PRIDI

REGIONAL PROJECT ON CHILD DEVELOPMENT INDICATORS

URGENCY AND POSSIBILITY

FIRST INITIATIVE OF COMPARATIVE DATA
ON CHILD DEVELOPMENT
IN LATIN AMERICA

Aimee **Verdisco** Santiago **Cueto** Jennelle **Thompson** Oliver **Neuschmidt**

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Presentation & Executive Summary

For many children, the circumstances of their birth and earliest years have lifelong consequences. Where and to whom a child is born can predict her economic and social outcomes later in life. Children born to parents who invest emotional and economic resources in their development tend to become healthy and productive adults, passing on the advantages that such investments bring to their own children. Children born in adverse circumstances, where poverty and stress limit possibilities and aspirations, fare less well. The odds are stacked against them from the beginning. Chances are that neither school nor any life experience will level the playing field.

Meaningful change requires meaningful action, early-on. Gaps in what a child knows and is capable of doing will grow over time absent targeted and high quality interventions incorporating stimulation, early education, health and nutrition. The potential of these interventions, referred to as early childhood development (ECD), has caught the attention of policy makers across the globe. Indeed, ECD occupies an increasingly central place on policy agendas in Latin America and internationally. Research confirms the economic and social returns of ECD and its potential to help level the playing field for all children. Although more and more of this research concentrates on places other than North America or Europe, comparable data and validated tools that allow for the monitoring and benchmarking of young children remain scarce in other regions.

The Regional Project on Child Development Indicators (Programa Regional de Indicadores de Desarrollo Infantil), or PRIDI, emerged in this context and with the intent of narrowing this void. It was launched in December of 2009 as the first initiative of its kind. Three pillars oriented its activities: (i) children develop in an integral manner and the data used to assess their development should capture this; (ii) children should be able to achieve basic developmental milestones and competencies before entering school, independent of their race, gender, socioeconomic background, origin, language, or any other circumstance; and (iii) internationally comparable, nationally representative data on child development to inform and guide policies, particularly towards the most disadvantaged children, are largely absent in the region.

PRIDI took its inspiration from regional and international tests, such as the Latin American Laboratory on Education Quality (LLECE and its subsequent iterations, SERCE and TERCE), PIRLS

(Progress in International Reading Literacy Study) and PISA (Program for International Student Assessment), among others. By providing comparable data across countries that served to empirically define oft-used yet vaguely defined concepts such as "quality" and benchmark progress against solid indicators, these initiatives opened new avenues for policy dialogue and collaborative efforts between governments on how best to improve education. PRIDI hopes to do the same, providing a platform for informed dialogue and cooperation on how best to address the needs of young children and their families.

PRIDI is a package of tools, data and analyses, each of which is available to policy makers, researchers and practitioners in Latin America and internationally. It includes:

1. A Conceptual Framework detailing the objectives and scope of PRIDI.
2. The Engle Scale for evaluating cognitive, language and communication, and motor development through direct observation of the child. It is named in honor and recognition of Patrice Engle who made enormous contributions to PRIDI and ECD internationally until her untimely death in 2012.
3. A Survey of the child and home, which captures factors associated with child development. It is designed to be applied to the mother or principal caregiver, and includes a section of the Engle Scale for evaluating the child's socio-emotional development.
4. Application and training manuals and materials for the Engle Scale and Survey.
5. Sampling guide.
6. A database with nationally representative data collected from the Engle Scale and Survey for the four countries that participated in PRIDI.
7. Technical annexes detailing the processes undertaken to create, validate and apply the Engle Scale and Survey, as well as the quality controls implemented during each phase to ensure validity of items and data.
8. The present report which highlights the main policy messages emerging from PRIDI.

After five years in execution, PRIDI has lived up to its promise. Working together with four countries – Costa Rica, Nicaragua, Paraguay and Peru – it created, validated and applied a series of new instruments in nationally representative samples. The Engle Scale and accompanying Survey measure cognitive, language and communication, motor and socio-emotional development in children from 24 to 59 months and capture key factors associated with child development. Notably, in contrast to other studies that have looked at learning in pre-school aged children in organized settings (e.g., ECD centers or schools), all PRIDI instrumentation was applied in nationally representative samples in homes. In this way, PRIDI captured the universe of children 24 to 59 months in the four countries.

With few items, the Engle Scale allows for a holistic measurement of child development through direct observation and maternal report. The data it generates are regionally comparable and identify gaps between different groups of children. PRIDI includes indigenous populations, thus differentiating it – again - from other studies (e.g., standardized tests of learning) that exclude, ex-ante, such populations, given the logistical difficulties, including language and cost, of reaching them.

PRIDI finds a sense of urgency and of possibility. Child development in Latin America is unequal. Inequality in results appears as early as 24 months, PRIDI's youngest participants, and increases with age. There is variation

in inequality. For example, correlations of the results of the Engle Scale with the socio-economic characteristics of the home and maternal education are stronger for cognition, and language and communication than for motor development. The environment within which children develop – the nurturing environment - is important for all domains of child development measured by the Engle Scale, although stronger associations appear for cognition, language and communication, and socio-emotional development.

Gaps between the development of children in the top and low extremes in these factors matter. By 59 months, the development of a poor and under-nurtured child will lag by as much as 18 months behind her richer and more nurtured peers. This child will not be able to recognize basic shapes like triangles or squares, count to 20, or understand temporal sequences. She will also have gaps in her basic executive functioning and socio-emotional skills, including empathy and autonomy. She will not likely be ready for school and may not have success once there. Notably, however, if this same child, in the same poor household, were to benefit from a nurturing environment, her level of development would rise and would start to approach levels found in children in richer but less nurtured households. The nurturing environment thus appears to mitigate the negative association lower levels of wealth have with the domains of development measured by the Engle Scale.

This is the profile of children entering formal education in the four participating countries. Insofar as the data speak to the readiness of these children to learn, they also speak to the readiness of schools to receive and provide them with a quality education. The challenges schools will face run the gamut, from appropriately trained teachers, to adequate infrastructure and mechanisms for interacting in meaningful ways with families.

All PRIDI products are regional public goods, freely available on our website. We invite other countries to apply these instruments and to add to the data and knowledge initiated by PRIDI. We hope that the information and data it provides will serve governments and practitioners in better identifying and dimensioning high quality ECD programs that will help all kids get off to a good start in life.

Emiliana Vegas, Chief

EDUCATION DIVISION

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The Nuts Bolts of PRIDI

The PRIDI Conceptual Framework, created in close collaboration with the four participating countries (Costa Rica, Nicaragua, Paraguay and Peru) recognizes child development as a holistic and integrated process that encompasses a number of inter-related domains, including: cognitive, language, emotional, health, social, motor, executive functioning, etc. Of these, PRIDI measures four (Table I): cognition, language and communication, socio-emotional, and motor. Each domain finds theoretical and empirical justification in the literature (see PRIDI Conceptual Framework and Selected Bibliography, below).

Table I. Domains of Child Development Included in PRIDI

Domain	Definition	Justification
Cognition	Ability to solve problems, including abilities to categorize, sequence, pay attention, recognize relationships between numbers and relationships between parts and whole, and of executive functioning.	Basic abilities for learning in school. Associated with learning, test scores and later successes in life.
Language and Communication	Development of expressive and receptive language. Expressive language relates to the child´s ability of articulate words and concepts. Receptive language relates to a child´s comprehension of language. Relates to knowledge and interest in books and drawings.	Predictive of learning in school. Interest in books is associated with the development of early learning skills.
Socio-Emotional	Recognizing and learning to deal with emotions, along with the development of self-esteem, autonomy, and social skills.	Association with a child´s ability to adapt to new situations. Has predictive validity.
Motor	Fine and gross motor skills, including coordination.	Through their motor skills, children experience new situations and things. Motor skills are related to learning and to cognition.

PRIDI also captures factors associated with ECD. Child development emerges from and is affected by the interaction of a number of contextual variables from the home, community, and parents. A broad literature speaks to the impact these and other factors have on child development (see Selected Bibliography, below). The associated factors included in PRIDI are summarized in Table II:

Table II. Associated Factors Included in PRIDI

Factor	Definition	Justification
Child Characteristics	Birth date, sex, maternal language, wwbirth-order	Immutable characteristics of the child.
Household Characteristics	Socio-economic status of the home, presence of both parents in home, maternal language and education level of parents, access to basic services in the home, number of siblings, parental interaction with child, language-rich activities and materials in the home, child rearing strategies, basic health information	Environment in which a child develops and grows. Socio-economic status strongly correlates with ECD. Poverty poses a serious risk to ECD and tends to occur concomitantly with other factors that detrimentally affect it, including inadequate nutrition, poor sanitation and hygiene, poor maternal education, and inadequate stimulation in the home.
Community Characteristics	Urban or rural, distance from health post or hospital, availability of basic services	Services available to the family and child that may have an impact on child development
ECD or early education programs	Participation and duration of child in such programs. Included here are ECD, early education, nutrition, and conditional cash transfers	Participation in these programs, if they are of quality, is likely to have a positive influence on child development.

PRIDI´s Children

PRIDI evaluates children aged 2 to almost 5 years (4 years, 11 months and 30 days) in their homes. In this way, PRIDI includes the universe of children in this age range, not just those in ECD centers or other organized care. PRIDI also includes indigenous children in all countries but Costa Rica (given the small size of its indigenous population) and adapted its instruments to the peculiarities of each in an effort to give all children as equal a chance as possible to show what they know and are capable of doing. Children displaying a clear disability or illness at the time of evaluation were excluded.

Creation of PRIDI Instruments

Instruments bear a close relationship to what is measured and how it is measured. A potential avenue for PRIDI would have been to choose a test currently in use in the region or elsewhere, adapt it and apply it. After carefully inventorying and reviewing instruments for child development in use in the Region and internationally, this course of action was rejected. The majority of these evaluations tended to either replicate, to a larger or lesser extent, tests used elsewhere in the world or were outdated, not informed by currently advances in ECD and brain research. Anecdotal evidence on others warned of biases against indigenous and rural children and an underestimation of their abilities. For example, a widely applied test based on black and white drawings includes a hot air balloon and an ornamental lamp in its opening sequences – objects that are not likely to be recognized by young children living outside of urban areas.

PRIDI chose to create new instruments for evaluating child development. The new instruments it created were built around commonalities in the scales and evaluations applied in the region (e.g., Escala Abreviada de Nelson Ortiz, Escala de Desarrollo Integral del Niño) and complemented with items found in more recent, international tests (see PRIDI Technical Annex). PRIDI instruments were not to be screening instruments, but rather tools for understanding various dimensions of child development at a population level. They were to be applied within the home, thus allowing for the universe of children aged 24 to 59 months to be captured and differentiating PRIDI from other studies that confine their analyses to children in ECD centers or preschools.

A three-phase plan was laid out for elaborating, validating and applying the instruments; the countries participated actively in all phases:

1. A formative phase (Phase I), in which the newly created instruments and respective materials, manuals and forms were piloted in small samples of children in two countries and adapted to different populations, particularly indigenous populations. Two countries participated: Paraguay and Peru. Implemented over the course of 2010.

2. A validation phase (Phase II), in which the instruments, adapted through the formative experiences of Phase I, were applied in limited samples (200 children) in all four participating countries, and validated against two internationally normed tests: the Peabody Picture Test (in its Spanish version, Test de Vocabulario en Imágenes Peabody, TVIP) , a normed reference test for measuring receptive vocabulary in children that has been applied in various countries in the Region; and height-for-age, an internationally used anthropometric test to measure physiological growth. Implemented over the course of 2011-2012.

3. A phase of national application (Phase III), in which PRIDI instruments together with the TVIP (children 42 to 59 months, only) and height-for-age were applied in nationally representative populations with a target of 2,000 children in each participating country. Implemented over the course of 2013-2014.

The set of instruments included a development scale (Escala Engle de Desarrollo Infantil, or Engle Scale), a survey administered to the mother or principal caregiver, application and training manuals, and a number of complementary forms (e.g., informed consent, household registry, etc.). All were designed to be easily administered by people with some knowledge of ECD and short, hands-on training. The Scale and Survey were adapted to the national contexts. Indigenous language versions of the Scale and Survey were generated for the Región Autónoma del Atlántico Norte (RAAN) in Nicaragua (Miskito), for rural areas in Paraguay (Guaraní), and the Cusco area in Peru (Quechua). In each case, the instruments were translated from Spanish and then translated back from the respective indigenous language to Spanish. Where differences existed, the translators met to determine the final wording to be used in the indigenous version.

The Engle Scale applies two main approaches for evaluating child development. Cognition, language and communication, and motor development are assessed via direct observation of the child; socio-emotional development is assessed via maternal (or principal caregiver) report. Given the large range of development which occurs in children from 24 to 59 months, the Scale for direct observation consists of two evaluations, one for children from the age of 24 to 41 months (referred to as Form A), and the other, more appropriate for children 42 to 59 months (referred to as Form B). The socio-emotional scale is contained in the Survey; mothers/principal caregivers of all participating children respond to the same scale.

The materials necessary for the application of the Scale are of common-usage in the countries and within their various populations, of minimal cost, durable and easily transported in a backpack, and can be used for various items and in both scales: e.g., small wooden blocks, a puppet, pencils, and a ball. An application manual includes figures and instructions on the correct use and positioning of the materials and the correct application of each item.

The Survey enquires into basic characteristics of the household and environment within which the child develops. It also enquires into factors associated with the child, including her socio-emotional development, attendance in preschool or organized care, overall health, and disciplinary methods applied in the home. A manual was created to orient its application and scoring in the field.

Training for PRIDI

A basic tenet of PRIDI was that its application would not require highly sophisticated human resources. A firm was hired through internationally competitive bidding processes to carry out all aspects of the field work in each country:

- Costa Rica: Leyden Consulting Group
- Nicaragua: Centro de Investigación y Acción Educativa y Social (CIASES) and Gesaworld
- Paraguay: Universidad Iberoamericana
- Peru: SASE Consultores

The responsibilities of these firms included the recruitment and training of enumerators, the application of instruments and scoring of results, and the digitalization of data.

PRIDI created a detailed training curriculum and support materials (e.g., DVDs) to facilitate the recruitment and training of enumerators and to ensure that they were sufficiently competent in the application of the Scale and Survey, the TVIP, and height-for-age prior to going to the field. This training was designed to be implemented over an 11 day period. It included structured activities on how to gain the trust of mothers/caregivers and children, apply and score each instrument, evaluate performance of individual enumerators, and ensure the standardization of all procedures.

Validation of Items

Results obtained from Phases II and III were rigorously analyzed to ensure validation of items, the reliability of the four domains, and ease and efficiency in application (see the PRIDI Technical Annex). The International Association for the Evaluation of Educational Achievement (IEA) provided technical support and oversight along these lines, running Rasch/item response and factor analyses on both Forms and all items, including those comprising the socio-emotional scale. Items that functioned poorly across countries (e.g., no variation, too easy/hard) or that were difficult to apply were removed from the Engle Scale and Survey, and improvements in formatting were introduced to allow for a more efficient registry and scoring of results. Both Forms of the Engle Scale were streamlined: Form A to 21 items and Form B to 22 items (from more than 40 on each in Phase I; and 35 and 41, respectively, in Phase II). This reduced application time from a high of two hours to 30-40 minutes. Similar changes were made in the Survey.

Issues of Sampling

These firms listed above, in consultation with the respective national statistical institute and with technical support from the IEA, created each of the nationally representative samples (see the PRIDI Technical Annex). A manual created for this purpose called for a three-staged strategy. In the first stage, a sample of primary

sampling units (PSUs, discrete geographic or administrative divisions covering the entire country) was drawn and stratified by following criteria; in all cases, urban/rural was defined by each country:

- Costa Rica (two stratification variables): Valle Central/rest of country, urban/rural
- Nicaragua (three stratification variables): Departments and regions, urban/rural
- Paraguay (one stratification variable): Urban/rural
- Peru (four stratification variables): Cusco/rest of country, region (Sierra, Costa, Selva, Lima), proportion of Spanish speakers (high/low), rural/urban.

From here, a sample of secondary sampling units (SSUs, in the case of PRIDI, households) was selected within each of the sampled PSUs. In an effort to prevent clustering, a single child per household could participate in PRIDI (third stage). In homes where more than one child fell within the 24 to 59-month age cohort, the participating child was selected randomly using a Kish Grid (table of selection numbers).

An intended sample size of at least 2000 children was targeted in each country (in Peru, the target sample size was 2300, given oversampling in Cusco). This sample size met international standards. Its precision required that the appropriate number of children were selected from a sufficient number of different PSUs. Where there was interest in a particular segment of the population, sample size was increased (oversampled) in areas where such segments were found. In the case of PRIDI, indigenous children were oversampled in the RAAN (Nicaragua, Miskito-speaking children) and in Cusco (Peru, Quechua-speaking children). In the case of Paraguay, initial results from the field indicated that the sample was smaller than expected. As a result, a second sample of PSUs was selected to compensate for the shortfall.

The intended and achieved sample sizes for PSUs and for children in each of the participating countries follow (Table III).

Table III. Intended versus Achieved Samples, PRIDI

Country	PSUs		Children	
	PSUs	Children	PSUs	Children
Costa Rica	150	150	2000	1804
Nicaragua	57	57	2000	1835
Paraguay	310	297	2000	1504
Peru	416	416	2300	2567

The results reported in this present document were calculated with sampling weights and corrected sampling variance. The PRIDI Technical Annex provides additional details of these processes. The PRIDI child weight is a product of base weights and non-response adjustments. Base weights reflect the selection probabilities of PSUs and SSUs and, at each level of sample selection, are the inverse of the selection probability of a sampled unit. Non-response adjustments compensate for potential bias due to non-participation of sampled units.

PRIDI's sample of children results from a stratified multi-stage cluster sample. PSUs are geographical areas, not individuals. This introduces a potential bias of children likely being more similar to one another within PSUs than across PSUs. The PRIDI stratification limits the possibility for atypical samples and decreases sampling variance, and the use of systematic sampling from lists sorted by PSU size further reduces the overall standard errors. The Jackknife Repeated Replication (JRR) was applied to mitigate the potential biases of these effects and provide correct estimators for standard errors of the population parameter estimates. All results reported here are presented with the appropriate sampling weights.

Scaling and Standardization of Scores

Twelve anchor items were included in both Forms A and B to allow for their vertical equating and the reporting of all results as a single scale (as is done in this present document). The socio-emotional scale, applied via maternal report, was applied to all PRIDI children, with no differences between children receiving Form A or B.

In Phase III, PRIDI used IRT scaling to combine responses and provide accurate estimates of proficiency for each domain (see PRIDI Technical Annex for details). Items were calibrated onto a single scale using a one parameter IRT model where the probability of a response was modeled as a function of the difficulty of the item and the ability of the person. The discrimination parameters for all items were fixed to 1 and scores were calculated using a weighted maximum likelihood estimation procedure. For the purpose of estimating the item difficulties, sampling weights were applied in such a way that each country contributed equally to the difficulty of the items and, within each country, children from each Form A and Form B contributed equally as well. The internal consistency, as measured by Cronbach's Alpha, was calculated and deemed to be acceptable (> .6) in all domains on both Forms (Table IV).

Table IV. Internal Consistency of the Engle Scale

Dimensions	Internal Consistency (Cronbach´s Alpha)	
	Form A	Form B
Cognition	0.68	0.76
Motor	0.68	0.64
Language and Communication	0.76	0.70
Socio-Emotional	0.85	

Based on these analyses and results, all scores were standardized and placed on a more useful metric with a mean 50 and standard deviation of 5. This metric is used from this point forward in this report. Standardization was done separately for each domain.

03

What PRIDI Tells Us about Children and Child Development in Four Countries

Table V presents a basic profile of PRIDI children. Their average age is about 3.5 years. Most speak Spanish. Their mothers have completed primary education, and a significant percent have completed some secondary education. Given the small size of its indigenous population, no indigenous children were included in Costa Rica.

		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Age Range	2 years	33.45 (1.38)	32.71 (1.51)	31.36 (1.37)	32.53 (1.01)	32.51
	3 years	32.35 (1.51)	32.44 (1.48)	35.73 (1.45)	33.56 (1.27)	33.52
	4 years	34.21 (1.46)	34.84 (1.68)	32.91 (1.45)	33.91 (1.18)	33.97
Sex	Male	49.73 (1.41)	51.41 (1.37)	51.97 (1.27)	51.97 (1.30)	51.27
	Female	50.27 (1.41)	48.59 (1.37)	48.03 (1.27)	48.03 (1.30)	48.73
Maternal Language	Spanish	99.83 (0.12)	96.50 (0.86)	57.75 (2.01)	98.70 (0.28)	88.20
	Indigenous	--- ---	3.50 (0.86)	41.62 (1.96)	1.30 (0.28)	11.60
Maternal Education	Incomplete primary or less	19.92 (1.55)	32.37 (2.08)	35.91 (1.90)	14.21 (1.14)	25.60
	Primary but incomplete secondary	59.52 (1.51)	39.94 (3.34)	44.23 (1.93)	28.02 (1.34)	42.93
	Secondary or more	20.56 (1.53)	27.69 (4.67)	19.86 (1.36)	57.78 (1.67)	31.47

Standard errors in parentheses.

Mothers report that their children are generally healthy (Table VI).

Table VI. Reported Health of PRIDI Children

		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Health Status	Good Health	94.71 (0.64)	86.44 (1.01)	97.27 (0.60)	91.75 (0.72)	92.54
	Poor Health	5.29 (0.64)	13.56 (1.01)	2.73 (0.60)	8.25 (0.72)	7.46

Good health indicator takes the value of one if the mother/caregiver reported that her child is in excellent, very good or good health. Poor health takes the value of one if she reported that her child has somewhat good or bad health. Standard errors in parentheses.

When measured by PRIDI, the prevalence of stunting remains high (Table VII).

Table VII. Incidence of Stunting in PRIDI Children

		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Stunted	Non Stunted	91.44 (1.09)	84.46 (1.74)	88.01 (1.06)	80.52 (1.10)	86.11
	Stunted	8.56 (1.09)	15.54 (1.74)	11.99 (1.06)	19.48 (1.10)	13.89

Child is stunted if height for age, z-score (HAZ) is less than -2 SD. HAZ was calculated based on WHO 2006 tables for child nutritional status. Standard errors in parentheses.

Stunting, as the literature suggests, is caused by poor nutrition rather than genetic differences and can lead to cognitive damage (see Grantham-McGregor, et al, 2007). Stunted children are chronically malnourished. What limited energy their bodies have is devoted to essential organ function and growth, with what remains going to learning and social interaction. The figures reported above are consistent with data from other sources (e.g., the World Health Organization), and are alarming.

This finding suggests that neither stunting nor its consequences are well understood within households across the four countries. Stunting is less visible than fevers, diarrhea, respiratory or other more general health problems. Parents are likely unaware of the specific needs of young children and have little referent against which to demand higher quality services. PRIDI data indicate that the majority of its children live in homes with access to basic services and assets and most parents report that their children are healthy. Yet the high prevalence of stunting clearly suggests these endowments are insufficient for ensuring a good start in life.

04

Results of the Engle Scale: Scores and Associated Factors

Child development emerges from the interaction of any number of factors. Based on the leading literature (see Selected Bibliography, below), results of the Engle Scale should discriminate along various dimensions, including the socio-economic endowment of the home, maternal education, and indigenous-non, among others.

PRIDI conforms to these expectations and takes the analyses further. Insofar as the Engle Scale offers a multidimensional view of child development, it allows for deeper insight on how different factors affect child development. The PRIDI data clearly show that the magnitude of correlation of a given factor varies by domain. This variation is visible both between countries and within countries, thus offering fertile ground for structuring and targeting ECD interventions.

The following section discriminates overall results of the Engle Scale by key associated factors. The next section breaks these findings down by country. Annex A provides additional data on each country, domain and associated factor.

It merits reiterating that the Engle Scale is not a screening tool. No threshold exists for determining "good" or "bad" levels of development. Rather, the data allow for a deeper understanding of child development by the four domains measured by the Engle Scale and the associated factors captured by the Survey.

Age

Scores on each sub-scale of the Engle Scale, in each country, discriminate by age. Insofar as child development is a process of ordered emergence of skills, older children know more and are able to do more than younger children. This is reflected in Graph I: older children have higher levels of development. In each case, "r" denotes the correlation between the score on the given domain and the age; asterisks indicate that this correlation is statistically significant.

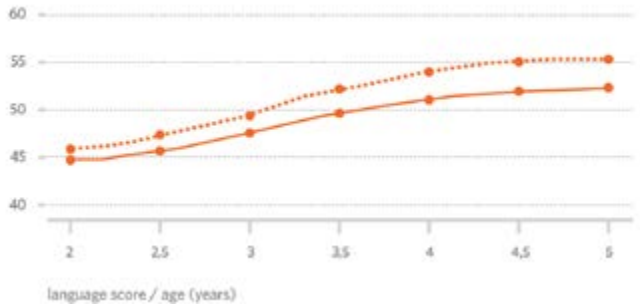
Graph I. Score by Domain and Age

Score

Maternal Education

Overall, the Engle Scale discriminates by maternal education. Gradients are steepest for cognition and language and communication. Gaps tend to widen as children age (Graph II). As will be discussed below, these results look different at a country level. Maternal education does not discriminate motor development in a statistically significant way in three of the four PRIDI countries and its association with socio-emotional development is statistically significant in only two countries. No statistically significant association with maternal education appears for any domain in Costa Rica.

Graph II. Scores by Domain, Maternal Education and Age



Incomplete primary or less

Complete secondary or more

The Environment within which Children Develop

Poverty negatively affects child development and tends to be inseparable from a range of other risk factors, including inadequate nutrition, inadequate sanitation and hygiene, low levels of maternal education and inadequate stimulation in the home. The literature finds that the deficits generated by the interaction of these factors increase with age and remain present throughout adulthood. As children age, they are increasingly more vulnerable to composition of their environment. By the age of two to three, children begin to learn more complex processes, such as language, and meaningful differences begin to appear in their levels of development. From this point onwards, the interaction of the child with her environment matters more and more for her development. The poorer the household both in terms of wealth and stimulation, the more likely it is that the child will have lower levels of development (Fernald et al., 2012). In short, wealth and stimulation gradients are present across most domains of child development, and tend to increase over time.

To see if PRIDI results conform to the wealth and stimulation gradients mentioned above, exploratory factor analysis was used to create two indices. Following Schady et al (2014) a wealth index was created using characteristics of the infrastructure found in the home, assets found in the home, access to basic services, and the ratio of household members to bedrooms. A second index was created to describe the nurturing environment. Drawing from Hamadani et al (2010) and the Family Care Indicators, it includes the number of books for children in the home, the number of adults who interact (play, sing, draw, tell stories) with the child, the frequency of adult-child interaction, routines implemented in the home, and basic hygiene routines practiced by the child. Table VIII provides the correlations for these indices and the Engle Scale domains based on the weighted averages for each of the four PRIDI countries.

Table VIII. Correlations of Indices and Domains

	Socio-Emotional	Cognitive	Motor	Language and Communication	Wealth Index
Cognition	0.21*				
Motor	0.17*	0.69*			
Language and Communication	0.19*	0.75*	0.69*		
Wealth Index	0.14*	0.18*	0.10*	0.21*	
Nurturing Environment	0.25*	0.24*	0.17*	0.27*	0.35*

** Correlations statistically significant at 5%*

These results indicate that the developmental domains measured by the Engle Scale are related, albeit different, and vary in their relation to different subdomains. The positive correlations observed are to be expected. Each domain contributes to healthy child development. This is consistent with the literature. Fernald et al. (2009) argue that while tasks can be divided into domains for categorical purposes, they often are overlapping and mutually influencing in children. Take, for example, the task of creating a bridge with 3 or 5 blocks, depending on the age of the child. In the Engle Scale, this task falls into the motor domain. But doing the task correctly requires cognitive skills, such as problem-solving and basic numeracy (e.g., fine motor and cognitive skills).

Wealth of the Household

Consistent with results obtained by Schady et al (2014) and others (Rubio-Codina et al., 2014; Paxson and Schady, 2011; Schady, 2006, among others), wealthier PRIDI children perform better than their poorer peers (Graph III).

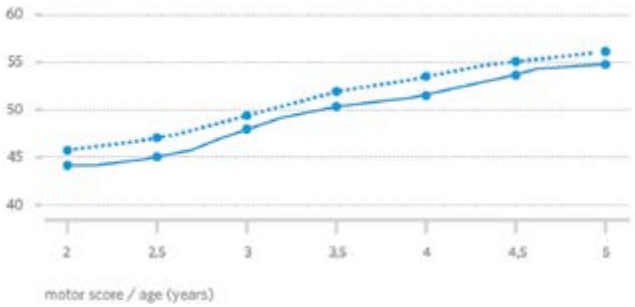
Graph III. Scores by Domain, Wealth Index and Age

The association between the wealth index and scores on the Engle Scale vary by domain, as will be discussed in more detail below. The stronger associations appear with cognition, language and socio-emotional; the weakest is with motor skills. In all cases, gaps are wider at 59 months than at 24 months.

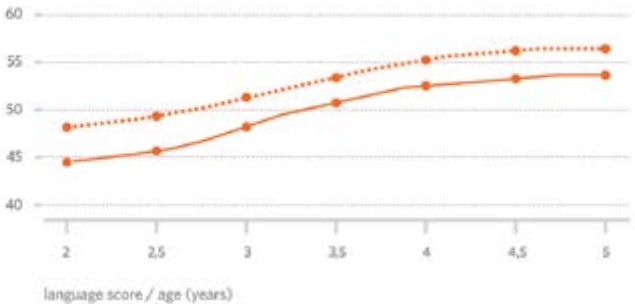
Nurturing Environment

PRIDI data find that the nurturing environment is more strongly associated with child development than the socioeconomic situation of the household, depending on the domain evaluated (Graph IV). For example, as will be discussed below, whereas the wealth index is not statistically significant for a child´s socio-emotional development in Costa Rica or Nicaragua, the nurturing environment is. In fact, the association with the nurturing environment is statistically significant for all domains, in all countries. What parents or caregivers do or do not do with their children has lifelong consequences for children. Mother-child interactions serve as crucial mediators of child outcomes in the United States (Gelfand and Teti, 1990; Goodman, 1992; Murray, 1997; Murray and Cooper, 1997; Webster-Stratton and Hammond, 1988). The PRIDI data confirm similar patterns in four countries in Latin America.

Graph IV. Scores by Domain and Nurturing Environment



motor score / age (years)



language score / age (years)

Lowest quintile (less nurturing)

Highest quintile (more nurturing)

05

Differences between Countries

Variation in levels of child development exists between PRIDI countries (Table IX). Means with different superscripts (a, b, c, read horizontally across countries) differ in a statistically significant way from each other ($p < 5\%$, T-test for independent samples): $a > b > c$. Take, for example, the socio-emotional domain. Scores for children in Costa Rica are significantly higher than scores for children in the other three countries ($a > b$, and $a > c$). Differences between scores in Nicaragua and Paraguay are not statistically significant ($b = b$). Scores in Peru are significantly lower than in the other three countries ($c < b$, and $c < a$).

Table IX. PRIDI Scores between Participating Countries

	Costa Rica	Nicaragua	Paraguay	Peru
Socio-Emotional	53.09 a (0.17)	49.28 b (0.19)	49.17 b (0.17)	48.52 c (0.15)
Cognitive	49.42 c (0.19)	48.91 c (0.21)	50.38 b (0.17)	51.55 a (0.18)
Motor	49.40 c (0.18)	49.16 c (0.19)	50.32 b (0.15)	51.40 a (0.14)
Language and Communication	49.90 b (0.20)	48.97 c (0.19)	49.76 b (0.17)	51.61 a (0.15)

Mean of 50. Standard deviation of 5. Standard errors in parentheses

Following this logic, Peruvian children perform best in all other domains. Differences between Peru and the other three countries are statistically significant. Nicaraguan children on average perform below all the countries in the cognitive, motor, and language and communication domains, although no statistically significant difference exists between children in Nicaragua and Costa Rica in cognition and motor skills.

06

Differences within Countries

The analyses that follow find that the variation in child development, as measured by the Engle Scale, within countries is greater than the variation between countries. Child development is unequal, and inequality in results appears as early as 24 months. Correlations of any given factor vary by domain. For example, and as will be seen below, correlations with the wealth index and maternal education are stronger for cognition and language and communication than for motor development. The nurturing environment appears to be particularly important for all domains of child development, although the strength of this association varies. Concrete examples from the Engle Scale are provided to illustrate what different children can and cannot do when categorized by associated factor. Again, in addition to the data presented below, Annex A provides additional, descriptive data for each domain.

Socio-Emotional

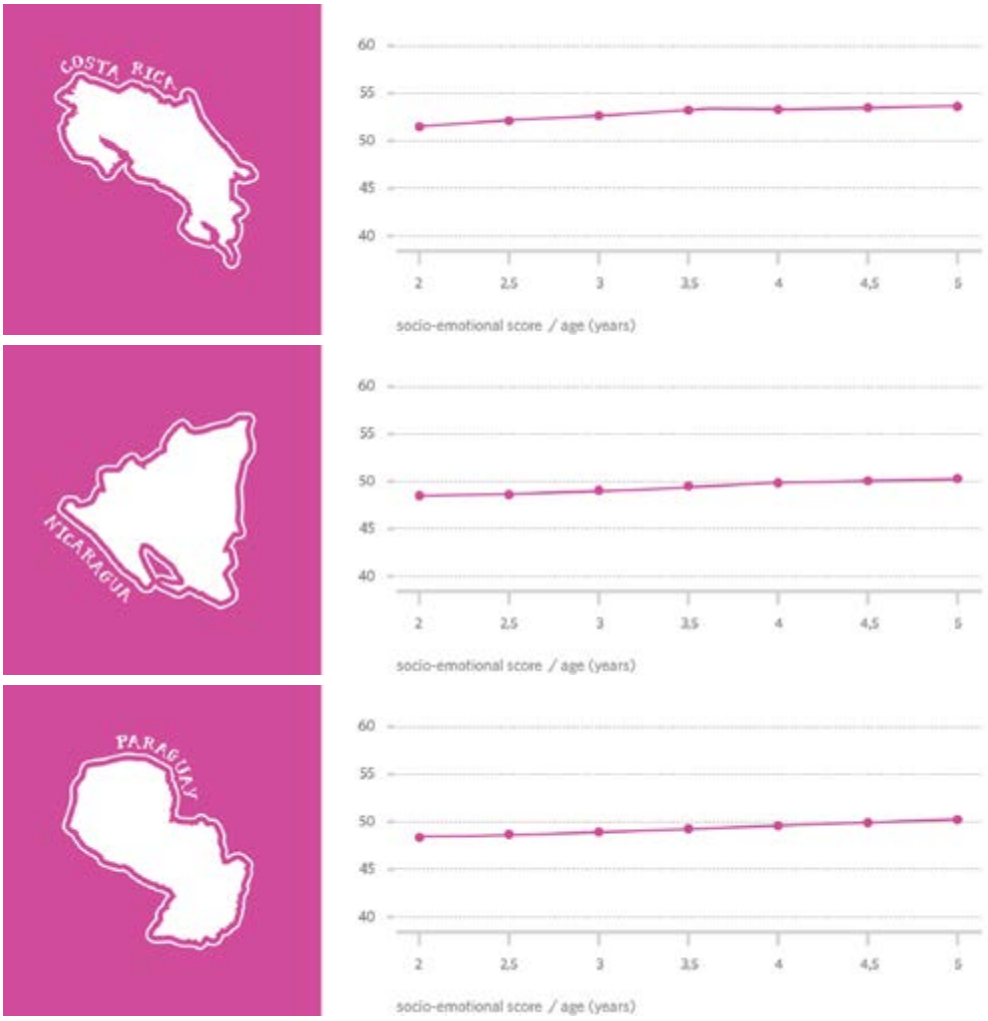
Recent literature has suggested that non-cognitive skills, including those in the socio-emotional domain, can be stronger predictor of future success than either the physical or the cognitive skills (Heckman, 2005). Non-cognitive skills also appear to be more malleable than cognitive skills.

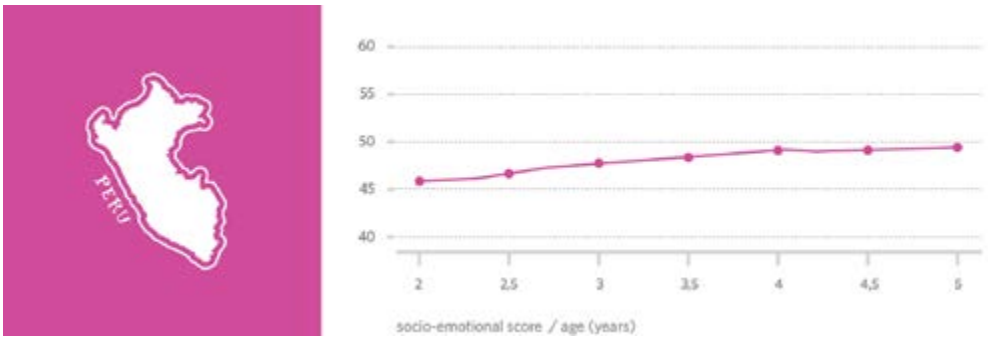
A child's socio-emotional development is the only domain in the Engle Scale assessed through maternal or principal caregiver report. The literature finds maternal report to be a valid means for assessing development in this domain (Fernald, et al, 2009).

The Engle Scale asks mothers or caregivers a series of 15 questions associated with the child's autonomy and socialization. Mothers respond to these questions with one of four options: almost never, sometimes, often, and almost always. For example, if the child can play for 15 minutes or more without needing attention from an adult; if, after a conflict, the child can control himself with the help of an adult; if the child helps with some things in the home when asked; if the child worries if someone is crying (is interested in the wellbeing of this person); and if the child is bothered by something, she can calm herself quickly by herself. The same scale was applied to all PRIDI children.

Of all the subscales measured by the Engle Scale, the socio-emotional subscale displays the weakest association with the age of the child (Graph V). Consistent with results reported above, "r" denotes that correlation between the score on the given domain and the age; asterisks indicate that this correlation is statistically significant.

Graph V. Socio-Emotional Scores by Age and Country



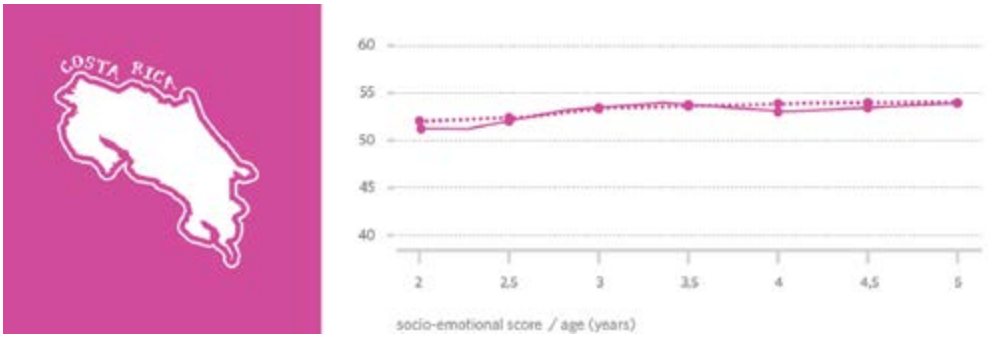


Score

Results from the Engle Scale suggest socio-emotional development bears a direct and statistically significant relationship with the social and economic context within which children are raised and reflect caregiver practices and limitations. The maternal education (Graph VI), wealth index (Graph VII) and nurturing environment (Graph VIII) wield interesting and varying associations.

In the cases of Nicaragua and Costa Rica, differences in a child's socio-emotional development by levels of maternal education are not statistically significant. In Paraguay and Peru, where the correlation with maternal education is statistically significant, results from the Engle Scale indicate that children with mothers with secondary education or more are "almost always" interested in the well-being of others: for example they "almost always" worry when another person is crying, sick or wounded.

Graph VI. Socio-Emotional Scores by Maternal Education, Age and Country



Incomplete primary or less

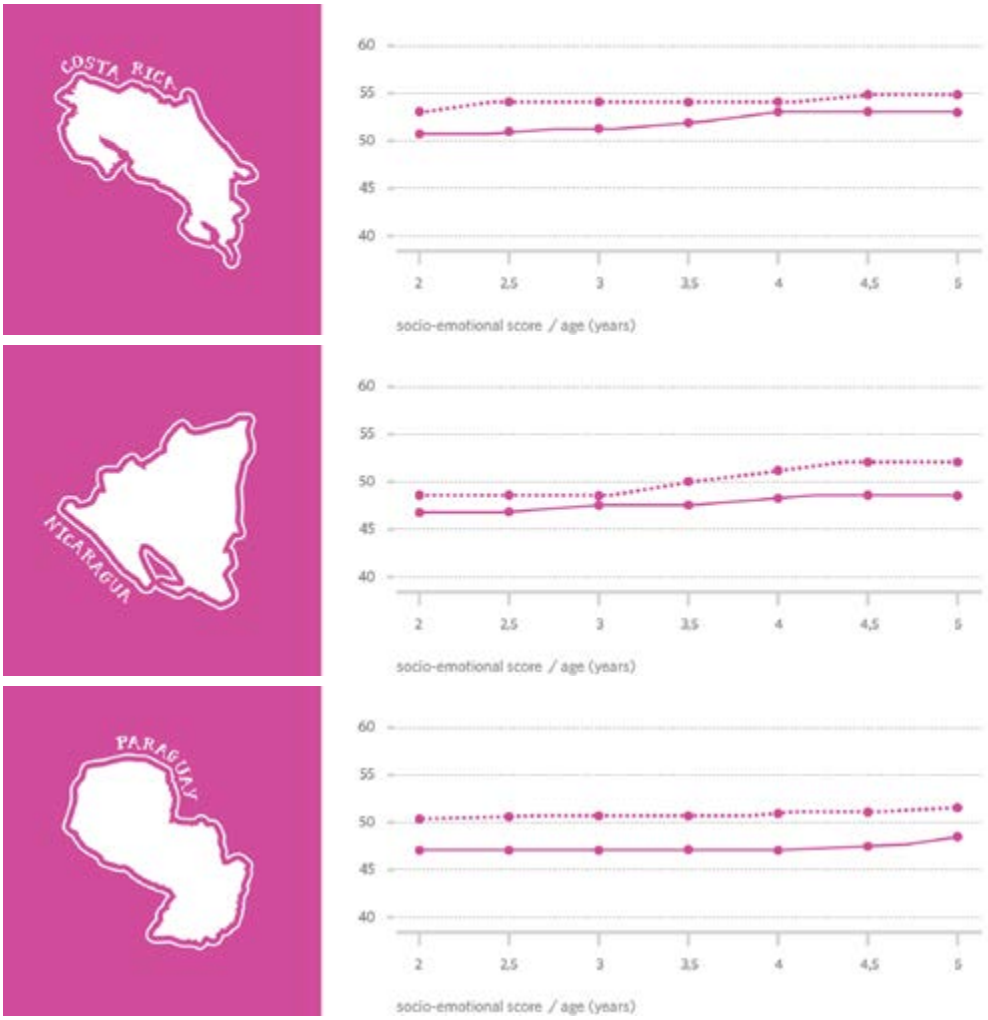
Complete secundary or more

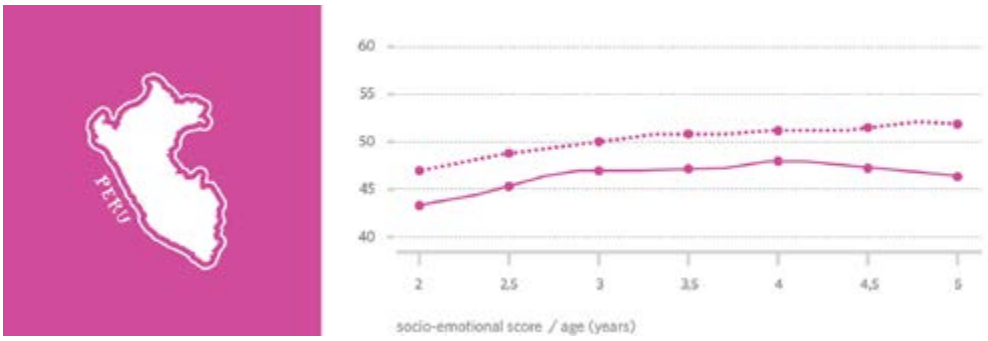
The wealth index correlates in a similar manner. In neither Costa Rica nor Nicaragua does a significant association appear. In those countries where statistically significant associations do appear (Paraguay and Peru), results from the Engle Scale find that children from wealthier homes "almost always" play alone for 15 minutes or more without needed attention from an adult and like to paint or draw.

Graph VII. Socio-Emotional Scores by Wealth Index, Age and Country

The nurturing environment appears to be a stronger discriminator than maternal education or the wealth index, in that its correlation with a child´s socio-emotional development appears statistically significant in all countries. This is consistent with literature from outside the Region. Mother sensitivity, a key component of the nurturing environment, tends to be the greatest predictor of non-cognitive development (Bakermans-Kranenburg, et al., 2004). Results from the Engle Scale indicate that children in nurturing environments "almost always" have preferences for some things and activities, like to paint or draw, and care about the well-being of others (i.e., they worry if someone else is sick or wounded, or crying).

Graph VIII. Socio-Emotional Scores by Nurturing Environment, Age and Country





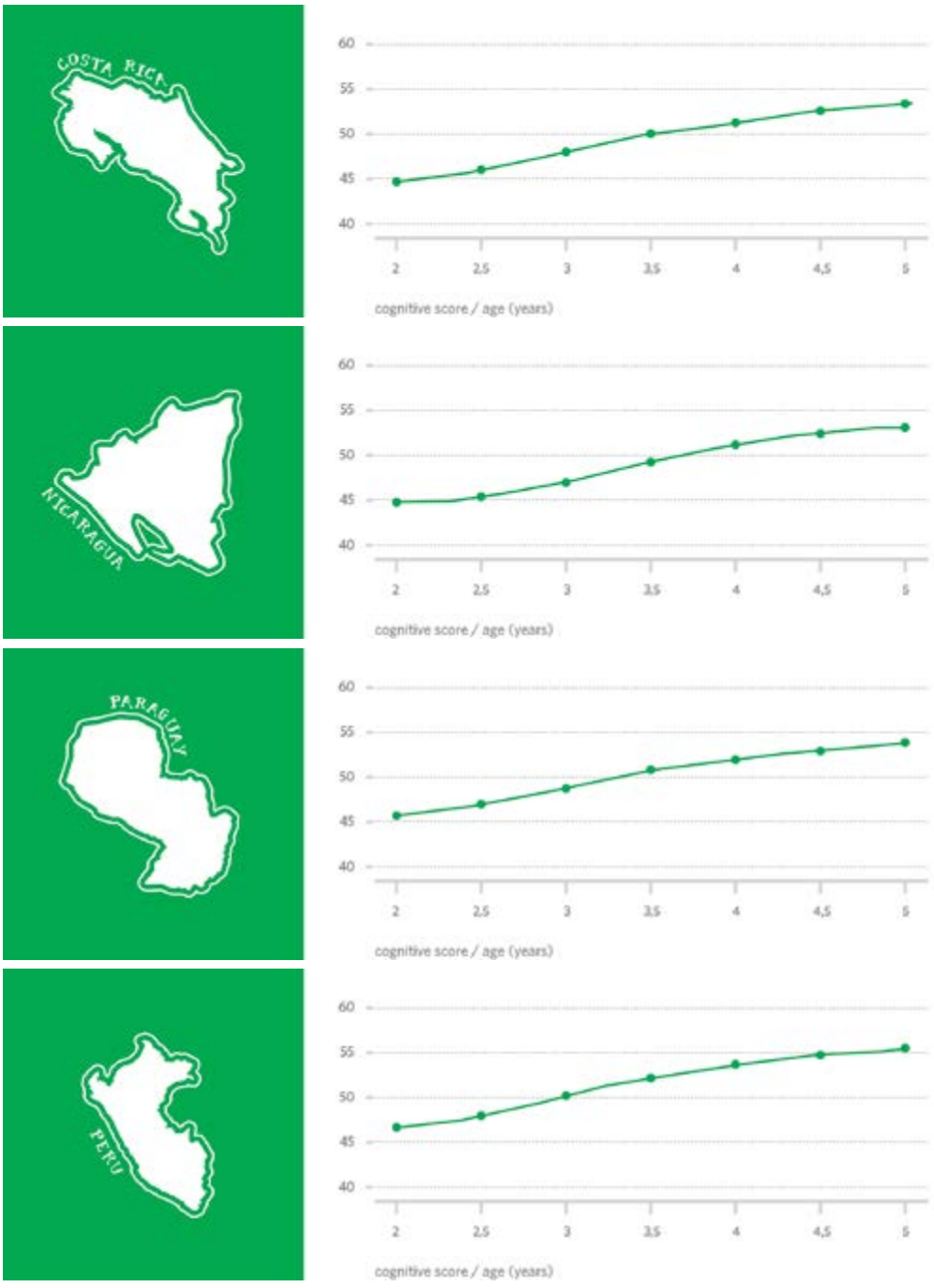
The association between stunting and children´s socio-emotional development is less understood than the association with cognitive development. PRIDI results presented in Annex A suggest that, in contrast to results in the other domains, stunting may not necessarily wield a fully negative association with a child's socio-emotional development. Stunted children in the four countries studied, on average, have the same level of socio-emotional development as non-stunted children; the same holds true for children reported to be in good and poor health. No statistically significant difference exists between boys and girls.

A clear message emerging from these results is that the nurturing environment appears to matter. How parents interact with their children and the quality of the adult-child interaction has important consequences for the socio-emotional development of children and their future successes in school, the labor market and beyond: do parents play with the child, sing with the child, is the child included in conversations. These are activities that can be performed independently of the resources available to the family, although poverty generates increased stress levels in households and often diminishes the ability of the parents to provide and engage in the necessary stimulation. Children in wealthier and more nurtured environments, and with mothers with higher levels of education, display by the age of 59 months key socio-emotional skills – including autonomy and empathy – that children from poorer and less nurtured environments do not. These skills are necessary for success in school and beyond.

Cognitive

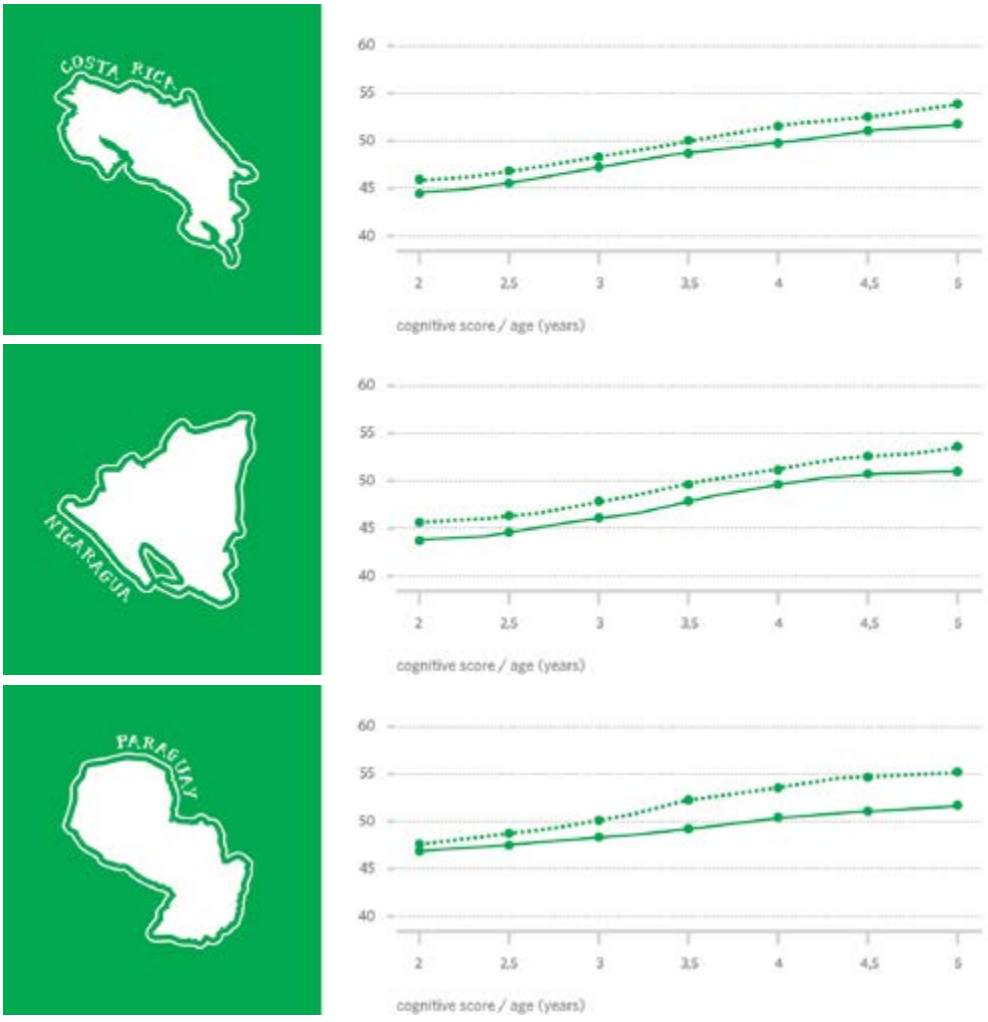
Cognitive abilities in young children include problem-solving and analytical skills, memory, executive functioning (higher order skills that regulate goal-directed behavior, including abilities to concentrate, stay focused and think, and not act on impulse), and basic notions of math. The Engle Scale evaluates these abilities by prompting children to solve problems with simple objects (e.g., identify concepts of more or less by using a puppet of a dog and asking which bowl has more food in it), match and sort colors (pairing toy animals; grouping colored cubes by size and color), do puzzles, and repeat series of unrelated words (head, pot; shoe, bread, moon; girl, sugar, hand, door). A direct relationship exists between age and scores on this subscale (Graph IX), as in the others. The "r´s" indicate the correlation between the score on the given domain and the age; asterisks indicate that this correlation is statistically significant.

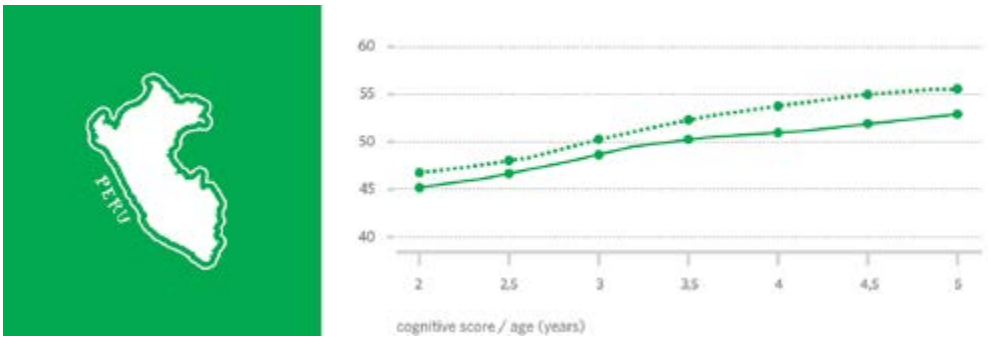
Graph IX. Cognitive Scores by Age and Country



Cognition, like language and communication development (discussed in the next section), bears a strong relationship with the level of parental, particularly maternal education, and the interaction of this factor with genetics (Shonkoff and Phillips, 2000; Fernald, et al., 2009). Results from the Engle Scale generally confirm this trend, although maternal education is not statistically significant in Costa Rica (Graph X). Results from the Engle Scale indicate that children with mothers who have secondary education or more understand temporal sequences (i.e., they can order cards showing the hatching of a chick: of an egg, an egg cracking open, and a chick coming out) and can order objects by shape or color.

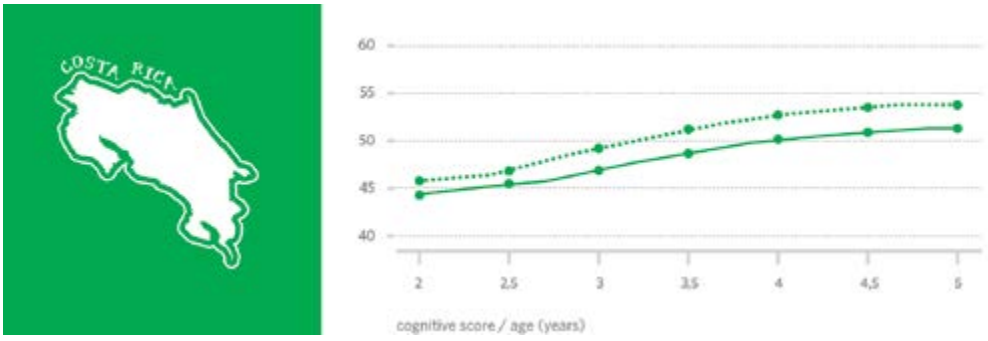
Graph X. Cognitive Scores by Maternal Education, Age and Country





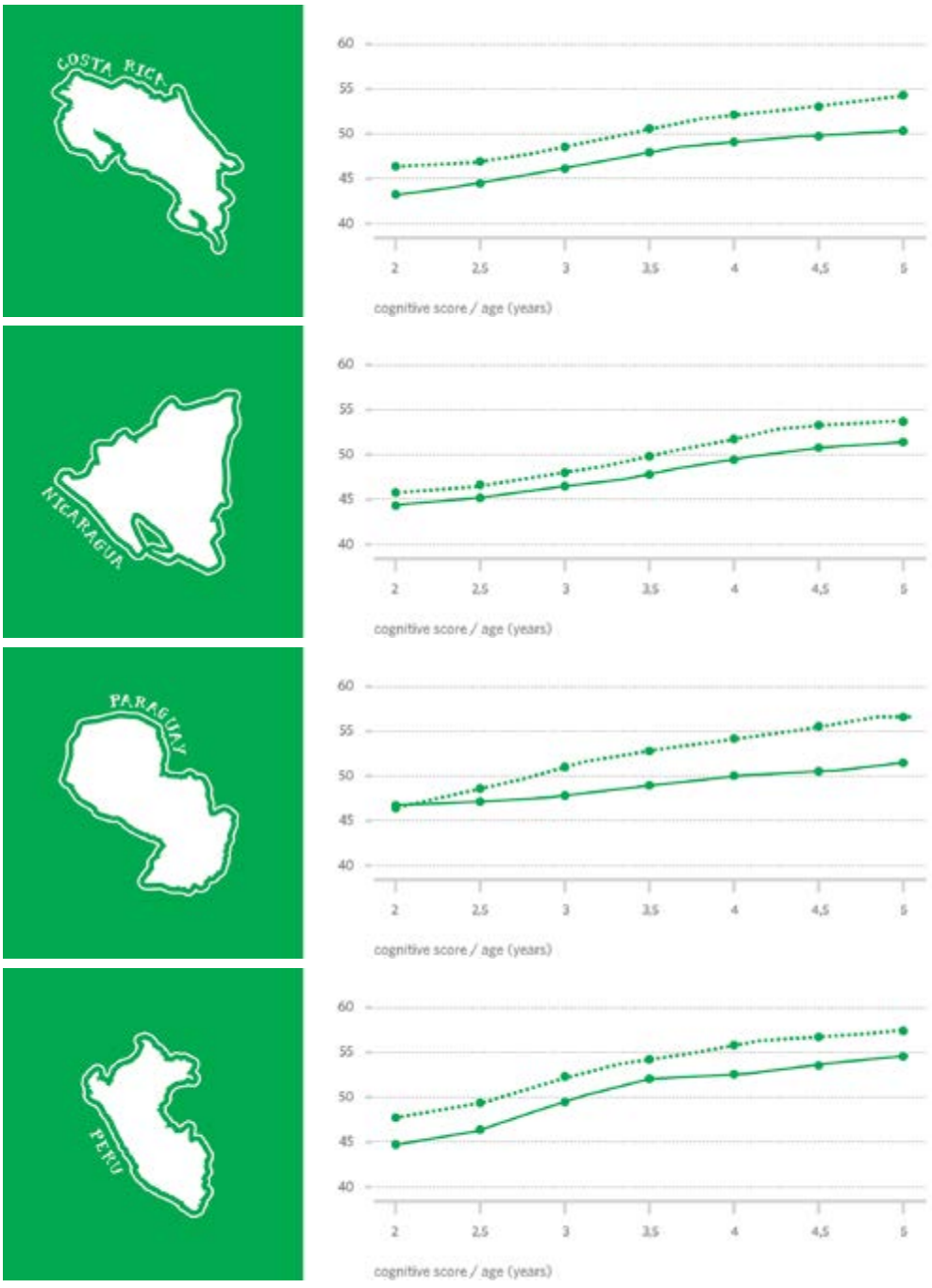
The wealth of the household bears a strong relationship with the level of cognitive development in PRIDI children (Graph XI). Statistically significant differences between richer and poorer children exist by the age of two and expand over time. This is consistent with trends for the Region documented by Schady et al. 2014, Rubio-Codina et al., 2014, Paxon and Schady, 2011; and Schady, 2006. Poverty places considerable constraints on the abilities of families to invest in resources (e.g., books) necessary for development along these domains (Grantham-McGregor et al., 2007; Engle et al., 2007; Almond and Currie, 2010). Results from the Engle Scale indicate that children from richer homes can respond coherently to when asked what they do if they fall and get hurt, are tired, or are hungry; and can count to 20.

Graph XI. Cognitive Scores by Wealth Index, Age and Country



The nurturing environment also holds an important relationship to a child's cognitive development. Differences between children on the high and low-end of the nurturing environment index are statistically significant and increase as the child ages (Graph XII). Gaps at 59 months are greater than those observed at 24 months. Results from the Engle Scale find that children from nurtured environments have better executive functioning skills (measured by showing a child a series of card with images of a dog, chicken and cow, and asking a child to put her hand over only those cards showing a cow).

Graph XII. Cognitive Scores by Nurturing Environment, Age and Country



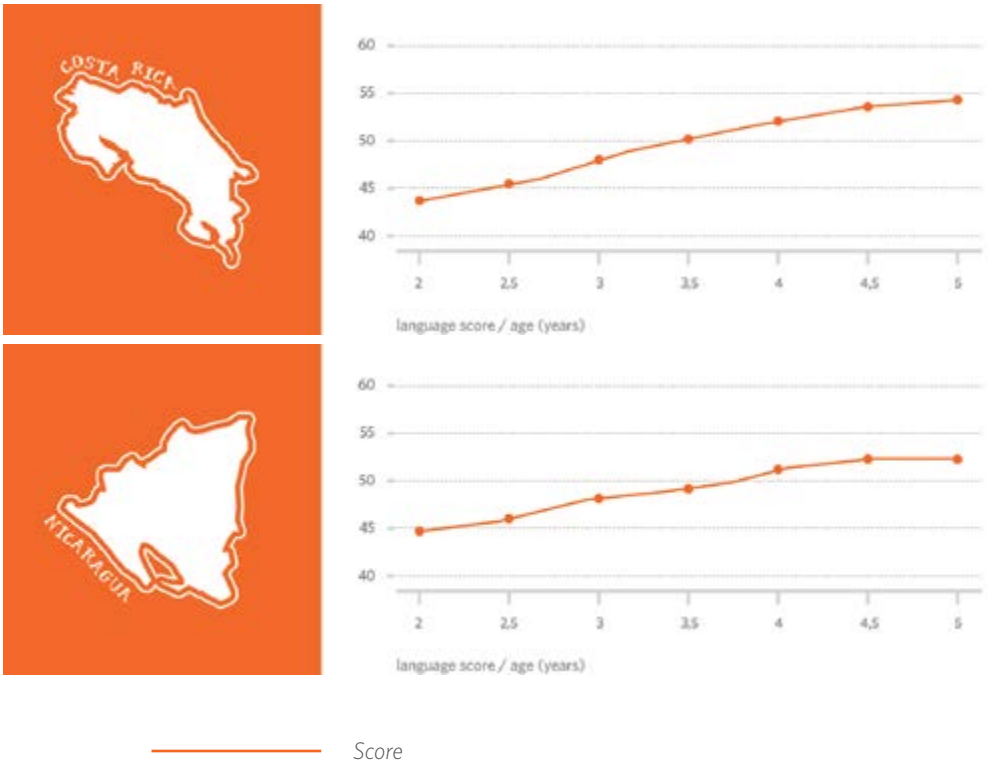
Non-stunted children outperform stunted children in all countries but Paraguay. In contrast to the socio-emotional domain where no statistically significant difference exists in gender, a gap favoring girls emerges in Costa Rica and Peru (see Annex A).

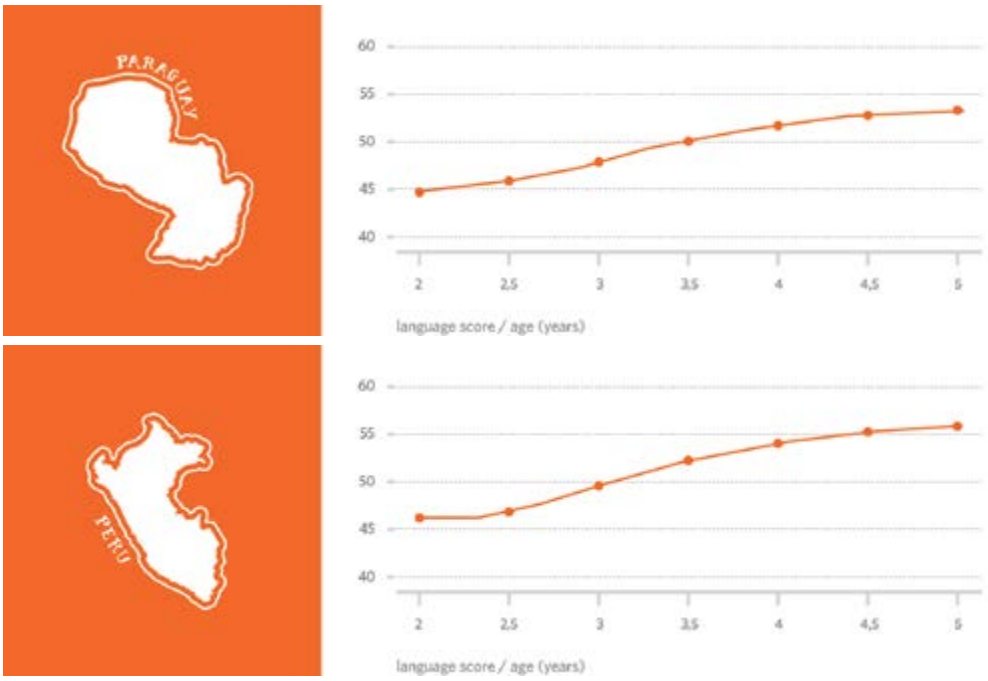
The message emerging from these results echoes the need to target high quality interventions towards the poorest children. There is an important gap in cognitive development between poorer and richer PRIDI children, in both the material (wealth index) and emotional sense (nurturing environment). Meaningful differences are apparent throughout the PRIDI age cohort and tend to widen as children age. The skills that children have by 59 months on the higher ends of the maternal education, wealth, and nurturing environment indices are basic. The fact that children on the lower ends of these indices have not mastered such skills is alarming.

Language and Communication

Language skills run the gamut of vocabulary and the communication of thoughts, ideas and feelings, to the understanding of instructions and the ability to read. The Engle Scale assesses expressive language skills by asking the child to name different body parts (finger, eyebrow, knee, stomach, elbow), differentiate concepts such as in front of and behind, give her name and the name of mother, and correctly use the present, past and future tenses of a verb. In the Engle Scale, and consistent with the literature, this subscale is positively related to the age of the child (Graph XIII). Again, "r" denotes that correlation between the score on the given domain and the age; asterisks indicate that this correlation is statistically significant.

Graph XIII. Language and Communication Scores by Age and Country

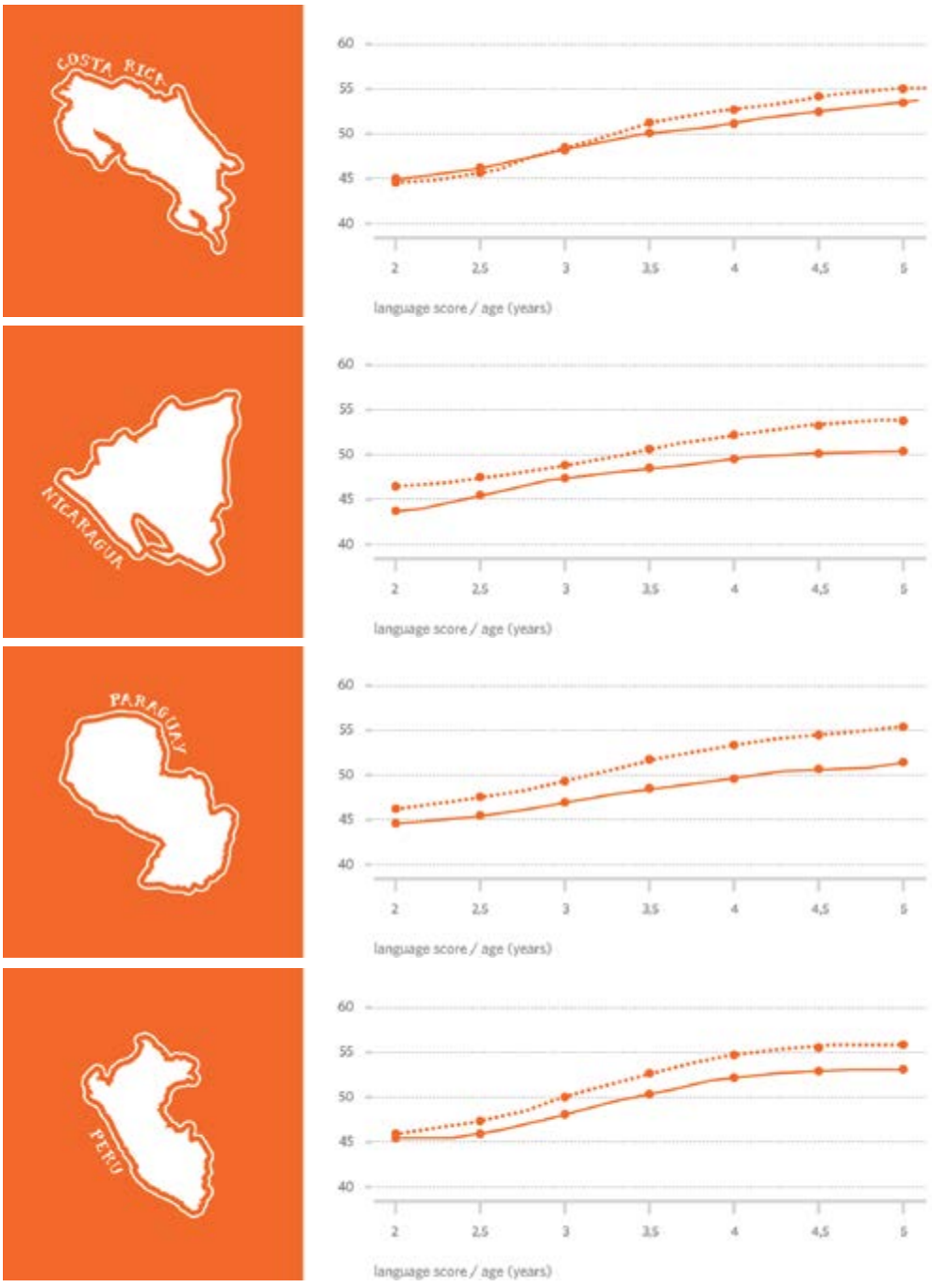




The literature establishes a close link between language, vocabulary and reading comprehension. It also finds that a child's language development bears a close association with the socioeconomic level of the home, the level of parental (particularly maternal) education, and the quality of the adult-child relationship. Families with fewer of these assets and resources have fewer books in their homes and thus are less likely than more advantaged families to read to their children, a critical means for exposing children to words and building their vocabularies. Fernald et al. (2013), Fernald et al, (2009) and Hart and Risley (2005), among others, find that children in disadvantaged households receive less directed speech and shared communication from their parents or caregivers. The speech these children hear is less complex in sentence structure and vocabulary and less responsive to their signals. As a result, they enter formal schooling with deficits, speaking and recognizing fewer words than children from more advantaged homes. Such deficits tend to accumulate over time.

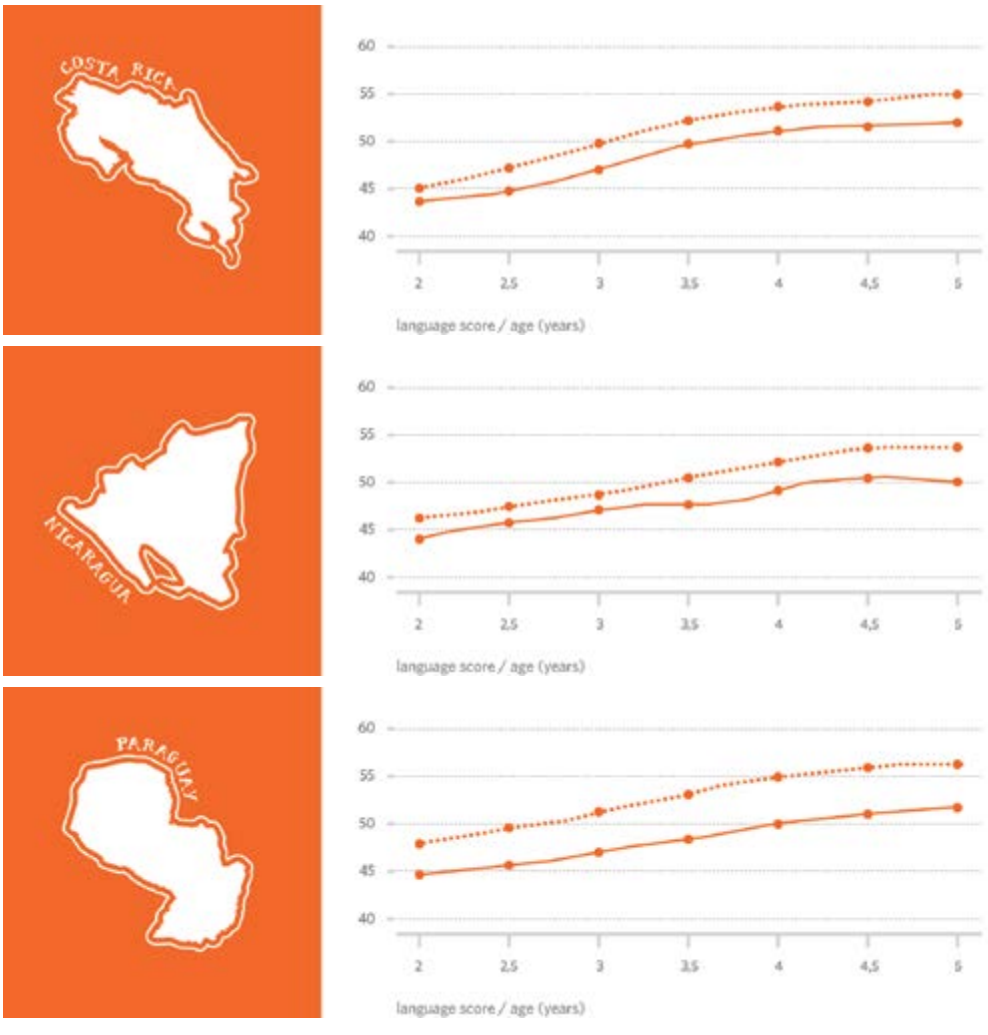
Results from the Engle Scale are consistent with these findings. In all countries but Costa Rica, statistically significant differences appear: the more educated the mother, the higher the language and communication development of her children; this is particularly the case for older children (Graph XIV). Results from the Engle Scale find that children of mothers who have secondary education or more know their colors (i.e., red, yellow, blue) and can name geometric figures (i.e., triangle, square, circle, star, rectangle, oval).

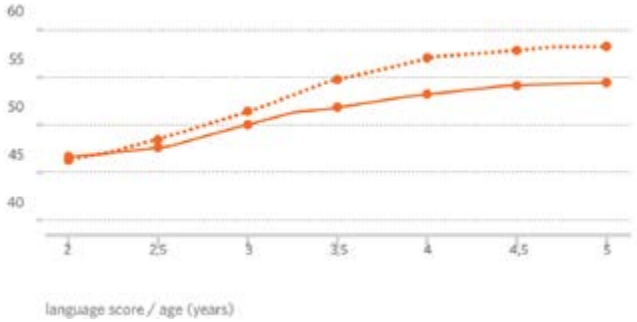
Graph XIV. Language and Communication Scores by Maternal Education, Age and Country



Children at the top end of the wealth and nurturing environment indices display higher language and communication scores. Differences between children at the tails of both indices are statistically significant and widen over time (Graphs XV and XVI). Results from the Engle Scale find that children at the high ends of wealth and nurturing environment indices – in addition to knowing their colors and being able to name geometric shapes – know the difference between front and back; can correctly use the past, present and future tenses; and can name common activities (i.e., petting a dog, cleaning, milking a cow, brushing hair, washing clothes, building a wall, swinging). These are all skills that will make these children considerably more ready to learn when they enter school than their peers in poorer and less nurtured environments.

Graph XV. Language and Communication Scores by Wealth Index, Age and Country

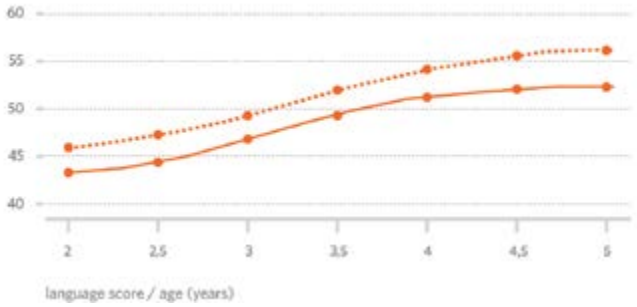


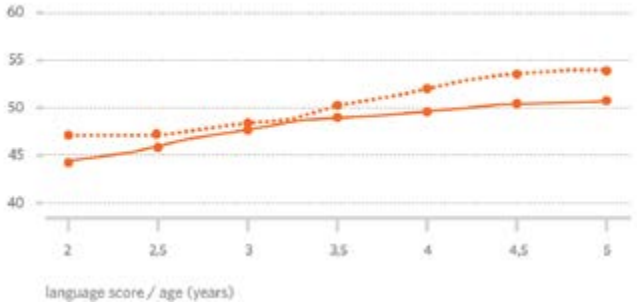


Lowest quintile (less wealthy)

Higuest quintile (most wealthy)

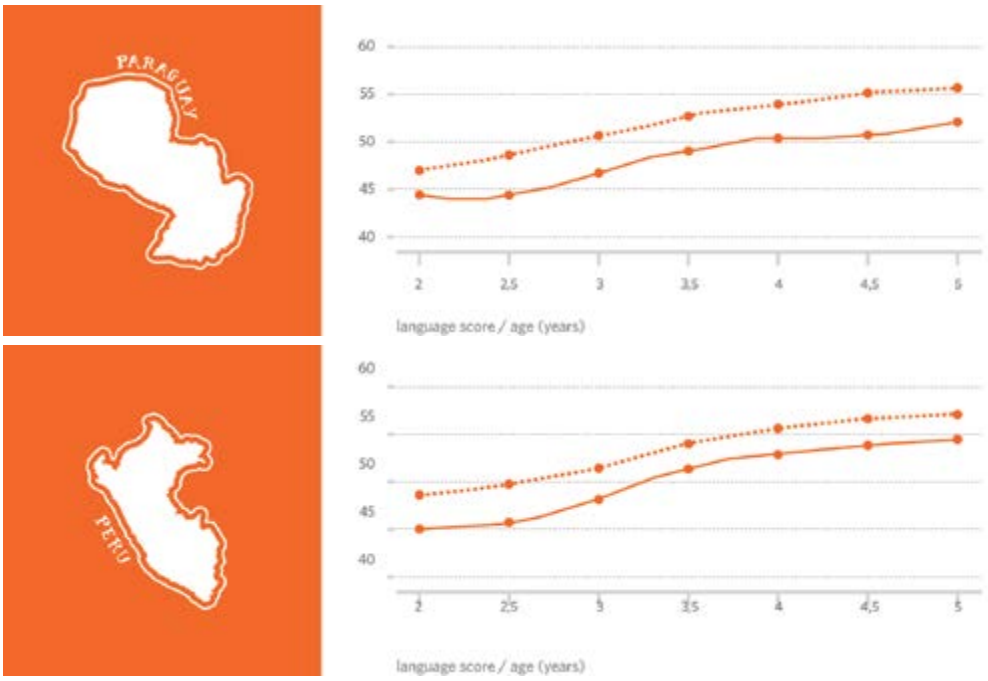
Graph XVI. Language and Communication Scores by Nurturing Environment, Age and Country





Lowest quintile (less nurturing)

Highest quintile (most nurturing)



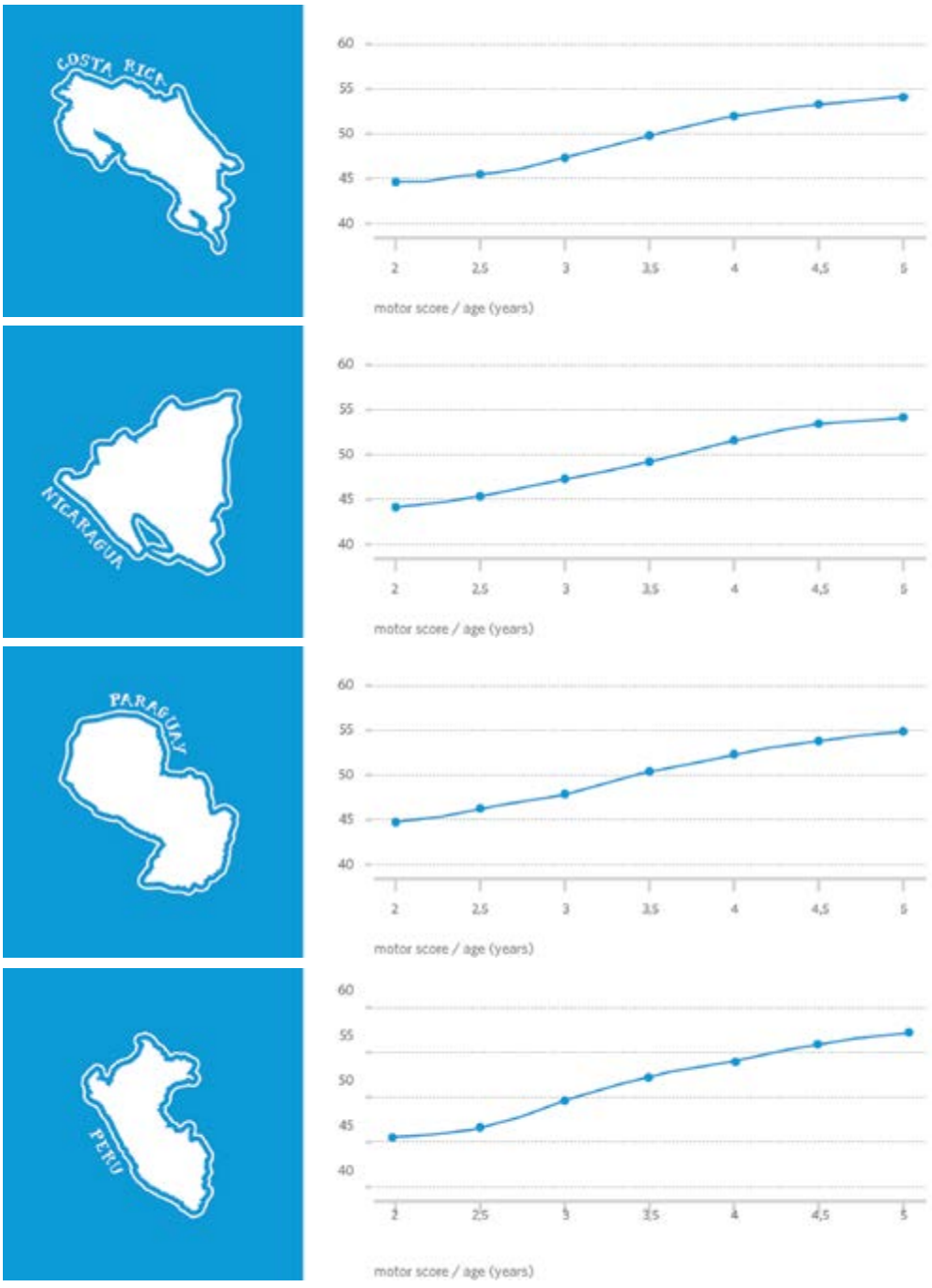
Annex A provides additional data. Similar to the cognitive domain, girls outperform boys, and stunted children fall behind non-stunted children. Language and communication development in children reported to be in good health does not differ in a statistically important way from children reported to be in poor health in any of the four countries.

The message emerging from these analyses suggest that interventions working directly with mothers or caregivers in how to be more responsive to their children's needs and signals could generate improvements along this domain. Included here would be teaching mothers or caregivers how to listen, understand and communicate more effectively with their children. This includes reading. Results of the Engle Scale in this domain parallel those found in the other domains and sound the alarm for children in less educated, less nurtured and less wealthy households.

Motor

At its most basic, this domain speaks to the ability of children to move. Nearly all healthy children reach key milestones – e.g., walking, running – in this domain, although the timing often varies. For this reason, motor skills, particularly gross motor skills at the ages under study, tend to be less predictive of future skills and abilities, although failure to reach a milestone can indicate the possibility of a developmental delay. Results from the Engle Scale confirm this relationship between age and motor development (Graph XVII). The "r" denotes that correlation between the score on the given domain and the age; asterisks indicate that this correlation is statistically significant.

Graph XVII. Motor Scores by Age and Country

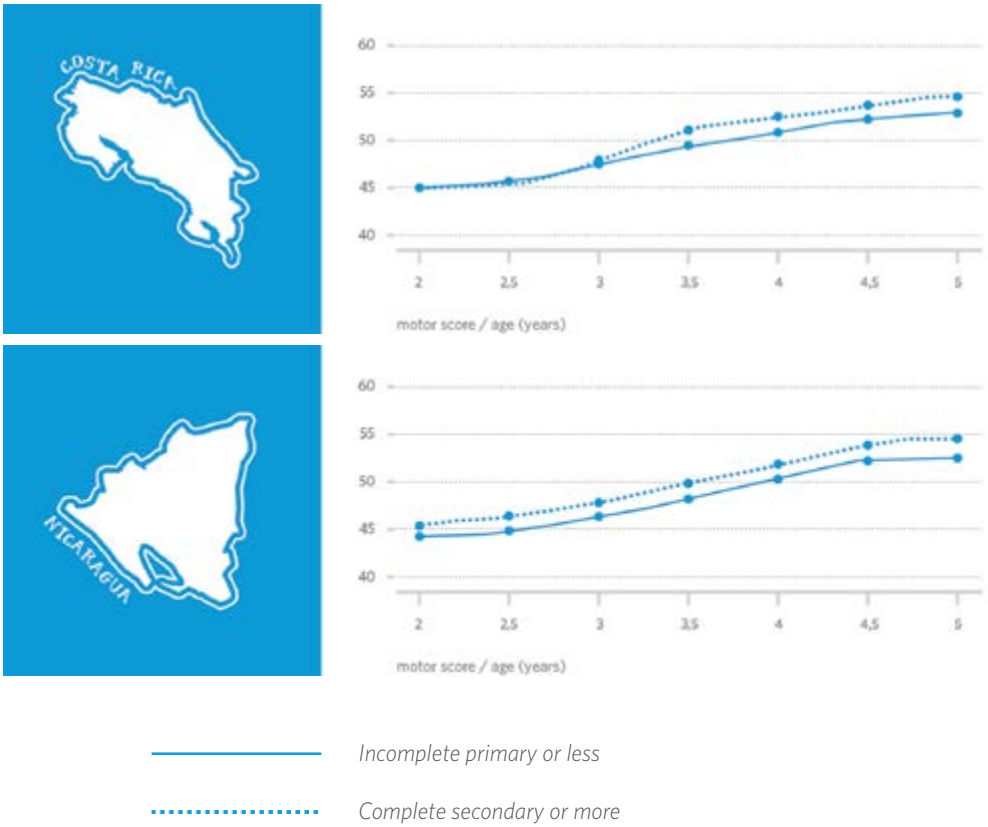


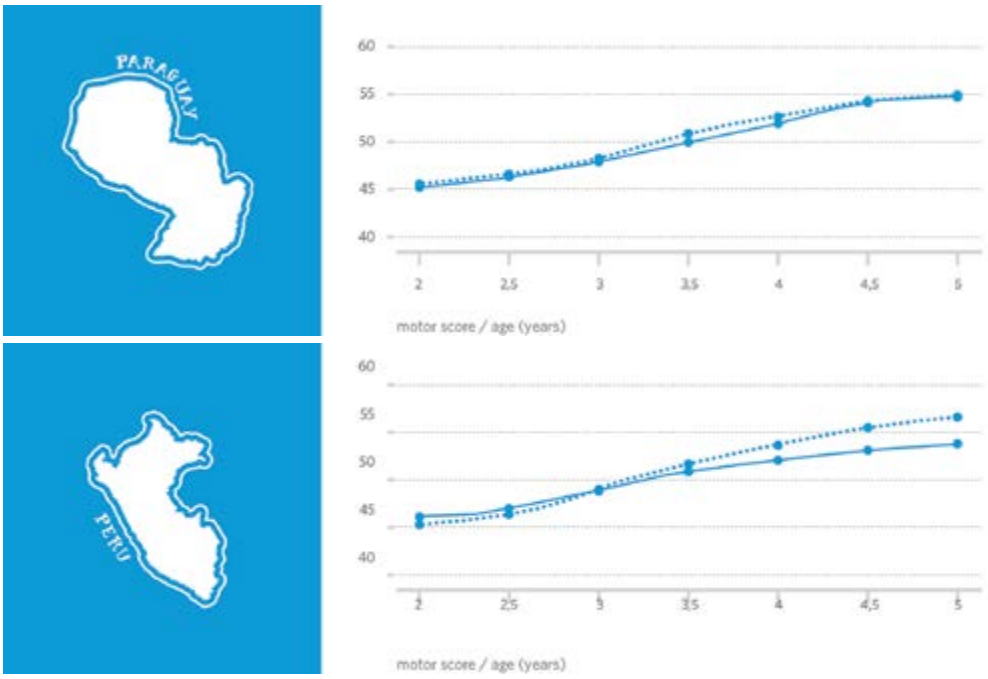
Recent research suggests that a child's development along this domain reflects more than brain and neuromuscular maturation. Motor development requires perception and adaptation to the surrounding environment, factors that are affected by physical growth and caregiver practices, among other variables (Fernald, el at., 2009). For example, walking is a developmental milestone but, by walking, a child can explore, communicate, and learn more.

The Engle Scale assesses both gross and fine motor skills, which the literature suggests function together. For example, it asks the child to copy figures (a straight line, circle, rectangle, triangle), to create a bridge out of 5 blocks, jump with two feet (younger children only), walk in a straight line, and catch a ball.

Results on this domain differ from those on others in significant ways. Of the four countries studies, only in Nicaragua does maternal education wield a statistically significant impact on a child´s motor development (Graph XVIII). There, results from the Engle Scale find that children of mothers with secondary education or more can jump with both feet together and walk in a straight line.

Graph XVIII. Motor Scores by Maternal Education, Age and Country



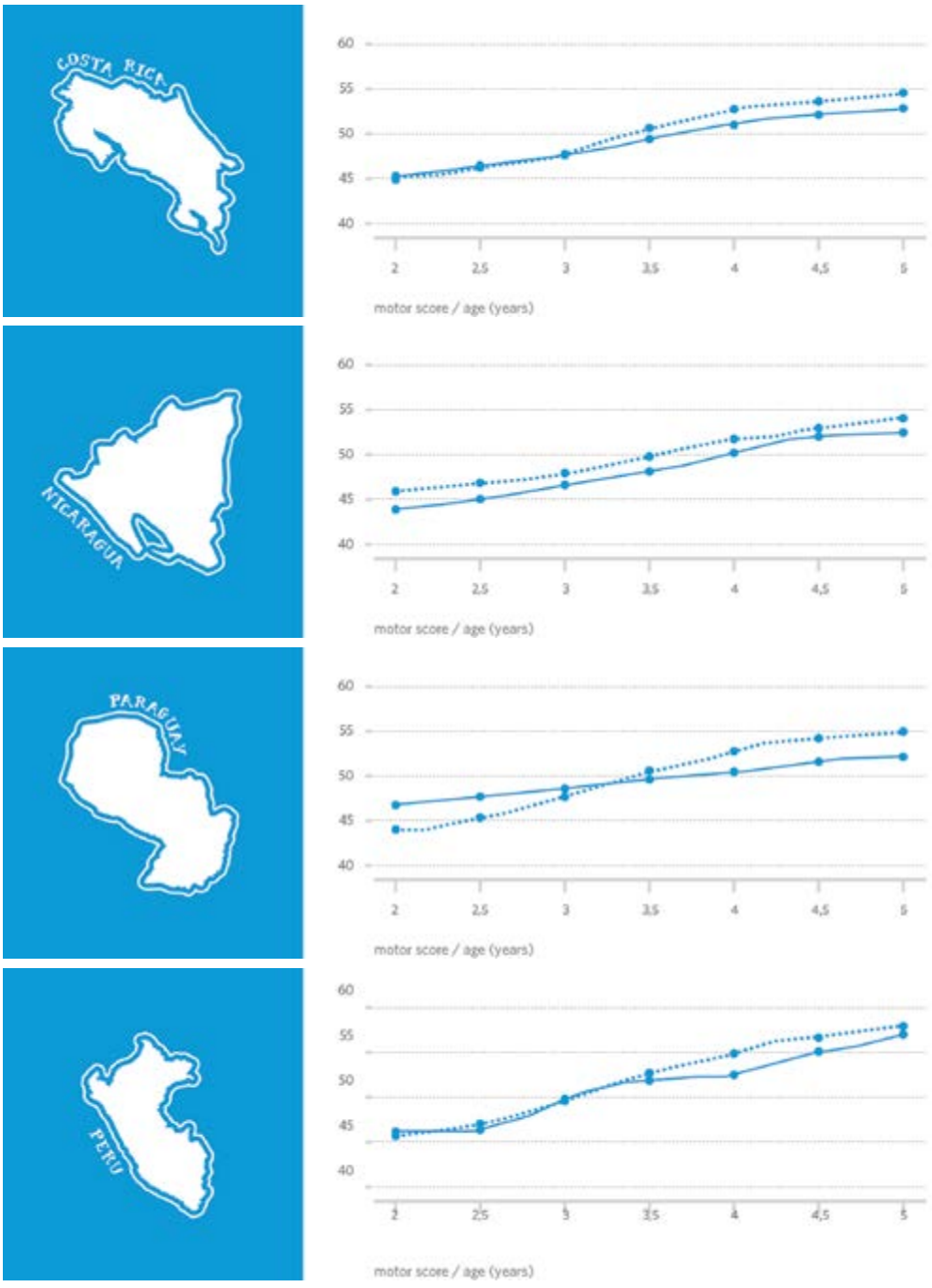


Incomplete primary or less

Complete secondary or more

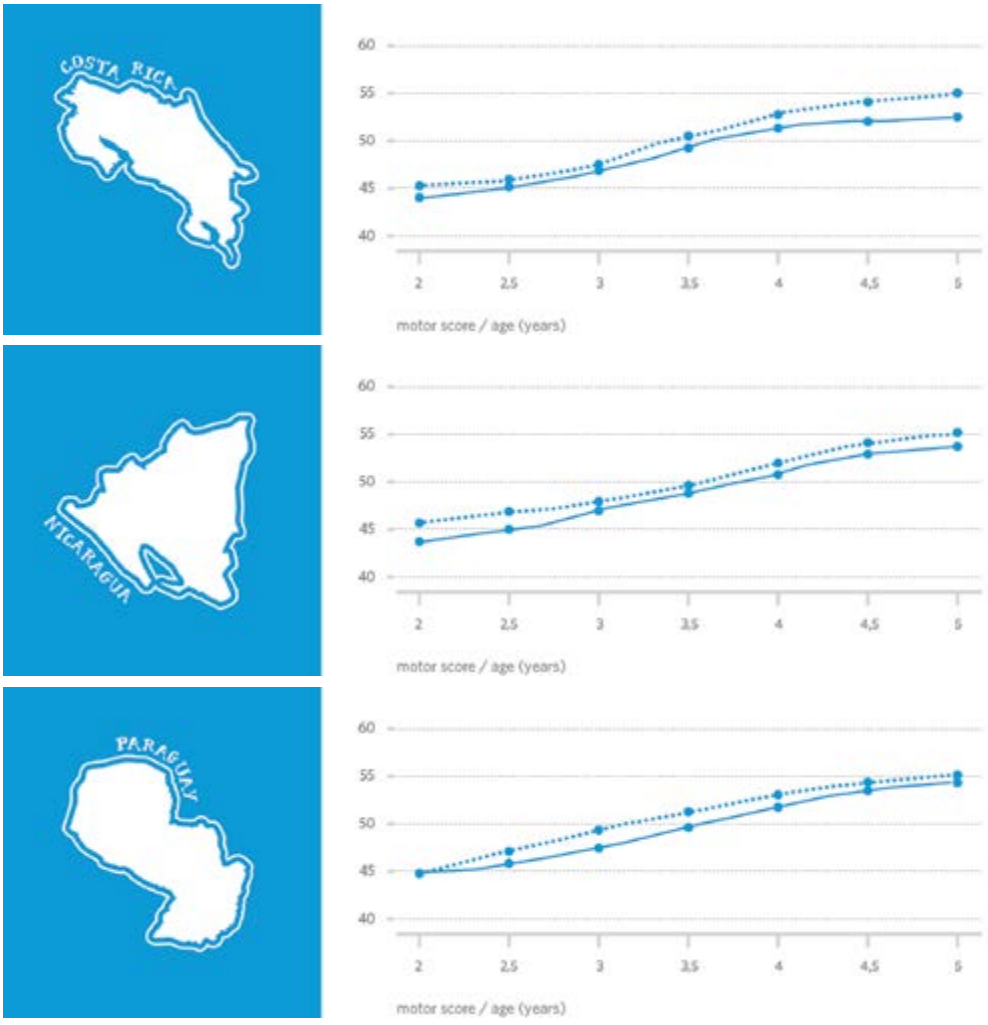
The wealth index (Graph XIX) displays statistically significant differences in all countries, but the respective trends are curious. In Paraguay, richer children start off behind their poorer counterparts, then catch up and surpass them. In Costa Rica and Peru, motor development appears quite equal in younger children, with a gap appearing around 3.5 years, the same point at which trends in Paraguay between richer and poorer children start to reverse. In Nicaragua, a gap favoring richer children remains across the PRIDI cohort. Results from the Engle Scale indicate that children from wealthier homes can build a bridge from 3 blocks, in addition to walking in a straight line and jumping with both feet together.

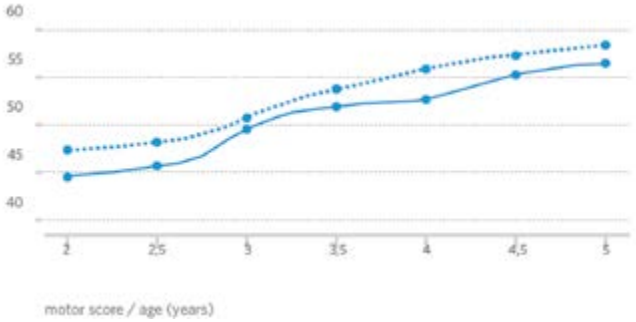
Graph XIX. Motor Scores by Wealth Index, Age and Country



The nurturing environment maintains a more linear and statistically significant association with a child's motor development as measured by the Engle Scale (Graph XX). In addition to those skills mentioned above, children from nurtured environment can catch a ball.

Graph XX. Motor Scores by Nurturing Environment, Age and Country





Lowest quintile (less nurturing)

Highest quintile (most nurturing)

As seen in Annex A, no statistically significant difference overall exits between boys and girls, between stunted and non-stunted children, or between children reported to be in good and poor health.

The clear message emerging from this domain is the lack of association between motor skills and the three key associated factors included in this report (maternal education, wealth index, nurturing index). The motor domain thus functions differently than the socio-emotional, cognitive, language and communication domains. Interesting next steps would be to look at the interaction between motor skills and the other domains measured by the Engle Scale. An increasingly larger body of literature links physical activity with better cognitive control (inhibition and working memory, in particular, both of which are associated with achievement in math and reading) and executive functioning from the age of 3-4 onwards (Diamond and Lee, 2011; Chaddock et al., 2011a, 2011b).

07

PRIDI's Indigenous Children

PRIDI includes indigenous children and is able to report results for indigenous-language speakers in Nicaragua and Paraguay. Despite best efforts to include Quechua-speaking children in Peru, the final sample is not sufficient to draw reliable results.

Several interesting results emerge from the results of the Engle Scale in indigenous children. Guarani-speaking children tend to underperform when compared to their Spanish speaking peers. However, the reverse is true for Miskito children in Nicaragua. These children outperform Spanish-speaking children in the cognitive and motor domains, with no statistically significant difference between the two groups in the language and communication domain (Table X). The use of superscripts (a, b) follow the same logic as above. Means with different superscripts (a, b, read horizontally between populations in the same country) differ in a statistically significant way from each other ($p < 5\%$, T-test for independent samples): a > b.

Table X. Results of Indigenous-Speaking versus Spanish-Speaking Children in Nicaragua and Paraguay

	Nacaragua				Paraguay			
	Miskito		Spanish		Guarani		Spanish	
Socio-Emotional	43.12 (0.40)	b	49.50 (0.19)	a	48.25 (0.22)	b	49.82 (0.21)	a
Cognitive	50.00 (0.33)	a	48.87 (0.22)	b	49.19 (0.21)	b	51.23 (0.23)	a
Motor	50.31 (0.46)	a	49.12 (0.19)	b	49.73 (0.22)	b	50.75 (0.20)	a
Language and Communication	48.90 (0.34)	a	48.97 (0.20)	a	47.98 (0.20)	b	51.03 (0.22)	a

Standard errors in parentheses.

Results for Miskito children invite reflection. An issue regarding the Scale and its translation in indigenous languages arises. At the end of Phase II, the country team in Nicaragua reviewed the instruments and the translated versions, adjusted some of the translations in Miskito and re-tested the newly translated items prior to advancing to Phase III. This was not the case in Paraguay. The Guarani version of the Engle Scale was not applied during phase II, but first used in Phase III. This calls attention to the difficulties of ensuring the cross-cultural and cross-linguistic comparability of items (e.g., ensuring items the same level of difficulty of items included in the language and communication scale). Another factor could be the composition of the sample, which was largely urban in the RAAN, whereas the overall sample in Nicaragua was more rural.

These factors aside, it merits noting that in the 2009 application of the Early Grade Reading Assessment (EGRA) test in Nicaragua, Miskito children display better performance in oral comprehension (Castro, et al., 2010). Miskito largely remains an oral language, widely spoken in the RAAN but with few inhabitants who write and read it. In addition, Serpell and Nsamenang (2014), in stressing the importance of culturally relevant instruments, suggest that bilingualism may be associated with better cognitive capacities. Although PRIDI data do not indicate whether its children in the RAAN are mono- or bilingual, a high probability exists that they have been exposed to Spanish. Morales, et al. (2013) find that bilingual 5 to 7 year olds have better working memory and executive functioning skills, abilities which bear a close relation to cognition.

08

Gaps in Child Development

Wealth Matters. Gaps in development in PRIDI children vary by domain, as illustrated above. Consistent with the literature, the stronger associations with the wealth index appear with cognition, language and communication, and socio-emotional; the weakest is with motor skills. By the time a PRIDI child in the poorest wealth quintile turns 5, her development lags behind that of her peers in the highest quintile by 2 months for cognition, 9 months for motor skills, and 16 months for language and communication.

But the environment in which a child develops may matter more. Scores from the Engle Scale suggest that the nurturing environment is a powerful factor affecting child development. Trends from this factor track those of the wealth index but, depending on domain, are stronger. By the time a PRIDI child in a home with minimal stimulation (lowest quintile in the nurturing environment index) turns 5, her development lags behind that of her peers in homes characterized by high quality adult-child interactions by 8 months for cognition, 19 months for motor skills, and 13 months for language.

Results from the Engle Scale also suggest that the nurturing environment can give kids in poorer households an edge-up. Performance of nurtured but poor children approaches that of the richest but less nurtured children on all domains with the exception of language and communication. In this domain, their performance continues to lag behind richer and less nurtured children, but is higher than their less nurtured peers (e.g., poor and un-nurtured children). Notably, on the socio-emotional domain, performance of poor children in a nurtured environment is essentially on par with that of nurtured children in richer homes. In this case, the nurturing environment closes the gap between rich and poor children.

09

Benchmarking Child Development

Economic and emotional investments in children are the best bet for ensuring a good start in life. In an effort to benchmark results from the Engle Scale, two groups of children were created (see Annex A). The first, privileged, has all the benefits of wealth and a nurturing environment (highest quintile in both indices). The second, not privileged, falls on the other end of the scale (lowest quintiles of wealth and the nurturing environment). The results are clear. The gaps between the two groups are large across all domains with the exception of socio-emotional. These differences are equivalent to 18 months for cognition, 17 months for motor skills, and 18 months for language and communication.

These results clearly highlight the advantages of children born to parents who invest emotional and economic resources in their development. These children will likely thrive in school, become healthy and productive adults, and pass on the advantages that such advantage brings to their own children. Children born in homes that lack such economic and emotional resources are at a disadvantage prior to entering school. The odds are stacked against them from the beginning. Chances are that neither school nor any life experience will level the playing field.

10

Conclusions and Moving Forward

The processes applied throughout the three phases of PRIDI have produced a valid and reliable instrument – the Engle Scale - for measuring the cognitive, language, socio-emotional and motor development of children 24 to 59 months in 4 countries. Results from the Engle Scale clearly show that child development is unequal. Inequalities exist between countries, by populations within countries and developmental domains. Particularly in the cases of cognition, and language and communication, gaps are evident early-on, with the youngest of the PRIDI cohort, and increase as children age. These gaps signal that not all children will have success in school. This calls attention to the urgency to intervene early on. The analyses presented also suggest that interventions targeting both children and parents may be effective in closing gaps in child development, such as working with parents to be more responsive in talking, listening and communicating with their children.

Gaps also exist by associated factors. Of all factors considered in this report, three are consistent in the relation they hold with child development: wealth, maternal education, and the nurturing environment. When young children have the benefits of all three, they likely will thrive, although the results presented here suggest that a nurturing environment can help mitigate the negative association lower levels of wealth have with the domains of development measured by the Engle Scale.

A long line of literature speaks to the correlations between child development, maternal education and the socio-economic status of the home. PRIDI confirms this for all domains, although the relation with these factors is weaker with motor skills. Far less evidence exists for the relationship with the nurturing environment. In this respect, PRIDI contributes to the existing body of knowledge by demonstrating the association child development has with the nurturing environment. Results from the Engle Scale clearly indicate that the quality of adult-child interactions matters. The nurturing environment matters for child development in the four domains included here, for all countries, and populations within countries. This opens the door to a plethora of interventions targeted towards families and parenting, including programs to improve the quality of the adult-child interactions in the home (e.g., reading, singing, responsive communication).

PRIDI calls attention to the need to look deeper into what different communities are doing to promote the development of children, like the Miskito in Nicaragua. The development of these children is mostly on par with their Spanish-speaking peers, despite the fact that levels of household wealth and maternal education tend to be lower in the RAAN than in the rest of Nicaragua.

In addition, PRIDI sends a message to schools and administrators. The PRIDI children are entering formal schooling. Schools need to be ready to receive them and provide them with a quality education, all of which holds implications for the structuring of curricula, the training of teachers, and outreach with families and communities.

Moving Forward

The analyses presented here raise a number of questions for future research. Foremost among these is the issue of predictability. Skills that children need for success in school are quite similar across countries and populations. These skills run the gamut of cognitive, social and emotional skills, some of which the Engle Scale measures in young children. To confirm the hypothesis, a panel of PRIDI children would need to be constructed and their performance in primary education measured. PRIDI samples were constructed in such a way as to allow for this type of analysis in the future.

Finally, PRIDI is a public good. Its instruments, manuals, database and reports are available to researchers and practitioners interested in child development in Latin America. The PRIDI database is a goldmine for research, with information on a number of factors not included in this report. The Engle Scale is solid and provides holistic look at ECD with relatively few items. This invites replication in other countries and, by doing so, opens the frontier for installing new capacities for evaluating early childhood development beyond the four original PRIDI countries.

Annex A

Data Tables by Domain

Socio-Emotional Development		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Sex	Male	52.84 a (0.21)	49.28 a (0.25)	49.00 a (0.19)	48.58 a (0.19)	49.92 a
	Female	53.34 a (0.23)	49.28 a (0.20)	49.35 a (0.23)	48.46 a (0.16)	50.11 a
Maternal Education	Incomplete primary or less	53.31 a (0.41)	49.12 a (0.31)	48.34 c (0.25)	46.13 c (0.56)	49.22 c
	Primary but incomplete secondary	52.87 a (0.21)	49.43 a (0.35)	49.22 b (0.25)	47.98 b (0.30)	49.88 b
	Secondary or more	53.09 a (0.36)	49.37 a (0.17)	50.44 a (0.23)	49.28 a (0.15)	50.55 a
Wealth Index	First Quintile	53.33 a (0.35)	49.53 a (0.47)	47.93 c (0.32)	46.05 c (0.53)	49.21 d
	Second Quintile	52.93 a (0.38)	48.61 a (0.48)	48.81 b (0.32)	48.00 b (0.43)	49.59 d
	Third Quintile	52.94 a (0.24)	49.30 a (0.30)	49.17 b (0.27)	48.66 b (0.30)	50.02 c
	Fourth Quintile	52.76 a (0.31)	49.57 a (0.39)	49.93 a (0.26)	49.71 a (0.25)	50.49 b
	Fifth Quintile	53.59 a (0.39)	49.43 a (0.20)	50.39 a (0.34)	50.19 a (0.26)	50.90 a
Nurturing Environment	First Quintile	51.92 c (0.40)	47.71 c (0.39)	47.36 d (0.31)	46.46 e (0.53)	48.36 e
	Second Quintile	52.58 a,c (0.32)	48.70 b (0.20)	48.45 c (0.29)	47.41 d (0.27)	49.29 d
	Third Quintile	53.00 b (0.31)	49.67 a (0.29)	49.36 b (0.24)	48.38 c (0.21)	50.10 c
	Fourth Quintile	53.58 b,a (0.38)	49.77 a (0.39)	50.06 b (0.26)	49.30 b (0.29)	50.68 b
	Fifth Quintile	54.16 a (0.32)	50.42 a (0.32)	50.90 a (0.34)	50.76 a (0.24)	51.56 a
Height-for-Age	Non Stuntend	53.10 a (0.18)	49.28 a (0.20)	49.28 a (0.18)	48.53 a (0.19)	50.05 a
	Stunted	53.00 a (0.52)	49.28 a (0.43)	48.34 b (0.37)	48.50 a (0.31)	49.78 a
Health	Poor health	53.41 a (0.59)	47.93 b (0.38)	48.61 a (0.61)	47.68 a (0.57)	49.41 b
	Good health	53.08 a (0.17)	49.49 a (0.18)	49.17 a (0.16)	48.61 a (0.15)	50.09 a
Extreme Groups	Privileged	53.93 a (0.36)	49.82 a (0.32)	51.06 a (0.43)	51.82 a (0.39)	51.66 a
	Non-Privileged	52.59 a (0.72)	47.82 b (0.72)	46.82 b (052)	44.72 b (0.84)	48.03 b

Standard errors in parentheses. Means with different superscripts, read vertically within the same country and associated factor, differ in a statistically significant way from each other ($p < 5\%$, T-test for independent samples): a > b > c > d > e.

Cognitive Development		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Sex	Male	49.06 b (0.21)	48.75 a (0.23)	50.12 b (0.21)	51.46 a (0.22)	49.85 b
	Female	49.78 a (0.27)	49.08 a (0.27)	50.66 a (0.21)	51.65 a (0.24)	50.29 a
Maternal Education	Incomplete primary or less	49.37 a (0.38)	48.39 b (0.30)	49.25 c (0.19)	50.13 c (0.39)	49.29 c
	Primary but incomplete secondary	49.27 a (0.21)	48.83 a,b (0.26)	50.63 b (0.28)	51.29 b (0.29)	50.00 b
	Secondary or more	50.42 a (0.59)	49.61 a (0.35)	51.73 a (0.39)	52.01 a (0.19)	50.94 a
Wealth Index	First Quintile	48.07 c (0.34)	48.48 b (0.48)	49.26 c (0.32)	50.18 c (0.39)	49.00 d
	Second Quintile	48.97 b (0.40)	48.28 b (0.39)	49.80 b,c (0.30)	50.82 c (0.35)	49.46 c
	Third Quintile	49.10 b (0.31)	48.77 b (0.33)	50.42 b (0.29)	51.05 c (0.24)	49.84 c
	Fourth Quintile	50.31 a (0.46)	49.35 a,b (0.43)	50.61 b (0.32)	52.22 b (0.24)	50.62 b
	Fifth Quintile	50.34 a (0.36)	49.56 a (0.20)	52.32 a (0.47)	53.38 a (0.26)	51.40 a
Nurturing Environment	First Quintile	47.51 c (0.36)	47.59 d (0.35)	48.53 d (0.25)	49.85 c (0.49)	48.37 d
	Second Quintile	48.88 b (0.37)	48.18 c,d (0.40)	49.85 c (0.34)	51.12 b (0.25)	49.51 c
	Third Quintile	48.97 b (0.32)	48.93 b,c (0.23)	49.81 c (0.30)	51.28 b (0.30)	49.75 c
	Fourth Quintile	50.37 a (0.32)	49.36 b (0.29)	51.42 b (0.35)	51.64 b (0.35)	50.69 b
	Fifth Quintile	51.02 a (0.38)	50.34 a (0.40)	52.66 a (0.35)	53.67 a (0.27)	51.92 a
Height-for-Age	Non Stuntend	49.51 a (0.20)	49.03 a (0.25)	50.43 a (0.17)	51.70 a (0.18)	50.17 a
	Stunted	48.50 a (0.60)	48.24 a (0.46)	50.01 a (0.46)	50.96 b (0.34)	49.43 b
Health	Poor health	48.45 a (0.68)	48.93 a (0.36)	49.50 a (0.99)	51.06 a (0.53)	49.48 a
	Good health	49.48 a (0.19)	48.91 a (0.21)	50.41 a (0.17)	51.59 a (0.18)	50.10 a
Extreme Groups	Privileged	51.25 a (0.44)	50.46 a (0.61)	53.70 a (0.58)	54.94 a (0.36)	52.59 a
	Non-Privileged	46.67 b (0.61)	47.83 b (0.54)	48.10 b (0.41)	50.17 b (0.48)	48.19 b

Standard errors in parentheses. Means with different superscripts, read vertically within the same country and associated factor, differ in a statistically significant way from each other ($p < 5\%$, T-test for independent samples): a > b > c > d.

Language and Communication Development		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Sex	Male	49.74 a (0.26)	48.73 a (0.23)	49.31 b (0.22)	51.55 a (0.18)	49.83 b
	Female	50.06 a (0.24)	49.22 a (0.24)	50.25 a (0.21)	51.66 a (0.21)	50.30 a
Maternal Education	Incomplete primary or less	49.99 a (0.40)	47.99 c (0.20)	48.4 c (0.22)	50.11 c (0.40)	49.12 c
	Primary but incomplete secondary	49.82 a (0.25)	48.89 b (0.19)	49.89 b (0.26)	51.38 b (0.24)	49.99 b
	Secondary or more	50.65 a (0.59)	50.18 a (0.29)	51.78 a (0.39)	52.03 a (0.17)	51.16 a
Wealth Index	First Quintile	48.28 c (0.43)	48.04 c (0.33)	48.24 c (0.28)	50.87 c (0.35)	48.86 d
	Second Quintile	49.08 b,c (0.39)	48.44 b,c (0.33)	48.49 c (0.30)	50.70 c (0.27)	49.18 d
	Third Quintile	49.77 b (0.34)	48.66 b,c (0.26)	49.79 b (0.28)	50.89 c (0.27)	49.78 c
	Fourth Quintile	51.02 a (0.40)	49.19 b (0.35)	50.44 b (0.36)	52.12 b (0.23)	50.69 b
	Fifth Quintile	50.96 a (0.40)	50.30 a (0.15)	52.58 a (0.38)	53.31 a (0.26)	51.79 a
Nurturing Environment	First Quintile	48.20 d (0.38)	47.78 c (0.33)	47.72 d (0.25)	49.69 c (0.37)	48.35 d
	Second Quintile	49.05 c,d (0.39)	48.12 c (0.35)	49.04 c (0.29)	51.23 b (0.32)	49.36 c
	Third Quintile	49.33 c (0.38)	48.65 b,c (0.25)	49.33 c (0.32)	51.11 b (0.32)	49.61 c
	Fourth Quintile	50.72 b (0.37)	49.41 b (0.27)	50.76 b (0.34)	51.90 b (0.32)	50.70 b
	Fifth Quintile	51.84 a (0.45)	50.72 a (0.42)	52.35 a (0.32)	53.87 a (0.23)	52.20 a
Height-for-Age	Non Stuntend	50.00 a (0.21)	49.16 a (0.22)	49.83 a (0.17)	51.81 a (0.16)	50.20 a
	Stunted	48.89 a (0.55)	47.92 b (0.40)	49.22 a (0.45)	50.76 b (0.26)	49.20 b
Health	Poor health	49.02 a (0,70)	48.91 a (0,35)	48.59 a (0,83)	51.07 a (0,52)	49.40 b
	Good health	49.96 a (0,20)	48.98 a (0,21)	49.79 a (0,17)	51.65 a (0,15)	50.09 a
Extreme Groups	Privileged	52.17 a (0.72)	51.67 a (0.39)	53.62 a (0.48)	54.98 a (0.31)	53.11 a
	Non-Privileged	47.49 b (0.63)	47.30 b (0.52)	47.31 b (0.40)	50.86 b (0.53)	48.24 b

Standard errors in parentheses. Means with different superscripts, read vertically within the same country and associated factor, differ in a statistically significant way from each other ($p < 5\%$, T-test for independent samples): $a > b > c > d$.

Motor Development		Costa Rica	Nicaragua	Paraguay	Peru	Four Country Average
Sex	Male	49.07 b (0.21)	49.35 a (0.21)	50.06 b (0.20)	51.40 a (0.14)	49.97 a
	Female	49.73 a (0.24)	48.97 a (0.28)	50.61 a (0.21)	51.40 a (0.25)	50.18 a
Maternal Education	Incomplete primary or less	49.30 a (0.33)	48.51 b (0.31)	49.87 a (0.25)	50.92 a (0.37)	49.65 b
	Primary but incomplete secondary	49.31 a (0.23)	49.23 a (0.22)	50.52 a (0.25)	51.72 a (0.26)	50.19 a
	Secondary or more	49.84 a (0.45)	49.71 a (0.25)	50.43 a (0.36)	51.29 a (0.16)	50.32 a (0.16)
Wealth Index	First Quintile	48.76 c (0.44)	48.51 b (0.41)	49.87 b (0.35)	51.04 b,c (0.43)	49.54 c
	Second Quintile	48.95 b,c (0.31)	48.88 a,b (0.47)	49.96 b (0.32)	51.02 c (0.30)	49.70 c
	Third Quintile	49.15 a,c (0.39)	49.33 a,b (0.30)	50.98 a (0.33)	50.70 c (0.24)	50.04 b,c
	Fourth Quintile	50.16 a (0.36)	49.25 a,b (0.27)	50.18 a,b (0.33)	51.86 a,b (0.22)	50.37 a,b
	Fifth Quintile	49.77 a,b (0.35)	49.75 a (0.19)	50.85 a,b (0.44)	52.28 a (0.22)	50.66 a
Nurturing Environment	First Quintile	48.44 b (0.34)	48.07 c (0.27)	49.18 c (0.29)	50.04 c (0.46)	48.93 d
	Second Quintile	48.83 b (0.33)	48.42 c (0.32)	50.39 a,b (0.31)	50.96 b (0.21)	49.65 c
	Third Quintile	48.91 b (0.33)	49.28 b (0.28)	49.73 b,c (0.31)	50.73 b,c (0.28)	49.66 c
	Fourth Quintile	50.02 a (0.37)	49.50 b (0.36)	50.98 a (0.32)	51.53 b (0.39)	50.51 b
	Fifth Quintile	50.57 a (0.37)	50.42 a (0.28)	51.55 a (0.31)	53.57 a (0.24)	51.53 a
Height-for-Age	Non Stuntend	49.45 a (0.19)	49.36 a (0.22)	50.39 a (0.16)	51.54 a (0.14)	50.19 a
	Stunted	48.82 a (0.50)	48.08 v (0.34)	49.84 a (0.35)	50.81 b (0.34)	49.39 b
Health	Poor health	48.54 a (0.59)	48.78 a (0.41)	49.24 a (1,11)	51.58 a (0,63)	49.53 a
	Good health	49.46 a (0.18)	49.22 a (0.21)	50.36 a (0,16)	51.37 a (0,13)	50.10 a
Extreme Groups	Privileged	50.73 a (0.47)	50.70 a (0.43)	51.81 a (0.53)	54.21 a (0.38)	51.86 a
	Non-Privileged	47.90 b (0.50)	47.90 b (0.52)	48.97 b (0.47)	51.56 b (0.31)	49.08 b

Standard errors in parentheses. . Means with different superscripts, read vertically within the same country and associated factor, differ in a statistically significant way from each other (p < 5%, T-test for independent samples): a > b > c > d.

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Team

Patrice Engle
Lead Investigator
Cal Poly, USA

Santiago Cueto
Lead Investigator
GRADE, Peru

Aimee Verdisco
Education Specialist
IDB

Jennelle Thompson
Education Specialist
IDB

Oliver Neuschmidt
Senior Research Analyst
IEA

Sebastian Meyer
Research Analyst
IEA

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