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Housing Quality and Access to Material and Learning Resources within the Home Environment in Developing Countries

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Abstract

This study examined home environment conditions (housing quality, material resources, formal and informal learning materials) and their relations with the Human Development Index (HDI) in 28 developing countries. Home environment conditions in these countries varied widely. The quality of housing and availability of material resources at home were consistently tied to HDI; the availability of formal and informal learning materials little less so. Gross domestic product (GDP) tended to show a stronger independent relation with housing quality and material resources than life expectancy and education. Formal learning resources were independently related to the GDP and education indices, and informal learning resources were not independently related to any constituent indices of the overall HDI.

Promoting and protecting the well-being of young children is considered the *sine qua non* of responsible parenting. To assure well-being for children, parents must: (a) provide for their safety, (b) provide sustenance and other health promoting supports, (c) foster socio-emotional competence, (d) provide stimulation and supports for learning, (e) monitor their activities, (f) supervise their behavior, (g) provide routines, guidance, and directions that give structure to daily life and ongoing activities, and (h) provide social connections to key persons and institutions that facilitate the child's adaptive functioning and long-term productivity (Bradley, 2006). Being the guardian of children's welfare can be a formidable task in conditions of extreme poverty and environmental degradation. Poor housing quality and limited access to material resources can directly undermine the health and adaptive functioning of children and limit what parents can do to protect children and promote their development (Bartlett, 1999; Evans, 2006; Evans, Wells, & Moch, 2003; Leventhal & Newman, 2010).

The World Health Organization (WHO, 2008) estimated that six health conditions account for 73% of the 10.4 million deaths among children under 5 annually. Major risk factors for four of those (acute respiratory illnesses, diarrhea, malaria, and sepsis) include poor housing quality and inadequate material resources. Housing quality and lack of proper facilities for food preparation and storage are also risk factors for malnutrition, a condition implicated in approximately 30% of all deaths among young children (Arabi, Frongillo, Avula, & Mangasaryan, 2012). Likewise, lack of material resources undermines the development of competence and can make it more difficult to address issues of safety and health maintenance (Bradley & Corwyn, 2002). These same conditions contribute to poor parental health and adaptive functioning as well as increase allostatic load (i.e., physiological wear

and tear on the body that results from ongoing adaptive efforts to maintain stability (homeostasis) in response to stressors; Evans, 2003). Altogether these poor physical conditions undermine parents' capacities to engage in the kinds of activities needed to maximally support children's development (Bornstein & Bradley, 2003). Differences in societal modernity, indexed by access to writing tablets, books, electricity, water, radios, TVs, and motor vehicles, are associated with children's cognitive functioning and self-managed behavior during play for families living in Belize, Kenya, Nepal, and American Samoa (Gauvin & Munroe, 2009).

The main goals of this study are to report on home environment conditions in 28 developing countries and to examine relations between the Human Development Index (HDI) and four aspects of the home environment that have established associations with child well-being: (1) household quality, such as floor composition, access to water, and toilet facilities; (2) material resources for enriching experiences, such as radios, TVs, motor vehicles, electricity, and telephones; (3) formal learning resources, such as books and store-bought toys; and (4) informal learning resources, such as makeshift toys. A secondary purpose is to examine relations between three constituent indices of the HDI (i.e., life expectancy, education, and gross domestic product) and four aspects of the home environment controlling for covariates and the other two constituent indices of HDI. As discussed in the introduction to this Special Section (Bornstein et al., 2012), the United Nations decided to use HDI in preference to other ways of representing the general standard of living present in a country.

Quality of Housing

Most of what is known about housing quality and how it affects well-being comes from research done in North America and Europe (Evans, 2006). For 3 decades, efforts have been made to establish standards pertaining to housing quality, both as regards the structural materials used to build homes (e.g., mud, thatch, wood) and the internal facilities (e.g., access to toilets, piped in water, closed facilities for cooking, and refrigeration appliances). In one of the few analyses done of housing quality in developing countries, Muoghalu (1991) observed that about 80% of dwellings in Benin, Nigeria met minimum standards for external construction materials but fewer than 50% met minimum standards for internal facilities. A subsequent study done in Nigeria showed that 80% of residents lived in households having three rooms or fewer, nearly 40% of which were not in good condition (Aribigbola, 2008). Likewise, a study done in Ghana revealed that the majority of residents lived in crowded conditions in substandard housing, especially those living in rural areas (Fiadzo, 2004). Using data from 85 Demographic and Health Surveys conducted under the auspices of the United Nations, Montgomery and Hewett (2005) estimated that roughly one-half to two-thirds of urban households in Latin America, North Africa, Sub-Saharan Africa, Southeast Asia, West Asia, and South and Central Asia had sleeping rooms. The recent mass migration of families from rural to urban areas in developing countries has increased concerns about the quality of housing afforded young children (Meng & Hall, 2006).

Provisions for water—A hallmark of housing quality in poor countries is clean drinking water. WHO estimates that only 58% of people in sub-Saharan Africa have access to improved drinking water sources (i.e., either piped into the home or from other nearby sources such as public taps, tube wells, boreholes, protected dug wells, protected springs, or rainwater collections). About 70% of households in Lima, Peru had water in the home (Meng & Hall, 2006). Studies done in Egypt and Turkey indicate that substandard water sanitation facilities increase morbidity and mortality in young children (Abou-ali, 2003; Arik & Arik, 2009). WHO estimates that water-related deaths account for 4% of all deaths and nearly 6% of all disease burden for young children. Contaminated drinking water is a

significant source of cholera and diarrhea in young children. When water does not come into the house, the storage of water becomes a major issue as regards contamination. Young children may dip their hands into water or drop water scoops on the floor which then becomes a major source of disease (Lindskog & Lundqvist, 1998). A study done in Malawi showed that diarrhea in children under 5 years old could be significantly reduced by something as simple as an improved bucket for carrying water (Roberts et al., 2001).

Sanitation facilities—The World Health Organization in 2008 estimated that 18% of the world population practices indiscriminate or open defecation, another 12% uses an unimproved sanitation facility that does not ensure hygienic separation of human excreta from human contact. Despite advances in access to improved sanitation facilities throughout the world, open defecation is still practiced by 48% of the population in Southern Asia and 28% in sub-Saharan Africa. In rural areas around the world less than half the population has access to improved sanitation facilities (WHO & UNICEF, 2008). Not having proper facilities to deal with waste contributes to childhood illness and mortality (Agha, 2000; Baltazar & Solon, 1989; Mertens, Fernando, Cousens, & Feacham, 1992; Podewils et al., 2004). Death rates remain alarmingly high in developing countries. For example, in some informal urban settlements in poor Asian, African, and South American cities, mortality rates among young children are estimated at 150–200 per 1000 (Bartlett, 2005; Prüss-Üstün, Kay, Fewtrell, & Bartram, 2004). The largest number of cases involve diarrhea, which is caused by a mélange of bacterial, viral, and parasitic pathogens connected to poor hygiene and sanitation (Podewils, Mintz, Natao, & Parashar, 2004). Diarrheal disease and intestinal parasites also impair food absorption, increasing the risk of malnutrition and stunting. These can lead to problems with behavior and cognitive functioning when children are school age (Grantham-McGregor & Fernald, 1997; Mendez & Adair, 1999). Lack of sanitation facilities has been consistently associated with diarrhea in children who live in poor countries. There is a higher incidence of intestinal parasites in children who share toilets or lack connection to the city sewer system (Ludwig, Fernando, Firmino, & Joao Tadeu 1999; Mahfouz, El-Morshedy, Fargaly, & Khalil, 1997).

Children's vulnerability to pathogens from contaminated water and poor sanitation relates both to their exposure level (children actively explore their environments and are unaware of problems pertaining to sanitation) and their level of immunity. Not having adequate toilet facilities at home is particularly problematic for young children. Taking children any distance to defecate is impractical given their limited capacity to withhold bowel movements. Maintenance of shared toilets is a problem, and young children fear using pit latrines (Curtis et al., 1995; Lindskog & Lundqvist, 1998). They often use yards, increasing their exposure to pathogens.

Food storage/refrigeration—Demographic and Health Surveys done in developing countries show that fewer than 25% of urban households in Sub-Saharan Africa have a refrigerator (Montgomery & Hewett, 2005). Only about one-third of households in Southeast Asia and one-half of the households in Latin America have refrigerators. This creates a risk for food contamination and gastro-intestinal illness (Ehiri et al., 2001). Motarjemi, Käferstein, Moy, and Quevedo (1993) reported that contamination of foods used to wean the child from the breast is a leading cause of diarrheal disease and malnutrition in children under 5. Because young children can hold only limited quantities of food in their stomachs at any given time, they often need several small meals a day to obtain the necessary calories and nutrients. However, when homes contain inadequate facilities for food preparation and storage, it often means food is left out for later consumption, thus increasing the likelihood of contamination (Bartlett, 1999).

Cooking facilities—Having an open stove with no chimney in the household increases indoor pollutants that can pose health risks. Having open fires in the house or a poorly vented stove increases susceptibility to respiratory illness (Awasthi, Glick, & Fletcher, 1996; Collins, Sithole, & Martin, 1990). In poor nations, acute respiratory illness associated with exposure to indoor air pollution is a leading cause of death among young children (Gauderman et al., 2004). Exposure to wood smoke can have other adverse health consequences as well. Prenatal exposure can lead to low birth weight (Siddiqui et al., 2008), and long-term exposure drives up blood pressure in mothers (McCracken, Smith, Díaz, Mittleman, & Schwartz, 2007). Having an open stove or fire in the home is also a significant risk factor for childhood burns. In a 10-year study in Manipal, India, 76% of burns happened to children under 5, and 8% were the result of contact with pressure stoves (a type of open stove used for cooking; Kumar, Chirayil, & Chittoria, 2000).

Construction materials—Few studies have examined the composition of materials used for the roof, floor, and walls in family residences in terms of how such materials may contribute to child well-being. Using data from 85 UN-sponsored Demographic and Health Surveys, Montgomery and Hewett (2005) estimated that roughly half to about 95% of urban households in Latin America, North Africa, Sub-Saharan Africa, Southeast Asia, West Africa, and South and Central Asia had finished floors. There is evidence that poor ventilation (often associated with inadequate flooring, wall composition, and roofing) is connected to poor indoor air quality and increased likelihood of respiratory illness (Awasthi et al., 1996; Collins et al., 1990). Dampness indoors is also associated with respiratory symptoms (Yang, Chiu, Chiu, & Kao, 1997). In a study done in Cameroon, Yongsi and Ntetu (2008) found that a composite index of housing quality that included composition of floors and walls, number of rooms, and availability of piped water and electricity together with material possessions in the residence such as TV, cookers, refrigerators, motor vehicles, and antennas was associated with the level of childhood diarrhea (19.9% prevalence rate in high standard homes versus 49.2% prevalence in low standard homes).

Studies done in countries ranked high on the HDI show that poor housing quality is associated with psychological distress and learned helplessness in school age children (Evans, Saltzman, & Cooperman, 2001). Low housing quality has been associated with mood disorders, psychosomatic complaints, and behavioral dysregulation as well (Evans et al., 2003). The number of studies is small; and most do not include the kinds of samples and controls needed to make strong generalizations to countries ranked low on the HDI. Even so, the evidence suggests that poor housing quality poses a risk for children's health and adaptive functioning.

Access to high quality housing materials, safe drinking water, improved sanitation, refrigeration, and a closed stove all increase the likelihood that young children will avoid diseases like diarrhea that could lead to malnutrition or even death. It also increases the likelihood children will avoid serious respiratory illnesses and injuries (Evans, 2006; Fisk, Lei-Gomez, & Mendell, 2007; Wu & Takaro, 2007). The MICS included each of these factors as indicators of housing quality for children under 5.

Material Resources

Most studies of household resources measure only monetary holdings or expenditures (e.g., Laaksonen, Rahkonen, Martikainen, & Lahelma, 2005). There is little published work on the prevalence of household material resources like a radio, TV, telephone, transportation, and electricity or how they relate to child well-being. One exception is the United Nations Demographic and Household Surveys. Those surveys reveal that, except in Sub-Saharan Africa, the majority of urban households have access to a TV, albeit the percentage is less

than 70% in most of South Asia (Montgomery & Hewett, 2005). Access to radio tends to be higher except in West Asia. Access to electricity increases the likelihood children will have opportunities to learn from radio and TV and that there will be light for reading and other learning activities (Kanagawa & Nakata, 2008). Unfortunately, a household survey done in South Africa found that only 47% of traditional homesteads had such access (Statistics South Africa, 2008). This contrasts to about 90% in Lima, Peru (Meng & Hall, 2006) – reflective of the rural-urban divide. As part of its *World Declaration on Education for All: Meeting Basic Learning Needs*, the United Nations (1990) specified that radio and television play significant roles in educating both children and adults in poor countries. This requires having both the electronics and access to electricity. Having electricity in the household also reduces mortality in children under age 5 in developing countries (Ridder & Tunali, 1999; Wang, 2003). Having household transportation can be critical in dealing with certain injuries and illnesses. It also increases the likelihood that both adults and children will access resources that are farther from the dwelling, including attending school and going to events and facilities that afford opportunities for learning and increased income.

Having access to electricity and devices for communication and transportation markedly increases opportunities for learning and health maintenance, fosters social networks, and increases a family's capacity to meet a variety of basic and emergency needs. Accordingly, we have included indicators of these material resources in this study.

Formal and Informal Learning Resources

Over the centuries there has been movement from the use of spontaneous learning episodes that involve natural objects and circumstances (i.e., informal learning activities) to more carefully structured experiences that involve the use of materials specifically designed to promote a particular type of learning (i.e., formal learning activities). The emphasis on providing stimulation and organized learning experiences for children escalated in technologically advanced societies. The practice fits with societal goals pertaining to higher order skills and independence. Research done in technologically advanced societies shows that children who have access to stimulating learning materials in the home and enriching experiences at home and elsewhere display higher levels of competence and adaptive functioning from late infancy through adolescence, albeit that varies somewhat by country (Bradley & Corwyn, 2006). In addition, there has been evidence from developing countries that exposure to stimulation in the home is associated with such other indicators of well-being as height and nutritional status (Chomitz, 1992; Church & Katigbak, 1991; Cravioto & DeLicardie, 1972; Lozoff, Jimenez, & Wolf, 1991). Unfortunately, few of the major international or national household surveys conducted in developing countries catalog such materials.

Many African households have very few material resources that children can use to stimulate learning (Aina, Agiobu-Kemmer, Etta, Zeitlin, & Setiloane, 1993; Drotar et al., 1999; Holding, 2003). Among the Yoruba, for example, only about 11% of children were observed engaging in technical play with toys and only 27% engaged in social-technical play with toys (Aina et al., 1993). Furthermore, Agiobu-Kemmer (1984) found that Nigerian mothers had to be told to play object games with their children to stimulate them. The paucity of toys and learning materials present in African homes reflects the high rates of poverty present in many African nations. The low level using objects to help children learn also reflects cultural practice and generally low levels of maternal education (Goldberg, 1977).

Children in rural China and Thailand tend to have few toys or books and relatively little exposure to parental teaching of literacy skills (Chi & Rao, 2003). Only 13.9% of Thai households had 10 or more books compared to 54.3% of U.S. households, only 16.7% had

role-playing toys (vs. 99% U.S.), only 5.6% had musical toys (vs. 89.1% U.S.), only 11.1% had eye-hand coordination toys (vs. 49.5% U.S.). The reasons for low scores on these items might be because rural Thai mothers are introverted, low income, and have little formal education (Williams et al., 2003).

In countries rated high on the HDI, there tends to be a consistent relation between family socioeconomic status and the level of exposure children have to stimulating materials and experiences (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Lleras, 2008). Although fewer studies have been conducted in less wealthy countries, the findings are largely the same (Black, 2003; Church & Katigbak, 1991; de Oliveira, Barros, Anselmi, & Piccinini, 2006; Drotar et al., 1999; Duhan & Punia, 1998; Lozoff, Park, Radan, & Wolf, 1995; Masud, Luster, & Youatt, 1994; Misra & Tiwari, 1984; Richter & Grieve, 1991; Torralva & Cugnasco, 1996; Zeitlin et al., 1995; Zevalkink & Riksen-Walraven, 2001). Sahu and Devi (1982) observed a particularly striking SES difference in a study of the home environments of 3- to 6-year-old children from socially advantaged and socially disadvantaged families in an urban area of India. Others have also noted extremely low levels of materials and enriching experiences for children from lower castes in India (Das & Padhee, 1993; Kurtz, Borkowski, & Deshmukh, 1987).

Having access to a variety of both formal and informal materials for learning shows a consistent relation to children's competence and achievement (Bradley & Corwyn, 2006). We focus on both types because formal learning resources (books and manufactured toys) generally require financial resources. By contrast, informal learning resources are items that are readily available in most home environments, but their construction and use may depend more on parental education and family assumptions about their children's future (i.e., things that reflect different aspects of overall standards of living). Consequently, the implications of children not using formal and informal learning resources may differ.

Summary - A General Consideration of Poverty

There is a vast amount of evidence that the quality of the home environment is associated with children's health, competence, and adaptive functioning. However, because of the social, political, and economic constraints present in many developing countries, there remains limited information on the extent to which children from developing nations are exposed to particular home conditions that either protect their health or increase the likelihood of social and intellectual competence. Evans (2003) argued that cumulative risk (sometimes in the form of environmental dangers and obstacles – often co-occurring with other conditions of chronic poverty) leads to allostatic load which reflects chronic wear and tear on body systems. The body's efforts to adjust to ongoing environmental demands lead to constant readjustments of physiological systems which, in turn, can lead to a multiplicity of negative outcomes over the life course. The earlier the risk conditions manifest themselves and the more persistent they are through time, the more likely an individual will succumb to increasing allostatic load.

As discussed in the Introduction to this Special Section (Bornstein et al., 2012), housing quality and access to materials (along with parenting practices and access to health care) reflect not only the general standard of living present in a country but also conditions present at neighborhood and family levels. Many of the conditions examined in this study are co-factors of poverty (Bradley & Corwyn, 2002; Conger & Donnellan, 2007; Evans, 2006). Consequently, it can be difficult to isolate the impacts of specific conditions on particular aspects of parenting and child development. The challenge of determining how specific physical conditions influence parenting or child well-being is made greater given that parental behavior also reflects cultural and geographic circumstances. The general systems principles of equifinality (different conditions can produce the same outcome) and

multifinality (the same condition can produce multiple outcomes) are operative. Granting this uncertainty, it is important for both scientific and policy reasons to more fully document how frequently certain family level conditions are present within a country and how these conditions connect to the broader conditions present in the country.

The data reported on in this study afford an opportunity to further elucidate how home conditions for young children are related to the Human Development Index in developing nations and to explore the relation of the constituent indices of the HDI to the quality of housing, access to material resources, and opportunities for formal and informal learning, enrichment, and comfort experienced by those children. Prior studies have shown that indicators of housing quality are related to several markers of health and health behavior in developing countries (Montgomery & Hewett, 2005). The total number of indicators of housing quality available in this study exceeds the number present in most studies, and the availability of child relevant material resources increases the relevance of findings for children.

Method

Participants

The total sample consisted of 127,347 households with children under age 5 in 28 developing countries (Table 1). Surveys done in all 28 countries included at least some of the home environment questions. The Jamaican survey did not include several questions about the household, and the Albanian survey did not ask whether the household had a radio or electricity. Surveys done in Belarus, Bangladesh, Guinea-Bissau, Iraq, and Somalia did not include questions about books and toys, and the Ghana survey did not ask questions about books. Across countries, the average number of children under 5 in the family was 1.30 ($SD = .53$; range = 1–6); for the purpose of this study, we randomly selected a target child under 5 from families with more than one child under 5. The randomly selected child under 5 averaged 29.16 months of age ($SD = 16.82$; range = 0–59), and 48.6% were female. Mothers averaged 29.37 years ($SD = 8.13$, range = 15–95), and the highest level of education mothers had completed was none or preschool for 29.5%, primary school for 27.5%, secondary school for 36.0%, and higher for 6.9%. Household crowding (computed as the number of household members divided by the number of bedrooms, and then recoded into 5 scaled categories; see Bornstein et al., 2012) averaged 3.23 ($SD = 1.09$; range = 1–5).

Procedures

MICS3 items—The Multiple Indicator Cluster Survey (MICS) is a nationally representative and internationally comparable household survey (UNICEF, 2006). It was implemented in many developing countries and provides a unique source of information to examine protective and risk factors for child health, nutrition, education, and adaptive functioning in different regions of the world. UNICEF developed MICS so low- and middle-income countries could collect comparable data to evaluate country-level progress on issues related to children and women. Three rounds of MICS have been implemented; we use data from the MICS3 which was conducted in 2005–2007. The MICS3 has three questionnaires: a Household Questionnaire, a Questionnaire for Individual Women (15 to 49 years old), and a Questionnaire for Children Under Five. Each questionnaire is composed of core, additional, and optional modules, which are sets of standardized questions grouped by topics. Each country was responsible for designing and selecting a sample. The survey sample was usually a probability sample in all stages of selection, national in coverage, and designed in as simple a way as possible so that its field implementation could be easily and faithfully carried out with minimum opportunity for deviation from an overall standard

design. Multiple steps were taken to ensure data reliability. MICS3 respondents were normally the mother or primary caregiver of the child.

The home environment questions were taken from the water and sanitation and household characteristics modules of the MICS3 Household Questionnaire and the child development module of the Questionnaire for Children Under Five (questionnaires are available at http://www.childinfo.org/mics3_questionnaire.html). Unordered categorical items were recoded into ordinal categories. Following the WHO and UNICEF's (2008) drinking water ladder, we coded drinking water into three categories: *unimproved* (1), *improved* (2), and *pipd* (3). Unimproved drinking water sources were unprotected springs or wells, tanker-trucks or carts with a small tank/drum, surface water, or bottled water (bottled water is considered to be unimproved because it is not regulated and water from other unimproved sources is sometimes bottled and sold in developing countries). Improved drinking water sources were public taps or standpipes, tube wells or boreholes, protected wells or springs, or rainwater collection. Piped water sources were piped directly to the household dwelling, plot, or yard.

Following the sanitation ladder recommended by WHO and UNICEF (2008), we coded toilet facilities into four categories: *open defecation* (1), *unimproved* (2), *shared improved* (3), and *unshared improved* (4). Open defecation consisted of no facilities or toileting in the bush or field. Unimproved sanitation included pit latrines without a slab or platform, hanging latrines, and bucket latrines. Improved facilities included flush or pour-flush latrines, ventilated improved pit (VIP) latrines, pit latrines with slabs, and composting toilets.

The main material of the dwelling floor was recoded into the three existing superordinate categories of natural (1), rudimentary (2), and finished flooring (3).

Cooking was recoded to indicate whether household cooking was done *on an open fire or stove* (0) or in *a closed stove* (1).

Nine household items (radio, television, mobile telephone, non-mobile telephone, refrigerator, motorcycle or scooter, animal-drawn cart, car or truck, and boat with motor) were coded as *no* (0), *yes* (1). Mobile and non-mobile telephone were recoded into a single item to indicate the *presence* (1) or *absence* (0) of either type of telephone in the household. Finally, the four items about household transportation - motorcycle or scooter, animal-drawn cart, car or truck, and boat with a motor - were recoded into a single item to indicate the *presence* (1) or *absence* (0) of any kind of transportation not powered by humans.

The number of books and children's books in the household were recoded into three categories to indicate *no books* (0), *1–9 books* (1), *10 or more books* (2).

Finally, 4 categories of children's toys (household objects, outside objects, homemade toys, and store-bought toys) were coded as (0) *child does not play with the item* or (1) *child plays with the item*.

Home environment indices—We organized the items above into four indices relevant to child development: quality of housing, material resources, formal learning resources, and informal learning resources. Summary scores were computed for each index so long as fewer than 30% of the constituent items were missing. For example, a 5-item index allowed one item to be missing, and a 3-item index allowed no missing items. For summed indices with a missing item, the total was prorated based on the remaining items. We consider these aggregates to be indices and not scales because they are conceptually related as indicators of child development, but they are not necessarily statistically related (see Bradley, 2004;

Streiner, 2003). For example, the likelihood of having a telephone in the household may be unrelated to the likelihood of having transportation, but both items indicate increased access to people and places outside the home.

Quality of housing included drinking water, toilet facilities, household flooring, cooking, and refrigeration. Higher scores on these 5 items were all indicative of a healthier and safer home environment for children under 5. These 5 items were standardized and averaged to create an index of quality of housing.

Material resources included the presence of a radio, television, telephone, non-human-powered transportation, and electricity in the household. Higher scores on these 5 items were all indicative of the availability of a broader range of experiences for children under 5. These 5 items were summed to form an index of material resources.

Formal learning resources consisted of books, children's books, and store-bought toys. Higher scores on these items indicated the availability of items children under 5 might use to learn about letters, words, shapes, colors, and other object properties. These 3 items were standardized and averaged to form an index of formal learning resources.

Informal learning resources consisted of household objects, outside objects, and homemade objects used for play. Higher scores on these 3 items indicated that children under 5 used these commonly available items for play. Items were summed to form the index of informal learning resources.

Human Development Index—The Human Development Index (HDI) was developed by the United Nations as a measure of the social and economic status of a country (UNDP, nd). It was computed for 179 countries and territories in the world, serves as a proxy for standard of living, and is associated with the general level of purchasing power present within a country. The HDI ranges from 0 to 1 and has three major constituent indices: Life expectancy (in years), education (comprised of the adult literacy rate and combined gross enrollment in primary, secondary, and tertiary school), and gross domestic product (GDP; U.S. dollar purchasing power parity per capita). Countries with an HDI of .80 or greater are considered High, .50 to .79 Medium, and .00 to .49 Low. The countries in our study draw from high, medium, and low ranges of HDI. (Additional information about the HDI is available in Bornstein et al., 2012.)

Covariates

Household crowding was used as a covariate for analyses involving quality of housing and material resources. Households with more members are likely to have fewer resources that are divided among many. Crowding varied across countries, $F(26, 124,000) = 649.72, p < .001, \eta^2_p = .12$, and was significantly associated with quality of housing, $r = -.09, p < .001$, and material resources, $r = -.14, p < .001$. Therefore, household crowding was controlled in all analyses of quality of housing and material resources.

Child age and the number of children under age 5 in the family were used as covariates for formal and informal learning resources because having younger children and more children under 5 may relate to having fewer resources. Child age and number of children under 5 in the family varied across countries, $F(27, 127,319) = 50.94, p < .001, \eta^2_p = .01$, and $F(27, 127,319) = 359.47, p < .001, \eta^2_p = .07$, respectively, and were significantly associated with formal and informal learning resources, $r_s = .18$ and $.24, p_s < .001$, for child age, and $r_s = -.15$ and $.01, p_s < .001$, for the number of children under 5. Therefore, child age and the number of children under 5 were controlled in analyses of formal and informal learning resources.

Analytic Plan

First, the 4 indices of environmental resources were explored via ANCOVA, with country as a predictor and crowding as a covariate for quality of housing and material resources, and with child age and number of children under 5 in the family as covariates for formal and informal learning resources. Next, for each of the 4 resource indices we averaged the households in each country and treated each country average as an “observation”. Accordingly, instead of the observations being 120,000 (the total number of children in the survey), the number of observations ranged from 22 to 27 depending on the number of countries for whom data were available on particular resources. Because the households were averaged within countries, the power for these tests is low, and they should be interpreted accordingly. Country averages were then correlated with country HDI and its 3 constituent indices (life expectancy, education, and GDP), controlling for the covariates listed above, and, if significant, the other two indices of the HDI. The HDI is multi-dimensional and, although life expectancy, education, and GDP are related to one another, it is possible that the 3 indices relate in different ways to child development and parenting. Controlling the other 2 indices of the HDI allowed us to remove the shared variance among indices and give a more precise estimate of the effects of the index in question.

Results

Descriptive statistics for the 4 indices of environmental resources by country are presented in Tables 1 and 2. (Additional tables displaying the individual country results for individual items are available online at [URL].)

Deviation from the Grand Mean

Quality of housing—Scores from the 27 countries for which we had data varied within a standard deviation in terms of the quality of housing (Table 1). Controlling for household crowding, the overall effect of country was significant, $F(26, 123,816) = 10,851.72, p < .001, \eta^2_p = .70$. Households in all of the high-HDI countries had quality of housing at least a half standard deviation higher than the grand mean of .17, and households in all the low-HDI countries had quality of housing at least a half standard deviation lower than the grand mean. Countries in the medium-HDI and HDI N/A groups were split above and below the grand mean.

Material resources—Scores from the 26 countries for which we had data indicated wide variability in material resources available in the home (Table 1). Controlling for household crowding, the overall effect of country was significant, $F(25, 123,036) = 5,945.75, p < .001, \eta^2_p = .55$. Households in every high-HDI country had more material resources than the grand mean of 2.91, and households in every low-HDI country had fewer material resources than the grand mean. Countries in medium-HDI and HDI N/A groups were split above and below the mean.

Formal learning resources—Scores from the 22 countries for which we had data varied within a standard deviation in the number of formal learning resources available to young children in the household (Table 2). Controlling for child age and the number of children under 5 in the family, the overall effect of country was significant, $F(21, 74,331) = 2,346.68, p < .001, \eta^2_p = .40$. Households in all of the low-HDI countries scored more than a standard deviation below the grand mean of .12. Countries in the high- and medium-HDI groups were split above and below the grand mean.

Informal learning resources—Scores from the 23 countries for which we had data varied as regards the informal learning resources accessible to children (Table 2).

Controlling for child age and the number of children under 5 in the family, the overall effect of country was significant, $F(22, 79,314) = 562.75, p < .001, \eta^2_p = .14$. Households in all of the high-HDI countries used fewer informal learning resources than the grand mean of .98, and households in all of the low-HDI countries used more informal learning resources than the grand mean. Countries in the medium-HDI group were split above and below the grand mean.

Relations with the Human Development Index

Table 3 displays partial correlations of the HDI and its constituent indices with the home environment indicators, controlling for covariates. Because literacy and schooling could have different effects on child well-being, we also included these two indicators in the analyses.

Quality of housing—The HDI and its constituent indices were significantly correlated with the quality of housing. However, when the other indices of the HDI were controlled, only the GDP index was uniquely associated with quality of housing.

Material resources—The HDI and its constituent indices were significantly correlated with material resources. However, when the other indices of the HDI were controlled, only the GDP index was uniquely associated with material resources.

Formal learning resources—The HDI and its constituent indices were significantly correlated with formal learning resources. When controlling for the education and GDP indices, the life expectancy index attenuated to non-significance. When controlling for the life expectancy and GDP indices, the education index and schooling remained significant, but literacy attenuated. Finally, controlling the life expectancy and education indices, the GDP index remained significantly correlated with formal learning resources.

Informal learning resources—The HDI, life expectancy and the education indices, and literacy were negatively correlated with informal learning resources. However, controlling for the other 2 constituent indices of the HDI, no correlations remained significant.

Summary—Quality of housing, material resources, and formal learning resources were all uniquely related to the GDP index. Formal learning resources were also uniquely related to the education index and schooling. Informal learning resources were not uniquely related to any HDI index.

Discussion

We found a wide range of home environment conditions in the 28 developing countries from the MICS, consistent with findings obtained from other surveys done in developing countries (Montgomery & Hewett, 2005). The quality of housing and material resources were tied to HDI status in that they were higher in all high-HDI countries and lower in all low-HDI countries than the grand mean. However, there were some medium-HDI countries that scored higher than some high-HDI countries, and some low-HDI countries that scored higher than some medium-HDI countries. Formal and informal learning resources were somewhat less tied to HDI. Formal learning resources varied above and below the grand mean in both the high and the medium-HDI groups. Informal learning resources showed the opposite pattern, with all high-HDI countries scoring below the grand mean and all low-HDI countries scoring above the grand mean. This finding likely occurred because children with store-bought toys were more likely to choose to play with them than outside items, household items, and homemade toys. Those countries with high percentages of households

with no store-bought toys also tended to have higher scores on informal learning resources. What was not determinable from the data is what use children actually made of the materials and particularly whether parents used the materials to assist their children's learning. This latter activity may be more closely tied to country HDI.

Findings from this study show that, even within nations that have a low GDP, country level HDI is associated with aspects of the home environment known to support the well-being of young children. Specifically, homes in those countries that scored as relatively high in the HDI were far more likely to have piped water (46.5% to 90.7%) than households in countries that scored as low HDI (1.3% to 26.1%). Similar discrepancies were noted for having unshared improved toilet facilities (87.0% to 98.0% vs. 7.1% to 51.8%). Because GDP plays such a large role in calculating HDI, it was not surprising to find that households in countries with higher levels of HDI had significantly higher levels of access to resources such as radios, TVs, telephones, vehicles for transportation, and electricity. Most notable, perhaps, is the difference as regards electricity: high-HDI countries ranged from 98.8% to 100% of homes with electricity, whereas low-HDI countries ranged from 6.2% to 57.5%. Likewise, in homes from high-HDI countries, books for children were far more readily available: from 10% to 59.3% of households had 10 or more children's books in high-HDI countries contrasted to no more than 2.0% in low-HDI countries. Store bought toys were available in from 62.4% to 91.6% of homes from high-HDI countries. This contrasts to 20.0% to 69.8% in homes from low-HDI countries. Differences in access to these materials and facilities would seem particularly significant given findings showing that country level differences in access to such resources are related to measures of children's cognitive and behavioral functioning (Gauvin & Munroe, 2009).

Given that the HDI tracks GDP closely, it is not surprising that of the three constituent indices of the HDI, GDP shows the strongest association with quality of housing, access to opportunities for broadened experiences, and materials for learning available. Housing quality has been linked to family income in many studies (Evans, 2006); and family income has been associated with the availability of toys and learning materials as well (Bradley, Corwyn, MacAdoo, & Garcia Coll, 2001). Even so, the findings showed that the other constituent indices of the HDI contributed to the prediction of some material resources above and beyond what could be predicted from GDP alone. For example, maternal level of schooling showed a unique relation to the availability of books and store-bought toys for learning. Not surprisingly, parents with high levels of education tend to provide more materials and experiences for their children's learning than do parents with low levels of educational attainment (Bornstein & Bradley, 2003).

According to the International Committee on Economic, Social, and Cultural Rights, every person has a right to adequate housing. The Committee argues (Comment 4, Section 8), "To ensure the health, security, comfort, and nutrition of its occupants, an adequate house should have sustainable access to natural and common resources, safe drinking water, energy for cooking, heating and lighting, sanitation and washing facilities, means of food storage, refuse disposal, site drainage and emergency services" (Office of the High Commissioner on Human Rights, Article 11(1): 12/13/1991). Living in poorly constructed homes with inadequate facilities for drinking, cooking, toileting, and learning not only pose direct threats to children's health and competence, but they make the tasks of parenting more difficult. Parents themselves are likely to be more stressed and less healthy. Moreover, they have less time and fewer resources to provide the kinds of stimulation and nurturance children need to assure well being. Thus, poor housing both directly and indirectly undermines children's development (Bradley, 2006; Evans, 2003).

One of the great difficulties with the high rate of low quality home environments in poor countries is that low quality home environments contribute to the intergenerational transmission of poverty and low quality of life. Because poor housing quality and lack of access to high quality materials at home contribute to poor health and lower competence, they reduce the likelihood of increased GDP at the community and societal levels (Qureshi & Mohyuddin, 2006). Failure to improve GDP then increases the likelihood that low quality of housing will persist into the second generation and beyond.

Finding that informal learning resources were not significantly related to GDP indicates that parents in all countries could be encouraging learning with readily available objects. For example, parents could teach colors using flowers and leaves, counting using rocks, and shapes using cups, sticks, and other household items. Children can learn about object properties without costly store-bought toys. It would seem worthwhile for UNICEF, WHO, the World Bank, NGOs, and governmental agencies to devise ways of both educating very low income parents on how to utilize everyday objects to teach their children concepts and skills pertinent for academic success, and encouraging them to employ those learning techniques as part of daily routines. The key is to devise ways that are both culturally appropriate and sensitive to the constraints parents (mostly mothers) face in daily life. This means brief, carefully targeted interventions and public health announcements. Such simple approaches have been found to be effective techniques for improving water quality in the home (Jalan & Somanathan, 2004).

The findings from the MICS3 are limited in terms of what they can say regarding relations between the HDI and the likelihood children will experience better housing conditions, more access to learning materials, and a greater likelihood of having experiences that afford opportunities for enrichment and comfort. Data were available from only a select number of countries, and not all countries included in the MICS3 completed all the key items. Moreover, the data from the MICS3, like the data from most other surveys that address household quality and material resources, do not contain an optimal set of indicators of these constructs. Nonetheless, the findings point to needs to increase the standards of living in low-HDI countries and to find ways of increasing family income and opportunities for education. The well-being of the current generation of children and the turnover to the next would almost certainly improve with greater access to income and education (Walker et al., 2007). Even so, the efforts to improve standards of living and quality of life are likely to be fraught with challenges as numerous other factors are implicated in quality of life, and a diverse array of cultural and political factors would help determine the likelihood that any effort would result in meaningful change at the individual household level (Southern African Regional Poverty Network, 2006). Moreover, a full understanding of how the HDI (and related measures of standard of living) connects to child development via housing quality and material availability awaits the implementation of longitudinal studies on carefully targeted samples.

There is increased interest in how assets of all sorts can be converted into practices and arrangements that foster children's health and development (Chowa, Ansong, & Masa, 2010). For those interested in the well-being of children who live in low-HDI countries – and, for that matter, children who live in most countries – the data base on how housing quality and the materials available in homes affect developmental course and life prospects is especially weak. There is a growing literature on how poverty and chronic adversity affect parenting processes; but that literature is mostly informed by research on children from technologically advanced societies and research that is limited to a few key parenting practices. Research that is inclusive, both in terms of the people it investigates and the environmental conditions it considers, remains scarce (Leventhal & Newman, 2010). Moreover, the extant research rarely considers the indirect pathways through which physical

arrangements and access to materials affect children's well-being. For example, a study done in rural Ethiopia showed that a family's access to sickles and plows increased the likelihood children would attend school regularly as the children were not needed as much to help with farming tasks (Cockburn & Dostie, 2007). In effect, for child development research to usefully inform housing and economic policy in most countries – policies that necessitate careful decision making and hard choices given limited economic resources – it must expand in terms of who is studied, what environmental conditions are considered, and what processes linking those conditions to key child outcomes are analyzed. This broader undertaking is also needed to advance the science of environment-development relations more generally. Too much of what we believe about how environments are implicated in children's development derives from research that is insufficiently inclusive of the totality of factors in the home environment that likely matter and the diversity of living conditions present throughout the world. Most developmentalists would probably not have entertained the notion that a family's access to a plow could increase the level of education a child might obtain (and whatever that might augur for employment or health downstream). But exploring such paths in a diverse array of places will almost certainly lead to expansions and corrections in our understanding of how environmental conditions function to impact children.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive Statistics and Effect Sizes for Deviation from the Grand Mean for Quality of Housing and Material Resources

	Quality of Housing				Material Resources		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>ES</i>	<i>M</i>	<i>SD</i>	<i>ES</i>
High HDI							
Montenegro	814	.88	.26	1.10	4.61	.69	1.33
Serbia	2868	.82	.30	1.01	4.41	.90	1.18
Belarus	2810	.81	.22	.95	3.97	.83	.74
Macedonia	3225	.83	.27	1.04	4.11	1.01	.95
Albania	944	.84	.27	1.00	--	--	--
Kazakhstan	3536	.58	.34	.57	3.54	.98	.43
Bosnia and Herzegovina	2704	.91	.18	1.10	4.62	.63	1.27
Medium HDI							
Thailand	8312	.53	.31	.54	4.41	.87	1.17
Ukraine	2748	.77	.29	.87	3.86	.86	.64
Belize	585	.40	.50	.34	3.58	1.35	.53
Jamaica	1168	--	--	--	--	--	--
Syrian Arab Republic	7553	.85	.29	1.10	3.87	.90	.81
Mongolia	3040	.05	.56	.43	2.89	1.21	.44
Viet Nam	2302	-.16	.64	-.57	2.98	1.29	.02, <i>ns</i>
Uzbekistan	3876	.46	.41	.42	3.30	.98	.28
Kyrgyzstan	2353	.54	.41	.57	3.28	1.01	.29
Tajikistan	3136	.07	.55	-.16	2.98	1.03	.08
Yemen	2409	.03	.73	-.18	2.50	1.67	-.22
Ghana	2624	-.47	.51	-1.02	1.76	1.44	-.90
Bangladesh	26206	-.63	.44	-1.29	1.34	1.43	-1.24
Low HDI							
Togo	3151	-.67	.43	-1.38	1.62	1.46	-1.06
Gambia	4886	-.18	.51	-.60	2.53	1.34	-.34
Côte d'Ivoire	6541	-.33	.57	-.80	2.27	1.59	-.50
Guinea-Bissau	4485	-.50	.55	-1.12	1.35	1.19	-1.29

	<i>n</i>	Quality of Housing			Material Resources		
		<i>M</i>	<i>SD</i>	<i>ES</i>	<i>M</i>	<i>SD</i>	<i>ES</i>
Central African Republic	6565	-.81	.36	-1.63	.74	.92	-1.83
Sierra Leone	4066	-.88	.45	-1.71	.60	.85	-1.90
HDI N/A							
Iraq	10587	.74	.45	.95	3.65	1.07	.69
Somalia	3853	-.83	.51	-1.55	.83	1.22	-1.57
TOTAL	127347	.17	.63	NA	2.91	1.25	NA

Note. All countries significantly differed from the grand mean at $p < .001$, except where noted.
Effect sizes (*ES*) are based on models with covariates. -- = Data were not collected. NA = Not applicable.

Table 2

Descriptive Statistics and Effect Sizes for Deviation from the Grand Mean for Formal and Informal Learning Resources

	Formal Learning Resources				Informal Learning Resources			
	<i>M</i>	<i>SD</i>	<i>ES</i>		<i>M</i>	<i>SD</i>	<i>ES</i>	
High HDI								
Montenegro	.77	.60	1.23		.61	.81	–1.08	
Serbia	.47	.76	.71		.86	.96	–.34	
Macedonia	.07	.76	–.10		.35	.52	–1.78	
Albania	.05	.65	–.19		.87	.88	–.39	
Kazakhstan	.71	.52	1.19		.77	.90	–.54	
Bosnia and Herzegovina	.59	.64	.90		.76	.90	–.64	
Medium HDI								
Thailand	.28	.62	.28		1.07	1.05	.22	
Ukraine	1.01	.36	1.74		.72	.90	–.75	
Belize	.54	.63	.88		.97	.95	–.05, <i>ns</i>	
Jamaica	.61	.55	.97		1.44	1.09	1.16	
Syrian Arab Republic	.07	.67	–.03, <i>ns</i>		.96	.95	–.03, <i>ns</i>	
Mongolia	.09	.61	–.06		.50	.68	–1.20	
Viet Nam	–.03	.72	–.34		.43	.66	–1.43	
Uzbekistan	.38	.55	.55		1.13	.97	.40	
Kyrgyzstan	.36	.56	.49		.95	.92	–.12	
Tajikistan	–.04	.66	–.28		.84	.95	–.37	
Yemen	–.27	.63	–.68		1.07	.97	.31	
Ghana	–.52	.63	–1.25		1.45	1.06	1.23	
Low HDI								
Togo	–.68	.52	–1.59		1.05	.96	.27	
Gambia	--	--	--		1.35	1.07	1.10	
Côte d'Ivoire	–.64	.52	–1.49		1.08	1.11	.35	
Central African Republic	–.74	.50	–1.65		1.37	.13	1.10	
Sierra Leone	–.52	.63	–1.28		1.97	1.05	2.59	
TOTAL	.12	.51	NA		.98	.38	NA	

Note. All countries significantly differed from the grand mean at $p < .05$, except where noted.

Effect sizes (ES) are based on models with covariates. -- = Data were not collected. NA = Not applicable.

Table 3

Partial Correlations of HDI and its Constituent Indices with the Home Environment Indices

	Quality of Housing ^a	Material Resources ^a	Formal Learning ^b	Informal Learning ^b
HDI	.92 ***	.94 ***	.76 ***	-.47 *
Life Expectancy Index	.80 ***/.10	.85 ***/.35	.50 */-.13	-.44 */-.24
Education Index	.82 ***/.34	.82 ***/.26	.72 ***/.50 *	-.50 */-.35
Literacy	.81 ***/.41	.81 ***/.34	.63 **/.40	-.54 */-.41
Schooling	.76 ***/.04	.77 **/-.03	.82 ***/.63 **	-.32
GDP Index	.90 ***/.64 ***	.92 ***/.67 ***	.71 ***/.48 *	-.30

Note. $N = 22$ – 27 countries. Partial correlations after the / are controlling for covariates and the other 2 indices that compose the HDI.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.

^aControlling for crowding.

^bControlling for number of children under 5 in the family and target child age.