographic characteristic measured here: maternal education. Specifically, data from HICs indicate that "the primary pathway by which delaying first births benefits children is by enabling mothers to complete more years of schooling."[37](p 2229) In other words, it may be that in HICs, older mothers accrue more years of education, which leads to better child developmental outcomes. However, in the LMICs examined here, older mothers have not accrued the higher levels of education needed to promote child development, perhaps because educational opportunities are rarer to achieve. In the current sample, 56.3% of mothers reported either no formal education or only primary education. Therefore, in this sample, maternal education, as opposed to maternal age, may be especially important in child development because it is not a given that older maternal age leads to higher levels of education. Indeed, maternal education is a powerful and robust correlate of child development in this sample of ~160 000 households in 51 LMICs. This finding aligns with systematic reviews from HICs that identify parental socioeconomic status, often most parsimoniously indexed by parental education,[39] as one of the most powerful predictors of physical, cognitive, and socioemotional development in children.[3,40–42] Parents with higher levels of education are more likely to identify and have the means to

SUPPLEMENTAL TABLE 3 Multiple Linear Regression Analyses Comparing the Simultaneous Associations of Child and Maternal Sociodemographic Characteristics and Household and Country Demographic Characteristics With ECDIs

	ECDI (R^2 = 0.24)			ECDI-LN (R^2 = 0.16)			ECDI-SE (R^2 = 0.04)			ECDI-PH (R^2 = 0.07)			ECDI-AL (R^2 = 0.13)		
	β (SE)	*P*	ΔR^2	β (SE)	*P*	ΔR^2	β (SE)	*P*	ΔR^2	β (SE)	*P*	ΔR^2	β (SE)	*P*	ΔR^2
HDI	.27 (.00)*	<.01	0.049	.08 (.00)*	<.01	0.005	.15 (.00)*	<.01	0.015	.18 (.00)*	<.01	0.023	.27 (.00)*	<.01	0.051
Child sex (0 = female, 1 = male)	−.05 (.00)*	<.01	0.003	−.03 (.00)*	<.01	0.001	−.07 (.02)*	<.01	0.004	.00 (.00)	.51	0.000	−.02 (.00)*	<.01	0.000
Child age (mo)	.17 (.00)*	<.01	0.027	.21 (.00)*	<.01	0.042	.03 (.00)*	<.01	0.000	.03 (.00)*	<.01	0.001	.09 (.00)*	<.01	0.008
Mother's age (y)	.03 (0.00)*	<.01	0.001	.03 (.00)*	<.01	0.001	.02 (.00)*	<.01	0.000	0.01 (0.00)	.07	0.001	.01 (.00)*	<.01	0.000
Maternal education (0–3 range)	.22 (.00)*	<.01	0.031	.25 (.00)*	<.01	0.042	.04 (.00)*	<.01	0.001	.09 (.00)*	<.01	0.005	.10 (.03)*	<.01	0.006
No. people in household	.03 (.01)*	<.01	0.000	.06 (.01)*	<.01	0.001	−.01 (.01)	.10	0.000	−.03 (.01)*	<.01	0.001	.03 (.01)*	<.01	0.000
No. children in household <18 y old	−.01 (.01)*	.02	0.000	−.06 (.01)*	<.01	0.001	.01 (.01)*	.03	0.000	.04 (.01)*	<.01	0.001	.01 (.01)	.16	0.000
No. children in household <5 y old	−.05 (.00)*	<.01	0.002	−.04 (.00)*	<.01	0.001	−.02 (.00)*	<.01	0.000	.00 (.00)	.21	0.000	−.04 (.01)*	<.01	0.001
Household crowding (No. people per bedroom)	−.05 (.00)*	<.01	0.003	−.03 (.00)*	<.01	0.001	−.03 (.00)*	<.01	0.000	−.05 (.00)*	<.01	0.003	−.03 (.00)*	<.01	0.001

HDI, Human Development Index; ECDI, Early Childhood Development Index; ECDI-LN, Early Childhood Development Index-Literacy and Numeracy; ECDI-SE, Early Childhood Development Index-Socioemotional; ECDI-PH, Early Childhood Development Index-Physical Health; ECDI-AL, Early Childhood Development Index-Approaches to Learning; ΔR^2, Percent of explained variance uniquely added to model by variable standardized parameter estimates.
* $P < .05$.

use the nutritional, health care, housing, and cognitively stimulating resources necessary to promote child development.[41,43] Parents with higher levels of education are also more likely to learn about effective, sensitive caregiving techniques and discipline behaviors that promote healthy child development.[41,44,45] In summary, greater maternal education appears to be a powerful tool for promoting multiple domains of child development, perhaps especially in LMICs where such educational opportunities are more limited.

The 4 household demographic covariates (number of people in the household, number of children aged <18 in the household, number of children aged <5 in the household, and household crowding) had varying associations with child development. At the zero-order correlational level, all 4 household variables had small negative correlations with most measures of child development. Taken together, those findings indicate that households with more people of all ages in them and less space have children with lower developmental scores. However, the regression analyses revealed that none of these household characteristics predicts >0.03% of variance in child development scores after other demographic covariates are controlled.

SUPPLEMENTAL REFERENCES

31. Steinberg L, Vandell D, Bornstein MH. *Development: Infancy Through Adolescence*. Belmont, CA: Wadsworth Cengage Learning; 2011
32. Hyde JS. The gender similarities hypothesis. *Am Psychol*. 2005;60(6):581–592
33. Bornstein MH, Putnick DL, Bradley RH, Deater-Deckard K, Lansford JE. Gender in low- and middle-income countries: introduction. *Monogr Soc Res Child Dev*. 2016;81(1):7–23
34. Bornstein MH, Putnick DL. Chronological age, cognitions, and practices in European American mothers: a multivariate study of parenting. *Dev Psychol*. 2007;43(4):850–864
35. Bornstein MH, Putnick DL. *The Architecture of the Child Mind: g, Fs, and the Hierarchal Model of Intelligence*. New York, NY: Routledge; 2019
36. Bornstein MH, Putnick DL, Suwalsky JTD, Gini M. Maternal chronological age, prenatal and perinatal history, social support, and parenting of infants. *Child Dev*. 2006;77(4):875–892
37. Duncan GJ, Lee KTH, Rosales-Rueda M, Kalil A. Maternal age and child development. *Demography*. 2018;55(6):2229–2255
38. United Nations Children's Fund. Early childbearing. Available at: https://data.unicef.org/topic/child-health/adolescent-health/. Accessed September 14, 2021
39. Bornstein MH, Hahn CS, Suwalsky JTD, Haynes OM. Socioeconomic status, parenting, and child development: the Hollingshead Four-Factor Index of Social Status and the Socioeconomic Index of Occupations. In: Bornstein MH, Bradley RH, eds. *Socioeconomic Status, Parenting, and Child Development*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers; 2003:29–82
40. Bornstein MH, Bradley RH, eds. *Socioeconomic Status, Parenting, and Child Development*. Mahwah, NJ: Lawrence Erlbaum Associates Publishers; 2003

41. Bradley RH, Corwyn RF. Socioeconomic status and child development. *Annu Rev Psychol.* 2002;53:371–399

42. Hoff E, Laursen B. Socioeconomic status and parenting. In: Bornstein MH, ed. *Handbook of Parenting. Volume 2: Biology and Ecology of Parenting.* 3rd ed. New York, NY: Routledge/ Taylor & Francis Group; 2019: 421–447

43. Bornstein MH, Putnick DL, Bradley RH, Lansford JE, Deater-Deckard K. Pathways among caregiver education, household resources, and infant growth in 39 low- and middle-income countries. *Infancy.* 2015;20(4):353–376

44. Bornstein MH, Cote LR, Haynes OM, Hahn CS, Park Y. Parenting knowledge: experiential and sociodemographic factors in European American mothers of young children. *Dev Psychol.* 2010; 46(6):1677–1693

45. Bornstein MH, Yu J, Putnick DL. Mothers' parenting knowledge and its sources in five societies: specificity in and across Argentina, Belgium, Italy, South Korea, and the United States. *Int J Behav Dev.* 2020;44(2): 135–145