HHS Public Access

Author manuscript

Child Dev. Author manuscript; available in PMC 2016 September 01.

Published in final edited form as:

Child Dev. 2015 September ; 86(5): 1571–1587. doi:10.1111/cdev.12402.

A Developmental Analysis of Caregiving Modalities across Infancy in 38 Low- and Middle-Income Countries

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Abstract

Caregiving is requisite to wholesome child development from the beginning of life. A cross-sectional microgenetic analysis of six caregiving practices across the child's first year (0–12 months) in 42,539 families from nationally representative samples in 38 low- and middle-income countries (LMIC) is reported. Rates of caregiving varied tremendously within and across countries. However, caregiving practices followed one of two developmental trajectories: (1) greater proportions of caregivers read, told stories, and named, counted, and drew with each additional month of infant age, (2) proportions of caregivers who played, sang songs, and took their infants outside increased each month from birth but reached an asymptote at 4–5 months. Rates and growth functions of caregiving have implications for infant care and development.

Keywords

parenting; caregiving; infant development; LMIC

Which caregiving practices do infants' principal caregivers engage in? How do those practices change as infants develop? How are those practices distributed in low- and middle-income countries (LMIC) around the world? Are those practices the same or different for infant girls and boys? This study attempts to contribute answers to these four significant developmental questions for populations on which very little contemporary research exists.

Infant Caregiving Practices

To survive infants must have their biological requirements for nourishment and protection met, but to thrive infants also need their psychosocial essentials for mental growth and emotional well-being addressed. In every society, caregivers act in ways to meet the

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biological needs of infants as well as infants' other psychosocial requisites. Beyond nurturance and safety, therefore, active and enriching caregiving responsibilities fundamentally invest in young children's education and socialization. Just as infants must connect with others through socioemotional interactions, they must also learn about the world through didactic interactions.

To address our first question, this study focused on six specific infant caregiving practices that represent these two broad modalities --- reading; telling stories; naming, counting, and drawing; playing; singing songs; and taking infants outside the home. Together, these kinds of caregiving practices stimulate infants to engage and understand the environment (e.g., by naming) and to participate in and model social relationships with others (e.g., by playing). Socioemotional caregiving focuses on the dyad and includes physical and verbal strategies caregivers use to engage infants interpersonally (Emde, 1992; Stern, 1985). Didactic caregiving turns outward from the dyad and consists of physical and verbal strategies caregivers use to stimulate infant attention, demonstrate, and the like. Many investigators have operationally distinguished and contrasted these modalities of interaction (Bornstein, Cote, Haynes, Suwalsky, & Bakeman, 2012; Reddy, 2008; Stern, 1985). Each domain of caregiving is developmentally significant in the sense that together they help lay foundations for children's future emotional, social, communicative, and cognitive competencies (e.g., Bornstein, 2015; Smith, Adamson, & Bakeman, 1988). For example, social sensitivity and responsiveness promote children's interpersonal competencies (e.g., De Wolff & van IJzendoorn, 1997), and educational interactions relate to children's developing instrumental competencies (e.g., Olson, Bates, & Bayles, 1984).

In their bioecological theory, Bronfenbrenner and Morris (2006) postulated that human development is the joint product of process, person, context, and time. In this formulation, processes refer to dynamic interactions that the developing person experiences, and "proximal processes"—face-to-face interactions with others and engagement in activities with materials in the microsystem—are hypothesized as particularly significant to children's development. The caregiving practices included in these two basic caregiving modalities instantiate proximal processes aimed at supporting development in children. Moreover, socioemotional and educational caregiving practices are likely universal in the sense that they characterize caregiver-infant interactions in a wide-variety of cultures. Parenting infants is multidimensional, modular, and specific (Bornstein, 2006, 2015). Although particular caregiving practices (both within and across dimensions) may serve similar needs for children, they are largely independent of one another; thus, there is a need to identify and focus empirically on individual caregiving practices. To ensure a comprehensive understanding of the links between caregiving practices and infant development, therefore, multiple caregiving practices must be examined individually across age.

Infancy as a Time of Change

Infancy is a period of life widely recognized for the dramatic changes that take place in biology, sensation, perception, cognition, language, emotions, and temperament. Although the general pace and thoroughgoingness of development during the first year are noteworthy (Bornstein, Arterberry, & Lamb, 2014), some changes are incremental and others saltatory.

How do the two modalities of caregiving change across the first year? There are several possible answers to our second question.

It could be that most caregiving practices bear no fixed relation to infant age. On this view, similar percentages of caregivers would utilize each of the caregiving practices throughout infancy with no systematic relation between caregiving and infant age. Alternatively, some caregiving practices might bear a linear relation to infant age. Some theorists view developmental change as gradual. That is, infants grow steadily in physiological regulation, cognitive awareness, and social appreciation as the first year progresses and reciprocally more and more caregivers will engage in certain caregiving practices as infants age across the year whereas fewer and fewer caregivers will engage in other caregiving practices as infants age. A third possibility is that caregiving bears a nonlinear relation to infant age. Still other theorists view developmental change in the infant as step- or stage-like. That is, the neonate is a rather different organism from the infant, as infants emerge on individual schedules from the state of *fetus ex utero* (Emde, Gaensbauer, & Harmon, 1976) and later achieve successive developmental milestones (e.g., starting to smile, reach, crawl, talk, and walk) around specific ages and over relatively short intervals. Many spectators of infant development have posited that sequences of qualitatively distinct “stages,” “periods,” “biobehavioral shifts,” “levels,” “phases,” “fundamental psychological transitions,” and the like characterize development in the first year (Bowlby, 1969; de Rosnay & Murray, 2012; Emde et al., 1976; Erikson, 1950; Freud, 1966; McCall, 1979; Piaget, 1952; Sander, 1962; Sroufe, 1997; Trevarthen & Hubley, 1978; Vygotsky, 1934/1962). The implication of the third view is that development of caregiving would proceed in steps or stages.

On the argument that different caregiving practices are more or less independent, it seems unlikely that all caregiving practices we studied here would fit a single growth function; rather, specific caregiving practices likely change in specific ways as infants develop. Guided by the developmental literature, we posited that infants’ interest in the environment and learning about the physical world (through educational interactions with caregivers) would grow continually. As infants age, and intentionality and flexibility in behavioral organization emerge and consolidate, infants are increasingly active in exploring their environment. That is, the scope of babies’ apperception continually broadens as they look to their surrounds and reach out and grasp, for example. Although infant socioemotional development proceeds incrementally until about midway in the first year, at that time reciprocal exchange (Sander, 1962), development from primary to secondary intersubjectivity (Trevarthen & Hubley, 1978), discriminating sociability (Sroufe, 1996), and relational competencies (de Rosnay & Murray, 2012) become manifest and stabilize. Infants’ interest in face-to-face play peaks between 3 and 5 months. From 6 months onwards they become more and more interested and fascinated by external stimuli as they are increasingly able to sustain joint object attention, explore the environment, and manipulate objects, resulting in changed play preferences towards more object-play instead of face-to-face play (Power, 2000). In turn, caregivers typically perceive shifts in infants’ abilities and in infants’ responsiveness to their caregiving. These perceived shifts in infant capability and behavior engender corresponding shifts in how caregivers engage infants. Thus, around the middle of the first year infants settle into a mutual focus of interest connecting with others

and engaging the social world. In shorter words, some caregiving growth functions would be linear and others nonlinear.

Measuring Change in Infancy

How can we best trace developmental changes in infant caregiving? Trial-and-error, connectionist models, and symbolic approaches to accomplishing everyday tasks assert that discovering and adopting new strategies occurs slowly. By contrast, some forms of learning, insight, and strategy acquisition follow more rapid change. Rates of uptake (the amount of time or experience before the frequency of a new strategy reaches an asymptotic level) vary depending on characteristics of the task, participants, and situations (Siegler, 2006).

Observations of emerging strategies are normally too widely spaced to yield detailed information about developmental processes. Assessing samples at wide intervals can make change appear more abrupt than sampling more frequently because the wider the sampling interval the more stage-like change appears to be (Robinson, Adolph, & Young, 2004). However, microgenetic analyses yield granular as well as rough depictions of paths of change and therefore unique information about development because microgenetic methods share three main features: Observations span periods of rapid change (here infancy), the density of observations is high (here monthly across the first year), and observations are analyzed intensively (here through graphical presentation) with the goal of inferring underlying processes (Siegler, 2006). Densely sampling development during periods of rapid change provides the temporal resolution necessary to expose processes. In turn, more precise analyses of strategy discovery and uptake, of generalizations across strategies, and of precursors to strategy discovery and uptake require identifying when a strategy first emerges, and their emergence can be specified reasonably precisely only through microgenetic assessments.

In general, developmental studies of fine-grain data suffer a tradeoff between numbers of observations and numbers of participants: the greater the number of observations, the smaller the number of participants, and vice versa. We overcame both shortcomings with large numbers of participants (> 42K) studied in closely spaced (monthly) observations by employing a cross-sectional variant of the microgenetic design.

Infant Caregiving in Context

Many factors influence infant caregiving, infant development, and caregiver–infant relationships, but few studies to date have examined variation in infant caregiving in LMIC, our third question. As it happens, most of the world's very young children live in LMIC—an estimated 560 million children under 5 years of age (Grantham-McGregor et al., 2007)—but precious little is known about the caregiving they receive or how it matters (Tomlinson, Bornstein, Marlow, & Swartz, 2014; Walker et al., 2007). The contemporary developmental literature is demonstratively skewed to populations living in technologically advanced high-income countries (HIC). Moreover, the northern European and North American societies typically included in developmental science research tend to be highly similar: In them, families normally adhere to the same basic nuclear organization, and parents play the same fundamental roles and share many of the same primary goals for their children. Studies that

employ a wider contextual lens therefore promise more penetrating insights into infant caregiving practices and how they are implicated in children's development. Such lessons illuminate how expansive or circumscribed are presumed universals. To advance our general understanding of caregiving and infant development, therefore, both must be studied in different contexts. This study uses data from the Multiple Indicator Cluster Survey (MICS3; UNICEF, 2006a), a nationally representative and internationally comparable survey of households in 38 LMIC. The samples in this study differ in terms of national backgrounds which form a powerful basis for conceiving of different caregiving norms and for implementing different practices in rearing infants, and the country samples we recruited are representative of their nation state.

We studied caregiving practice–infant age associations in different LMIC for theoretical as well as for practical reasons. Psychological universals are processes that are likely shared across peoples, cultures, and nations. Identifying and understanding psychological universals is theoretically significant in developmental and social science. "The discovery of genuine psychological universals entails the generalization of psychological findings across disparate populations having different ecologies, languages, belief systems, and social practices" (Norenzayan & Heine, 2005, p. 763). Here we studied caregiving in 38 different LMIC, but we also aggregated caregiving across countries to identify putative universal patterns of infant caregiving.

Practically, this study centers on infant experiences in the first year of life. Caregiving practices in infancy are often a neglected area of study in LMIC, where the main areas of interest in the first years of life normally encompass survival, nutrition, growth, disease, and motor development rather than infants' mental and socioemotional experiences. However, research indicates that many caregiving effects established in the first years carry forward in long-term development (Bornstein, 2014a) – a condition that may even be more applicable to children in LMIC given that the resources available in high-income, technologically advanced societies may create more opportunities to compensate for early deficiencies in caregiving. Comparative study also helps to identify caregiving practices that are plastic to contextual conditions. Such identification in turn aids in targeting interventions. Finally, cross-national study identifies caregiver involvement in specific practices that inform as to how caregivers in different places view and treat infants. If caregivers do not think infants are capable of play or benefit from being read to, infant caregivers may be less inclined to engage in play with infants or read to them (Gönçü & Gaskins, 2007) and thereby deprive infants of growth-promoting experiences.

As indicated earlier, bioecological theory characterizes development as a joint function of process, person, context, and time (Bronfenbrenner & Morris, 2006). Processes (already discussed) refer to dynamic interactions that the developing person experiences. The developing person includes characteristics and qualities, such as age, that interact with characteristics of the context to influence development. The contexts of child development are conceived in terms of a hierarchically organized and interlinked set of nested systems, with lower-level more proximal contexts (caregiver-infant interactions) nested within higher-level more distal contexts (nation). The LMIC reported here vary widely in terms of history and ideology, beliefs and values, social and economic situations, as well as other

sociodemographic factors thought to influence caregiving. However, all these nations constitute LMIC (UNICEF, 2006b) defined with reference to the World Bank's (2014) system of classification of economies based on gross national incomes per capita, quality of life (life expectancy, literacy rates), and economic diversification (labor force, consumption).

Gender

Our fourth question asked whether patterns of change in caregiving across the first year in LMIC are similar or different for infant girls and boys. It is important to understand possible gender differences from early in the life course because even small differences in patterns of treatment can cumulate over time, and so fashion variation in trajectories of children's development (Abelson, 1985; Prentice & Miller, 1992). Indeed, developments in brain science make clear that even seemingly innocuous differences in early experience can have impacts on brain structure and function (Kolb & Gibb, 2011). Parents may rear their infant girls and boys similarly or differently. Generally, child gender is believed to broadly organize different descriptions, impressions, and expectations of children from the start of life (Bornstein, 2013). Classic "Baby X" studies (where the gender of the infant is not known to study participants) suggest that parents even conceive of and behave toward infants differently depending on whether they think they are interacting with a girl or a boy. Lytton and Romney (1991) examined differential parental socialization of girls and boys through meta-analysis of the psychological and developmental literatures. They included 172 studies conducted in North America and non-North American Western societies. A clear effect to emerge from their survey was systematic parent encouragement of gender-typed activities in children. In consequence, it could be that caregivers engage more with infant girls or boys, preferentially engage in different caregiving practices with infant girls and boys, or begin to engage infant girls and boys at different ages in different ways. Each possible pattern would produce gender distinctive developmental trajectories of infant caregiving.

It is widely believed that the social contexts of many LMIC favor men over women (Morrison & Jütting, 2005; United Nations Development Programme, 2011) and that gender differences and differential treatment of children dominate in most parts of the developing world. Given limited resources, parents must decide how to allocate those resources to children and what roles to assign children within the family. In some LMIC, parents may choose girls or boys because one or the other is perceived to have a greater need. For example, if boys are more likely to attend school than girls, parents may be more likely to read to sons than daughters or to spend time naming and counting with them. However, the lives of girls and boys, and women and men may vary substantially across LMIC; therefore, we may not assume that girls and boys in LMIC are treated systematically differently. Some data from health, caregiving, and discipline suggest that young girls and boys in LMIC are treated more similarly than heretofore expected (Bornstein, Putnick, Lansford, Deater-Deckard, & Bradley, in press).

The historically strong and continuing focus on gender differences tends to mitigate or even entirely overlook gender similarities and the large variances of many characteristics within

each gender. In effect, the large overlap in distribution for males and females may be discounted in situations where small mean differences are observed. The gender differences perspective can exaggerate, reinforce, or even leverage gender differences. In contrast with the long-standing focus on gender differences, the "gender similarities" hypothesis states that females and males are actually similar on many biological and psychological indices (Hyde 2005, 2014). Wide variation in caregiving practices within gender would lead to an expectation that caregiving of infants of the two genders is similar or that any gender differences are modest in size. Some early evidence for this hypothesis can be found in Maccoby and Jacklin's (1974) narrative review of parents' gender-differentiated socialization practices. Even granting that parents reinforce certain gender-typed play activities and toy choices, Maccoby and Jacklin (1974, p. 342) concluded that "the reinforcement contingencies for the two sexes appear to be remarkably similar." Much stronger evidence for a hypothesis of gender similarities emerged from a review of 46 meta-analyses of the psychological and developmental research literatures. All told, 124 effect sizes for gender comparisons across a range of psychological domains, including cognitive, communicative, social and personality, well-being, motor, and a heterogeneous variety of other developmental categories, yielded 78% of reported gender difference effect sizes that were small or close to 0 (Hyde, 2014).

There is too little programmatic research on how, at the family level, young girls and boys are reared, and what situations obtain across countries or only in select countries. At the outermost circle of developmental influences in the ecological perspective are overarching macrosystem patterns of beliefs, values, customs, and living conditions -- culture, religion, the socioeconomic organization of society, and (most germane here) national indicators of gender equality. The overarching macrosystems context exerts profound effects on whether and how development is gendered, what is considered adaptive for each, which tasks girls and boys are prescribed and proscribed, and what roles they likely adopt as mature women and men. The macrosystem is not separate from children's more immediate environments; rather, it permeates and colors microsystems. Understanding the meaning and effect of proximal microsystem caregiver practices on the child often requires setting them within the broader macrosystem in which they occur (Bornstein, 1995).

In consequence, population-based multinational data from LMIC are also indispensable to identify the statuses, treatment, and condition of girls and boys in the majority world as well as how gender intersects with different domains of development more generally. Our understanding of child gender is severely limited by the existing body of research, and it is unclear if and whether gender lessons learned from the minority developed world apply to the majority developing world.

This Study

In overview, this report examines microgenetically the developmental distributions of six prominent caregiving practices across the first year of life toward girls and boys in more than 42,500 families in 38 LMIC. This work was guided by four main questions concerning those practices: (1) prevalence, (2) development, (3) context, and (4) gender. Answers to

these questions will inform expected rates, developmental courses, and differentiation of infant caregiving practices in LMIC around the world.

Method

Participants

This study evaluates caregiving of singleton infants under 1 year of age in 42,539 families in 38 LMIC (see Table 1) using the MICS3. Families with multiple children under 1 year (e.g., twins and triplets) were excluded in order to have independent observations and because parents with multiple infants may behave differently than do parents with single infants (Bornstein & Ruddy, 1984; Lytton & Gallagher, 2002). Infant age was coded as the month and year of assessment minus the month and year of birth, resulting in 12 monthly categories ranging from 0 months (1st month of life) to 11 months (12th month of life). The sample included 3,100–3,700 children in each monthly age group, and girls and boys were equally distributed across each month of age, $\chi^2(11, N = 42536) = 11.78$, $p = .381$. Of those contacted to participate in the study 96.6% completed the interview (range = 88.1–100.0%) across countries; 2.7% were not at home, 0.2% refused, and 0.5% did not participate for other reasons. Infants averaged 5.45 months of age ($SD = 3.39$, range = 0–11), and 49.3% were girls. MICS questions were answered by the infant's primary female caregiver, who was almost always the infant's biological mother (97.6%). Of the 2.4% of questionnaires that were completed by someone other than the infant's biological mother, 89.6% had no biological mother living in the household. The child's primary female caregiver averaged 27.11 years of age ($SD = 7.10$, range = 10–84), which varied across countries, $F(37, 42{,}485) = 49.65$, $p < .001$, $\eta^2 = .041$ Caregiver education also varied, $\chi^2(111, N = 42{,}498) = 23{,}805.15$, $p < .001$, with 32.1% of caregivers completing no schooling or only preschool, 30.1% completing primary/religious school, 32.6% completing secondary/vocational/tertiary school, and 5.3% completing higher education.

Procedures

The 1990 World Summit for Children adopted the World Declaration on the Survival, Protection, and Development of Children and its Plan of Action, where governments pledged to monitor progress towards achieving those goals. To aid in this effort, UNICEF developed the MICS, a nationally representative and internationally comparable household survey. The third round of the MICS (MICS3) on which these analyses are based was carried out between 2005 and 2010. Each country designed and selected a national probability sample and field implemented the MICS3 with minimum deviation from an overall standard design. A three-stage sampling frame was used: (1) primary sampling units were defined, if possible, as census enumeration areas, and they were selected with systematic probability proportionate to size (pps); (2) segments (clusters) were designated; and (3) households were selected within each segment that were to be interviewed in the survey. To simplify implementation, implicit stratification was followed. When this form of geographic stratification is used together with pps sampling, the sample proportionately distributes into each of a nation's administrative subdivisions as well as its urban and rural sectors. Participants were visited at home and interviewed by trained, local field workers.

Caregiving—The questions used here were part of the optional child development module of the MICS3 Under Five Questionnaire (for details, see Bornstein et al., 2012). This study included responses from female caregivers about what mothers, fathers, and other caregivers did with infants in the past 3 days. The six MICS3 items included whether mother, father, or other caregiver (1) read books to the infant, (2) told the infant stories, (3) named, counted, or drew with the infant, (4) played with the infant, (5) sang songs to the infant, or (6) took the infant outside the home, yard, compound, or enclosure. Items were coded as 0 = *no*, 1 = *yes*. We included all caregivers because non-parents (siblings, grandparents, community members) may take active roles in infant caregiving in LMIC (Bornstein, 2015; Leinaweaver, 2014; Smith & Drew, 2002). Items went through forward-translation of questionnaires (available in English, French, Spanish, Russian, and Arabic) into (major) local languages and then back-translation by a separate translator without referring to the original questionnaires. (More details about translation appear in the MICS3 manual, p. 3.8; http://www.childinfo.org/mics3_manual.html.)

Country-level development—The countries in this study were organized according to the Human Development Index (HDI; UNDP, 2008). The HDI has three major components: life expectancy (in years), education (composed of the adult literacy rate and the percentage of school-aged children enrolled in primary, secondary, and tertiary school), and gross domestic product (in purchasing power parity in U.S. dollars). The HDI offers a proxy for the level of support that is generally available to promote human development in a country. The HDI ranges from 0.00 to 1.00, and countries with an HDI of 0.90 to 1.00 are considered very high, 0.80 to 0.89 are considered high, 0.50 to 0.79 medium, and 0.00 to 0.49 low. None of the very high HDI countries meet criteria to be classified as low- or middle-income, so this sample did not include any very high HDI countries. Due to missing country-level data, the HDI was not available for two countries. Because MICS3 data were collected between 2005 and 2010, we used the 2008 HDI (UNDP, 2008) which is based on 2006 data.

Analytic Plan

First, basic data are described. Then, in accordance with principles of microgenetic analysis, data were visualized by graphing the proportions of caregivers who engaged in each caregiving practice against infant age in months. For dichotomous variables, such as strategy discovery or uptake, logistic regression can be used to determine hazard rate, that is the probability of an event occurring. Next, for caregiving practices that had linear relations with infant age, point biserial correlation and logistic regression analyses including infant gender as a moderator were performed across all countries and for each country separately. For caregiving practices that appeared to have nonlinear relations with infant age, a family of logistic spline regression analyses (Marsh & Cormier, 2002) was performed overall and by country to determine if and where on the infant age continuum the logit function changed (i.e., akin to a change in slope or a “knot” in the regression line). Logistic spline regression (aka piecewise logistic regression) allows for different logit functions (pieces) in segments of the sample. The average knot ages across countries (excluding out-of-range estimates—those that were negative or were greater than 12 months, indicating that there was no knot within the age range we studied in the country) were then used in logistic regression analyses to determine whether the logit functions differed significantly when the distribution

was segmented at the knot age. Infant gender was included as a potential moderator to determine if changes in logit functions differed for girls and boys. Last, based on the average knot locations across countries, point-biserial correlation analyses were performed on younger and older infants to clarify the piecewise logit functions.

Results

Prevalences of Caregiving Practices

Tables 1–4 show the average proportions (*M*s and *SD*s) of caregivers who engaged in each kind of caregiving overall and by country (question 1). Proportions of caregivers engaging in each varied across caregiving practices. For example, only 9% of caregivers had read to their infants in the past 3 days, but 70% of caregivers had played with their infants (see final rows in Tables 1–4). Despite large proportions of caregivers engaging in some practices, none of these caregiving practices displayed ceiling effects (Figure 1). The six kinds of caregiving also shared only 4% to 27% of their variance, which supports exploring developmental functions in each caregiving practice separately.

Notably, 15% of infants reportedly received none of the six caregiving practices, and only 6% received all six caregiving practices in the past 3 days. Between-country variation was large. For example, virtually no caregivers (0%) read to infants in Burkina Faso whereas more than half (54%) of caregivers read to infants in Trinidad and Tobago. Wide ranges were also evident for telling stories (3%–61%), naming, counting, and drawing (7%–91%), playing (11%–97%), singing (10%–91%), and taking the infant outside (11%–94%), and proportions tended to be largest in high-HDI countries and smaller in medium- and low-HDI countries. Within-country variation was also substantial for most reported caregiving practices (see the *SD*s in Tables 1–4).

Prevalence Rates of Caregiving Practices across Infancy, among LMIC, and for Girls and Boys

Inspection of cross-sectional microgenetic graphs indicated that relations between infant age and the proportions of caregivers reading, telling stories, and naming, counting, and drawing were linear, but relations between infant age and the proportions of caregivers playing, singing songs, and taking their infant outside were nonlinear (question 2; Figure 1). For all three of the logistic regressions of the linear caregiving practices (reading, telling stories, and naming, counting, and drawing), country interacted with infant age, Wald(37) = 84.41–230.60, *p*s < .001, indicating that proportions of caregivers who engaged in each practice across infant age were variable across countries (question 3). Point biserial correlations of infant age with the proportions of caregivers reading, telling stories, and naming, counting, and drawing by country are presented in Table 1. The proportions of caregivers reading, telling stories, and naming, counting, and drawing were significantly positively related with infant age in 25 (66%), 31 (82%), and 29 (76%) of 38 countries, respectively. Correlations with infant age were strongest in high-HDI countries, followed by medium-HDI countries, and finally low-HDI countries (*z*s = 2.29–7.27, *p*s < .05). However, all effects were small to medium sized. Infant gender did not interact with age for any caregiving practices, Wald(1)

= .01–1.85, *p*s = .173–.909, ORs = 1.00–1.01, indicating that the logit functions were similar across age for girls and boys (question 4).

To determine the age at which the logit functions changed for the proportions of caregivers playing, singing songs, and taking the infant outside, we conducted a series of spline logistic regression analyses using 6 months as the start value for a single knot for each country. As shown in Tables 2–4, the estimated knot ages varied by country. The location of a single knot was estimated at 4 to 5 months (e.g., the average knots across countries = 4.12–4.92 months). In preliminary logistic regression analyses, a significant interaction emerged between the change in knot age and country, Wald(37) = 71.20–260.38, *p*s < .001, indicating that the change in logit functions was not consistent at the knot age across countries (question 3). Consequently, we tested whether the logit function changed at the average knot age separately in each country. Using a knot of 5 months for playing, the logit function significantly flattened for 26 (68%) of 38 countries (bolded values in Table 2). Using a knot of 4 months for both singing songs and taking their infant outside, the logit functions significantly flattened for 19 (50%) and 25 (66%) of 38 countries (bolded values in Tables 3 and 4), respectively. When we aggregated the countries by HDI group, the logit functions for all three caregiving practices significantly flattened for high-, medium-, and low-HDI groups, indicating that the nonlinear developmental function was evident at all levels of country human development (Tables 2–4). Logit functions did not change at the knot age on any item for Belize, Bosnia and Herzegovina, Djibouti, Montenegro, Sierra Leone, and Trinidad and Tobago (16% of countries). Again, no significant interactions with infant gender were found, Wald(1) = .11–.72, *p*s = .398–.740, ORs = 1.00–1.01, indicating that the nonlinear functions were similar for girls and boys (question 4).

Discussion

Healthy human infants cannot grow up without competent and engaging caregivers (Winnicott, 1964). Caregivers are responsible for infants' developmentally important experiences because infants themselves have limited capacities. Here we report cross-sectional microgenetic analyses of six prominent infant caregiving practices in over 42,500 families in 38 LMIC (populations on which there is little research). Current knowledge and policy pertaining to infant care and development is framed by a body of research largely conducted on populations in HIC where a relatively small minority of children actually reside (Bornstein et al., 2014; Tomlinson et al., 2014). More needs to be learned about infant development and experience in the developing world of LMIC – where most families live. Moreover, studying microgenetic associations between caregiving practices and infant age in a range of diverse countries helps to identify socialization mechanisms and trajectories of their development that may be universal and submits the generalizability of such findings to test.

Infant Caregiving in LMIC

Caregiving practices with infants are not random behaviors, which do not imply a particular goal, but more resemble nonobligatory goal-directed strategies. Many factors influence infant caregiving, infant development, and caregiver–infant relationships, but few studies to

date have examined international variation in infant caregiving in LMIC (Walker et al., 2007). In answer to our first question about which caregiving practices infants' principal caregivers engage in, overall more caregivers of infants in every country played, sang songs, and took their infants outside than read, told stories, and named, counted, and drew with their infants, but there were tremendous ranges for these caregiving practices within and across countries. Taking an infant outside the home was the most prevalent, followed by playing, singing, naming, telling stories, and finally reading books. In the first year of life, infants' cognitive abilities are relatively limited, and didactic kinds of caregiving in terms of three MICS items (reading, storytelling, and naming, counting, or drawing) remained at a basal level with fewer than 40% of caregivers reporting each activity at any age and fewer than 10% of caregivers reportedly reading and telling stories at the youngest ages.

Rates for certain caregiving practices in LMIC may be low for a variety of reasons. Challenging in optimal circumstances, caregiving is even more difficult when family, community, and national resources are inadequate (Edin & Lein, 1997; Magnuson & Duncan, 2002). Numerous noxious links exist between economic privations on the one hand and parenting (and child development and well-being) on the other. For example, in the perspective of the "family stress model" (Conger & Donnellan, 2007), severe or persistent impoverishment stresses caregivers (e.g., stemming from day-to-day struggles to secure household resources and trying to cope with living in deteriorated or dangerous circumstances) that in turn undermine involvement with children and effective caregiving (see also Leventhal, Dupéré, & Shuey, 2015). These effects are likely compounded as a consequence of generally low parent literacy. Compared to middle-SES parents, low-SES parents even in HIC are less likely to converse, read, or provide appropriate play materials in the home to young children (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Hoff, Laursen, & Tardif, 2002). Moreover, in LMIC young children are more likely to be sick and malnourished which diminishes the likelihood they will be recipients of less survival-essential kinds of caregiving. In situations where basic health concerns are deemed critical, it could also be that some parents delay focusing on nurturing psychosocial competencies in children pending assurance of the continued existence and health of their child. The interplay of these issues is strong in LMIC. *Young Lives*, a four-country study of child poverty, revealed that children living in low-resource contexts tend to exhibit impaired cognitive and socioemotional development (Dercon & Krishnan, 2009). Positive caregiving promotes infants' cognitive and socioemotional competencies. Consider book reading, a caregiving behavior that was relatively neglected across the LMIC we studied. Shared book reading stimulates infants' interests, exposes infants to sounds, print, and vocabulary, and provides opportunities for caregivers to create novel interactive learning environments with infants. The frequency with which adults read to children and the frequency of maternal labeling questions while reading books together (e.g., "What do you call this little animal?") correlate positively with children's vocabulary (Quiroz, Snow, & Zhao, 2010). The low proportions of children's principal caregivers who engaged in book reading in these LMIC contrast with findings in some HIC. Given that we compiled the caregiving of mothers, fathers, and other caregivers, the amount of children's exposure to reading in LMIC is quite low in comparison with the United States, for example, where 70% of 4- to 9-month-old

infants are read to at least 3 times per week and only 9% are never read to (Kuo, Franke, Regaldo, & Halfon, 2004).

Developmental Changes in Infant Caregiving

In answer to the second and third questions about how caregiving practices change as infants develop and how those practices are distributed in LMIC around the world, we found that the likelihood that parents would enact many of the caregiving practices examined grew incrementally across the first year of life; specifically, marginally more caregivers of infants engaged in didactic activities, such as reading, telling stories, and naming, counting, and drawing, with each additional month of infant development. This pattern was supported in 25 to 31 of 38 developing countries, with 89% (34 of 38) of countries showing a significant linear pattern for at least one of these kinds of didactic caregiving. Moreover, relations between caregiving and infant age were strongest in high-HDI countries followed by medium- and then low-HDI countries. One possible reason for the stronger relation in high-HDI countries may be that there was less restriction of range in high-HDI countries. For example, 38% of high-HDI caregivers told stories to infants (*SD* = 49, range = 19–61%) compared to 19% of medium-HDI (*SD* = 39, range = 3–54%) and 14% of low-HDI caregivers (*SD* = 35, range = 2–53%). Caregivers in high-HDI countries may also be more likely to begin reading, telling stories, and naming, counting, and drawing as the infant in their charge ages because they are more likely to have access to books, paper, and other implements that facilitate these didactic activities. Another factor that may contribute to differences in didactic activities in low- versus high-HDI countries is the greater prevalence of maternal depression in lower-income countries (Hanlon, 2013).

By contrast with these cognitive kinds of caregiving, the patterns of relations between caregivers playing with, singing to, and taking infants out of doors and infant age were nonlinear. That is, the percentages of caregivers who engaged in these more socioemotional activities were not only greater but followed a different overall developmental trajectory: like didactic caregiving, they increased incrementally from birth through 4 to 5 months of age, but from 6 through 11 months socioemotional caregiving functions decelerated or flattened. Thus, the percentages of caregivers who played, sang, and took their infants outside essentially gelled by the middle of the first year. This pattern was supported in 19 to 26 of 38 developing countries, including high-, medium-, and low-HDI groups with 84% (32 of 38) countries showing nonlinear patterns in at least one kind of socioemotional caregiving. In a nutshell, more and more caregivers engage in playing, singing, and taking the infant in their charge out of doors as infants steadily increase in their socioemotional capabilities but only until around the mid-point of the first year.

Domains of caregiving practices with infants therefore generally followed one of two contrasting growth trajectories as revealed by cross-sectional microgenetic analysis. Differences in developmental functions for different kinds of caregiving could reflect caregivers' ethnotheories about the appropriateness of different kinds of caregiving for infants of different ages or infants' receptiveness or abilities to benefit from different experiences. Caregivers likely do not perceive newborns as so open to either didactic or socioemotional overtures as they do older infants, and only slowly grow in both these

practices across the first half-year. At this point, growth functions diverge. Alternatively, in LMIC which are beset by relatively high rates of infant mortality and morbidity, caregivers might only slowly display their increasing investment until infant survival is ensured (Lancy, 2013; Scheper-Hughes, 1989).

At around 6 months, attachments between infant and caregiver have likely formed (Bowlby, 1969) and mother and infant alike enjoy much more flexibility in the ways they respond to one another (Sroufe, 1997). Infants older than 6 months may therefore benefit equally from mutual cooperation and joint attention between them and their caregivers. By contrast, as they grow more and more infants are perceived to profit more from didactic caregiving. Mothers are thought to lead in exchanges with infants because they are the more mature or advanced partner in the dyad (Kochanska & Aksan, 2004; Vygotsky, 1930/1978), but infants play an active role in eliciting caregiving practices that are meaningful and relevant to their developmental needs (Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008). Infant caregivers look for and respond to particular infant cues that then elicit different kinds of interactions.

Gender

In answer to the fourth question about whether caregiving practices are the same or different for infant girls and boys, we found that developmental functions for all caregiving practices were similar for infants of the two genders. This finding may seem somewhat surprising. Parents are generally thought to hold different cognitions, beliefs, and expectations for their girls and boys, just as they are thought to treat them differently, even when infants do not differ in salient characteristics by their gender (Mondschein, Adolph, & Tamis-LeMonda, 2000; Rubin, Provenzano, & Luria, 1974). However, differential treatment of young girls and boys is not necessarily a rule, and wide-ranging data from LMIC show caregivers often treat girls and boys quite similarly (Bornstein & Putnick, in press; Deater-Deckard & Lansford, in press). In some instances, infant gender per se reputedly encourages differential caregiving (Pomerleau, Bolduc, Malcuit, & Cossette, 1990). The absence of gender differences in the trajectories of caregiving of infant girls and boys might indicate that caregivers in LMIC possess ethnotheories that prompt similar treatment of female and male infants. Gender effects might be specific to the Western, educated, industrialized, rich, and democratic societies where gender has been studied (Henrich, Heine, & Norenzayan, 2010). Alternatively, girls and boys in LMIC might be reared similarly in infancy and differential gender treatment begins later in childhood. So much is fragile in the first year of life for children in LMIC that cultural proclivities pertaining to gender may not strongly manifest themselves until survival is more assured. Yet another possibility is that gender differentiated treatment of infants occurs in more subtle or nuanced ways than captured by the MICS. For example, caregivers may take both girls and boys out of doors, but they may be more likely to take one gender or the other to locations that will somehow better that child's chances in life.

Caveats and Future Directions

This study has limitations that raise additional questions about infant caregiving in LMIC. The MICS relies on reports of caregiving activities. In some ways observations of actual

caregiver practices might constitute a stronger data base than self-report, but in other ways not; after all, caregiver reports constitute the prime social milieu of early childrearing (Bornstein, 2014b). It is useful to tally the different ways mothers, fathers, and others stimulate infants, and MICS items are helpful indicators. However, the MICS asked about a limited number of specific, if presumably universal (etic), caregiving items, and MICS items are dichotomous. Although they may be representative of infant caregiving, six MICS items should not be mistaken for the full spectrum of infant caregiving. Caregivers in LMIC engage in many other specific forms of caregiving, and they may privilege domains of development not tightly connected to the forms of caregiving captured by the MICS (Johnson & Adams, 2004).

Fully understanding caregiving practices and their meaning requires situating them in context (Bornstein, 1995). The same caregiving practice can have the same or different meanings in different contexts, just as different caregiving practices can have the same or different meanings in different contexts. European American parents use questions during joint book reading as a way to engage children (van Kleeck, 2003), where Tongans rely on recitation (McNaughton, 1995). In some locales, caregivers could display socioemotional involvement predominately through singing to a child, whereas in others caregivers could demonstrate affection physically. These different displays may serve the same socioemotional functions for caregivers in their respective societies. In addition, next to quantitative aspects of caregiving, qualitative aspects matter. Thus, two caregivers could equate in their engagement of play with infants, yet one might solicit sequences of high-level play that challenge and advance her infant's skills, whereas another might demonstrate low-level play that does not advance her infant's skills. Beyond considering the form and level of caregiving, it is critical also to consider the timing, content, and meaning of caregiving with respect to infants' ongoing activities.

Microgenetic analysis reveals that discovering and adopting a strategy can be slow or rapid. Here we focused on uptake and expression of caregiving practices. A comprehensive description of rates of change requires information regarding both discovery and uptake. In microgenetic analysis, the so-called "risk set" includes participants who have not yet experienced an event of interest or, in the case here, have not yet adopted or expressed a new practice. This set decreases with experience or over time, as more participants discover or take up a practice. Understanding individual differences and determinants of the risk set versus those converted will be of future interest.

On a practical note, the prevalence rates of caregiving practices that do not require caregiver literacy or the availability of costly materials exceeded those that did. Thus, LMIC caregivers might be alerted to the fact that important child capabilities benefit from "free" naming and storytelling kinds of caregiving early in life. Ideally, all caregivers would engage in each of the six caregiving practices because each is known to provide infants with vital life experiences that stimulate developing brains and foster emerging cognitive and socioemotional skills.

Conclusions

Child survival is achieved through caregiver protection and nurturance, but child thriving is fostered through caregiving that involves sharing information through education and inculcating interpersonal competencies through socialization. Caregivers who so engage infants in their charge also gain access to their infants' emotional competence, social style, and cognitive potential, and they learn about their infants' proclivities, capabilities, and limits. Such knowledge can lead to more appropriate and beneficial interactions with the salutary result of enhanced child development and well-being.

Acknowledgments

We thank A. Hancioglu, Y. Ota, O. Petrovic, and N. Ulkuer. This research was supported by the Intramural Research Program of the NIH, NICHD.

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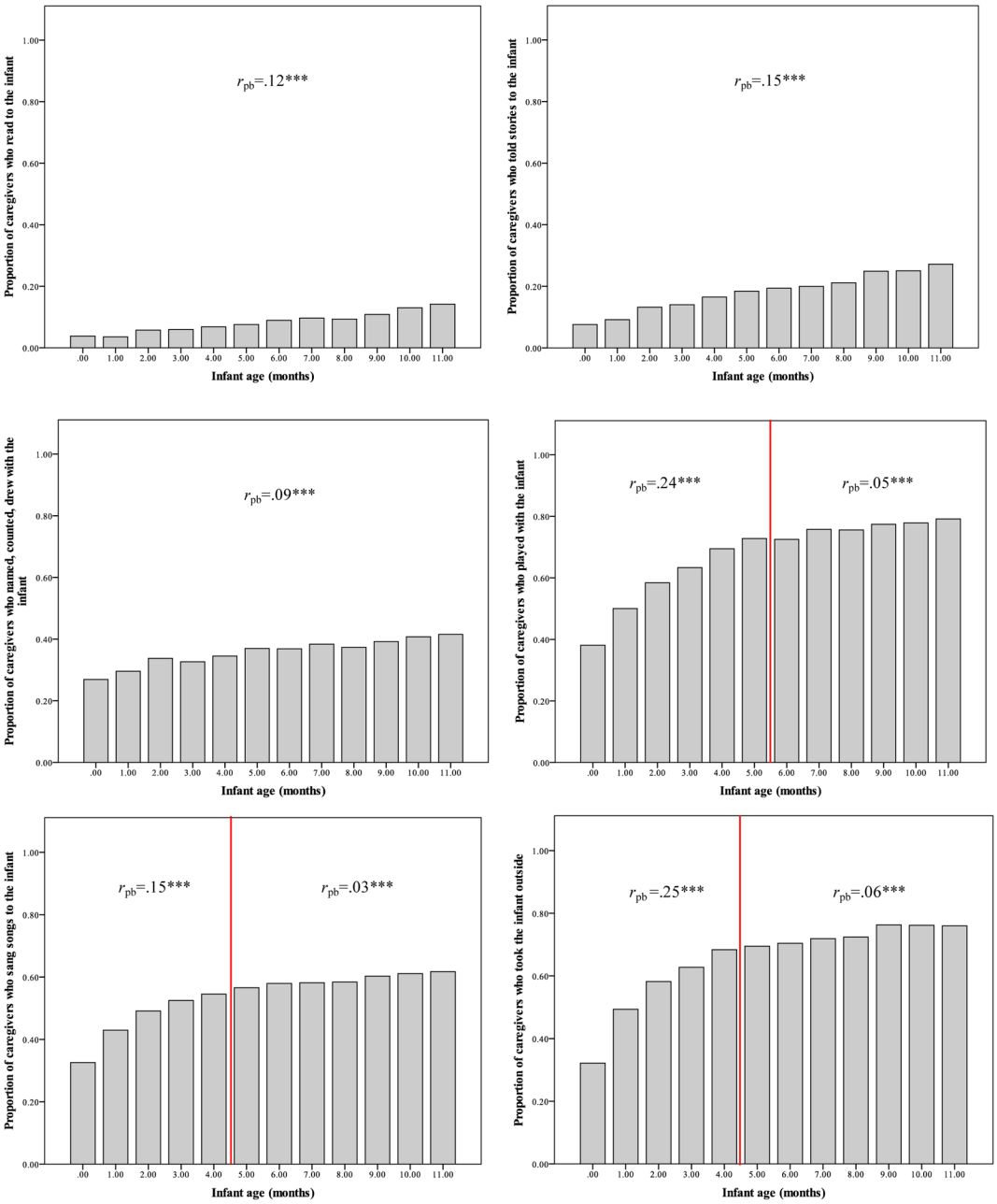

Figure 1.

Proportions of caregivers who engaged in caregiving behaviors across the first year of life. Age in months is coded into categories such that, for example, 1 month of age includes children who are in their second month of life. The break line indicates the knot age where the logit function changes. *** $p < .001$.

Child Dev. Author manuscript; available in PMC 2016 September 01.

Table 1

Descriptive statistics and correlations with infant age by country for reading, telling stories, and naming, counting, and drawing

		Reading Books			Telling Stories			Naming, Counting, Drawing		
Country	***n***	***M***	***SD***	r_{pb}	***M***	***SD***	r_{pb}	***M***	***SD***	r_{pb}
High HDI	3,698	.24	.43	$.21^{***}$	.38	.49	$.21^{***}$	.47	.50	$.15^{***}$
Albania	177	.19	.40	.08	.19	.39	.07	.14	.35	.08
Belarus	506	.37	.48	$.43^{***}$	.34	.47	$.26^{***}$	.24	.43	$.30^{***}$
Bosnia and Herzegovina	513	.18	.38	$.19^{***}$	.38	.49	$.23^{***}$	.72	.45	$.14^{***}$
Kazakhstan	892	.14	.34	$.19^{***}$	.22	.41	$.24^{***}$	.46	.50	$.10^{**}$
Macedonia	528	.30	.46	$.10^{*}$	.48	.50	$.15^{***}$	.86	.35	.03
Montenegro	170	.23	.42	$.18^{*}$	.60	.49	$.30^{***}$	.26	.44	$.27^{***}$
Serbia	697	.19	.39	$.24^{***}$	.50	.50	$.25^{***}$	.20	.40	$.24^{***}$
Trinidad and Tobago	215	.54	.50	$.27^{***}$	.61	.49	$.22^{***}$	.74	.44	$.18^{**}$
Medium HDI	21,508	.09	.29	$.11^{***}$	.19	.39	$.17^{***}$	.28	.45	$.11^{***}$
Bangladesh	5,832	.04	.19	$.13^{***}$	.27	.44	$.18^{***}$	.13	.33	$.12^{***}$
Belize	159	.45	.50	$.18^{*}$	.44	.50	.15	.62	.49	$.16^{*}$
Cameroon	1,394	.01	.08	.05	.08	.26	$.12^{***}$	.26	.44	.02
Djibouti	385	.06	.25	.06	.08	.28	.05	.09	.28	.03
Georgia	400	.29	.45	$.21^{***}$	.40	.49	$.26^{***}$	.64	.48	$.22^{***}$
Ghana	698	.02	.15	.06	.06	.23	.05	.19	.40	.02
Guyana	474	.32	.47	$.19^{***}$	.40	.49	$.22^{***}$	.51	.50	$.17^{***}$
Jamaica	268	.34	.48	$.25^{***}$	.31	.46	$.29^{***}$	.55	.50	$.24^{***}$
Kyrgyzstan	588	.10	.30	$.19^{***}$	.16	.36	$.25^{***}$	.51	.50	$.18^{***}$
Laos	840	.03	.16	$.11^{**}$	.03	.17	$.11^{***}$	.49	.50	$.09^{**}$
Mauritania	1,844	.03	.17	.02	.09	.28	$.11^{***}$	.32	.47	$.09^{***}$
Mongolia	774	.07	.25	$.24^{***}$	.03	.17	$.13^{***}$	.07	.26	$.19^{***}$
Suriname	419	.20	.40	.03	.31	.46	.09	.48	.50	$.12^{*}$

		Reading Books			Telling Stories			Naming, Counting, Drawing		
Country	***n***	***M***	***SD***	r_{pb}	***M***	***SD***	r_{pb}	***M***	***SD***	r_{pb}
Syria	2,015	.12	.32	$.10^{***}$	.16	.37	$.18^{***}$	.15	.36	$.09^{***}$
Tajikistan	840	.05	.21	.05	.17	.37	$.12^{***}$	.46	.50	.04
Thailand	1,842	.30	.46	$.23^{***}$	.31	.46	$.22^{***}$	.44	.50	$.25^{***}$
Uzbekistan	1,034	.08	.27	$.15^{***}$	.14	.35	$.18^{***}$	.37	.48	$.07^{*}$
Vanuatu	348	.40	.49	$.12^{*}$	.54	.50	$.11^{*}$	.80	.40	$.12^{*}$
Vietnam	503	.04	.19	$.14^{**}$	.11	.31	$.16^{***}$	.27	.44	$.39^{***}$
Yemen	851	.02	.13	−.02	.05	.21	.06	.10	.30	$.23^{***}$
Low HDI	12,646	.04	.20	$.06^{***}$	.14	.35	$.09^{***}$	.40	.50	$.05^{***}$
Burkina Faso	1,162	.00	.06	.03	.02	.14	−.02	.15	.35	.01
Central African Republic	2,074	.04	.20	$.06^{**}$	.10	.30	$.09^{***}$	.53	.50	$.08^{***}$
Côte d'Ivoire	1,918	.01	.11	.03	.06	.23	$.13^{***}$	.38	.48	$.07^{***}$
Gambia	1,561	.03	.16	$.10^{***}$	.05	.22	$.14^{***}$	.28	.45	$.09^{***}$
Guinea-Bissau	1,186	.03	.17	.03	.53	.50	$.11^{***}$	.27	.44	.04
Nigeria	2,920	.10	.30	$.08^{***}$	.20	.40	$.14^{***}$	.54	.50	$.05^{**}$
Sierra Leone	968	.04	.19	$.12^{***}$	.08	.28	$.13^{***}$	.53	.50	.03
Togo	857	.01	.10	.05	.07	.25	$.09^{**}$	.24	.42	$.09^{*}$
HDI N/A	4,687	.04	.20	$.07^{***}$	.13	.33	$.13^{***}$	.63	.48	$.11^{***}$
Iraq	3,374	.04	.21	$.08^{***}$	.09	.28	$.15^{***}$	.52	.50	$.15^{***}$
Somalia	1,313	.03	.16	.02	.24	.43	$.14^{***}$	.91	.28	$.09^{**}$
TOTAL	42,539	.09	.28	$.12^{***}$	.19	.39	$.15^{***}$	.37	.48	$.09^{***}$

Note. HDI = Human Development Index. For all behaviors, the correlation with infant age was strongest for the High HDI group followed by the Medium HDI group, and finally the Low HDI group (we did not compare relations for the HDI N/A group).

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

Table 2

Summary of spline logistic regression for playing by country

Country	*M*	*SD*	Knot estimate	r_{pb} (0–5mo)	r_{pb} (6–11mo)
High HDI	.83	.37	4.000	**.35*****	**.08*****
Albania	.73	.44	5.000	**.46*****	**−.01**
Belarus	.94	.23	4.000	**.40*****	**.07**
Bosnia and Herzegovina	.93	.26	1.071	.32***	.08
Kazakhstan	.76	.43	8.000	**.39*****	**.09**
Macedonia	.82	.39	−1.333	.24***	.15*
Montenegro	.89	.32	11.059	.51***	.26*
Serbia	.76	.43	6.749	**.37*****	**.07**
Trinidad and Tobago	.97	.18	−4.658	−.09	.07
Medium HDI	.67	.50	4.482	**.25*****	**.05*****
Bangladesh	.66	.47	4.480	**.26*****	**.03**
Belize	.92	.26	11.490	.16	.18
Cameroon	.80	.40	4.018	**.33*****	**.06**
Djibouti	.11	.32	−8.223	.04	−.01
Georgia	.83	.38	3.799	**.38*****	**.10**
Ghana	.84	.36	1.277	**.30*****	**.06**
Guyana	.86	.34	2.543	**.29*****	**.02**
Jamaica	.94	.25	4.232	.27***	.14
Kyrgyzstan	.50	.50	7.869	**.27*****	**.05**
Laos	.53	.50	3.000	.14**	.03
Mauritania	.46	.50	4.544	**.34*****	**.06**
Mongolia	.53	.50	7.000	**.34*****	**.10**
Suriname	.89	.31	4.000	.18*	.08
Syria	.65	.48	6.457	**.25*****	**.03**
Tajikistan	.58	.49	8.743	**.25*****	**.11***

Country	*M*	*SD*	Knot estimate	r_{pb} (0–5mo)	r_{pb} (6–11mo)
Thailand	.92	.27	3.586	**.29*****	**.08***
Uzbekistan	.55	.50	6.484	**.31*****	**.07**
Vanuatu	.86	.35	6.000	.22**	.00
Vietnam	.82	.39	4.000	.25***	.13*
Yemen	.61	.49	6.647	**.26*****	**.10***
Low HDI	.71	.45	4.108	**.20*****	**.04*****
Burkina Faso	.56	.50	4.384	**.29*****	**.01**
Central African Republic	.61	.49	6.405	**.18*****	**.00**
Côte d' Ivorie	.85	.35	4.735	**.22*****	**.06**
Gambia	.56	.50	3.310	**.29*****	**.13*****
Guinea-Bissau	.52	.50	1.651	**.18*****	**.09***
Nigeria	.81	.39	2.798	**.17*****	**.05**
Sierra Leone	.96	.20	1.000	.13**	.10*
Togo	.76	.43	4.000	**.23*****	**−.01**
HDI N/A	.68	.47	3.678	**.28*****	**.06*****
Iraq	.68	.47	3.405	**.28*****	**.08****
Somalia	.69	.46	4.323	**.27*****	**.03**
TOTAL	.70	.46	4.916[a]	**.24*****	**.05*****

Note. HDI = Human Development Index. Correlations that significantly changed at 5 months of age are bolded.

$^{*}p \leq .05$.

$^{**}p \leq .01$.

$^{***}p \leq .001$.

[a]Average of individual country knots excluding out-of-range estimates.

Table 3

Summary of spline logistic regression for singing by country

Country	*M*	*SD*	Knot estimate	r_{pb} (0–4mo)	r_{pb} (5–11mo)
High HDI	.81	.39	3.259	**.12*****	**.04**
Albania	.82	.39	−1.172	.04	.06
Belarus	.84	.36	17.083	.13	.14**
Bosnia and Herzegovina	.67	.47	5.001	.06	.06
Kazakhstan	.88	.32	4.394	.13*	.08
Macedonia	.75	.43	5.503	**.16***	**−.03**
Montenegro	.96	.20	2.361	.39**	.09
Serbia	.76	.42	3.675	**.21*****	**.00**
Trinidad and Tobago	.91	.29	−4.534	−.03	.05
Medium HDI	.54	.50	1.461	**.16*****	**.04*****
Bangladesh	.37	.48	1.554	**.18*****	**.07*****
Belize	.77	.42	1.000	.22	.19
Cameroon	.62	.49	7.000	.15***	.07
Djibouti	.12	.33	−1.419	.03	−.00
Georgia	.74	.44	1.529	.19*	.01
Ghana	.68	.46	2.000	.15**	.07
Guyana	.78	.42	4.261	**.23*****	**−.02**
Jamaica	.82	.38	3.147	.21*	.09
Kyrgyzstan	.66	.47	1.460	**.20*****	**−.00**
Laos	.10	.30	6.000	.08	−.01
Mauritania	.51	.50	6.302	**.29*****	**.09****
Mongolia	.50	.50	7.000	.07	.06
Suriname	.79	.41	6.551	**.18***	**−.00**
Syria	.64	.48	7.001	**.12*****	**.02**
Tajikistan	.66	.47	4.996	.04	.04

Country	*M*	*SD*	Knot estimate	r_{pb} (0–4mo)	r_{pb} (5–11mo)
Thailand	.78	.41	4.807	**.17*****	**.01**
Uzbekistan	.78	.41	7.000	.10	.07
Vanuatu	.78	.41	4.695	**.19*****	**−.02**
Vietnam	.30	.46	8.000	.15*	.20***
Yemen	.39	.49	3.000	**.19*****	**.05**
Low HDI	.54	.50	3.623	**.14*****	**.03*****
Burkina Faso	.18	.38	5.564	**.09**	**.01**
Central African Republic	.66	.47	2.413	**.18*****	**.02**
Côte d' Ivorie	.55	.50	4.701	**.11****	**.01**
Gambia	.30	.46	4.360	**.15*****	**.08***
Guinea-Bissau	.53	.50	1.062	**.15*****	**.06**
Nigeria	.65	.48	3.374	**.22*****	**.05***
Sierra Leone	.77	.42	7.949	.13**	.06
Togo	.75	.43	2.000	.14**	.07
HDI N/A	.49	.50	4.304	**.15*****	**−.02**
Iraq	.42	.49	6.035	**.14*****	**.01**
Somalia	.68	.47	1.494	**.15*****	**.05**
TOTAL	.56	.50	4.329 [a]	**.15*****	**.03*****

Note. HDI = Human Development Index. Correlations that significantly changed at 4 months of age are bolded.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

[a] Average of individual country knots excluding out-of-range estimates.

Table 4

Summary of spline logistic regression for taking outside by country

Country	*M*	*SD*	Knot estimate	r_{pb} (0–4mo)	r_{pb} (5–11mo)
High HDI	.83	.37	3.860	**.31*****	**.10*****
Albania	.70	.50	1.000	.35***	.20
Belarus	.89	.31	7.666	.20*	.06
Bosnia and Herzegovina	.94	.23	1.000	.27***	.11*
Kazakhstan	.83	.37	3.174	**.31*****	**.07**
Macedonia	.81	.39	3.446	.27***	.13*
Montenegro	.85	.36	12.009	.49***	.21*
Serbia	.74	.44	7.099	**.35*****	**.11***
Trinidad and Tobago	.92	.27	6.036	.13	.06
Medium HDI	.71	.46	3.036	**.28*****	**.05*****
Bangladesh	.76	.43	2.141	**.34*****	**.06*****
Belize	.86	.35	7.410	.26*	−.06
Cameroon	.70	.46	3.102	**.34*****	**.04**
Djibouti	.11	.31	21.440	.04	.07
Georgia	.94	.25	−2.099	**.33*****	**.04**
Ghana	.75	.43	1.701	**.29*****	**.03**
Guyana	.83	.38	3.341	**.41*****	**.01**
Jamaica	.88	.32	3.778	**.33*****	**−.02**
Kyrgyzstan	.71	.45	6.662	**.24*****	**.01**
Laos	.58	.49	3.000	**.21*****	**.04**
Mauritania	.42	.49	4.554	**.21*****	**.03**
Mongolia	.78	.42	7.000	.15**	.08
Suriname	.83	.38	3.928	**.26*****	**.01**
Syria	.68	.47	4.222	**.26*****	**.05**

Country	*M*	*SD*	Knot estimate	r_{pb} (0–4mo)	r_{pb} (5–11mo)
Tajikistan	.73	.44	3.937	**.24*****	**.05**
Thailand	.90	.30	2.879	**.33*****	**.08****
Uzbekistan	.86	.35	1.676	**.35*****	**.15*****
Vanuatu	.90	.31	2.498	.23**	.02
Vietnam	.55	.50	3.188	**.37*****	**.17****
Yemen	.39	.49	8.863	**.28*****	**.12****
Low HDI	.69	.46	3.189	**.19*****	**.04*****
Burkina Faso	.72	.45	6.445	**.14****	**−.06**
Central African Republic	.64	.50	6.091	**.20*****	**−.04**
Côte d' Ivorie	.88	.33	1.350	**.26*****	**.09****
Gambia	.64	.48	6.394	.19***	.16***
Guinea-Bissau	.34	.47	5.000	.08	−.00
Nigeria	.69	.46	3.223	**.20*****	**.07****
Sierra Leone	.85	.35	.829	.22***	.13**
Togo	.70	.46	1.386	**.31*****	**.04**
HDI N/A	.38	.49	6.053	**.22*****	**.08*****
Iraq	.39	.49	3.215	**.26*****	**.08*****
Somalia	.37	.48	6.886	**.11****	**.05**
TOTAL	.68	.47	4.118	**.25*****	**.06*****

Note. HDI = Human Development Index. Correlations that significantly changed at 4 months of age are bolded.

* $p \leq .05$.

** $p \leq .01$.

*** $p \leq .001$.

[a] Average of individual country knots excluding out-of-range estimates.