3 Exploring Differences in the Rural Home Environment: The Role of Biological and Environmental Factors

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The home environment is an important influence on children's health and development (Boivin et al., 1996; Bradley & Caldwell, 1995; Sigman et al., 1989). Having adequate levels of stimulation, support, and enabling structures at home is especially important for children who live in general conditions of poverty or threat (Bradley & Corwyn, 2006). In order to develop programs to protect children and to promote their healthy development, researchers, policy makers, and practitioners have long felt the need to better understand how children's home environments affect their well-being. Consequently, considerable attention has been devoted to finding ways to gauge the quality of children's environments accurately. One of the most frequently used measures of the quality and quantity of stimulation and support available to a child in the home environment is the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell & Bradley, 2003).

The Middle Childhood (MC) HOME Inventory (Bradley, 1994), which is the subject of the current investigation, was designed for children aged between 6 and 10 years. It comprises observations of parental responsivity to the child, descriptions of family routines and experiences, measures of orderliness in the home, and the opportunities for stimulation within the child's physical home environment. Several studies suggest that these dimensions of family influence are strongly related to socioeconomic status (Bradley, Corwyn, McAdoo, & Coll, 2001;

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Hart & Risley, 1995). However, in settings where many households are characterized by low parental education and household income, it is unclear whether the indicators contained in the HOME Inventory are optimal for characterizing diversity within the home environments of families.

Bradley, Corwyn, and Whiteside-Mansell (1996) have also reviewed evidence for the validity of the HOME Inventory across different cultural settings. Measurement of certain constructs which are assumed to be universal is expected to yield similar results across cultures (Whiteside-Mansell, Bradley, Little, Corwyn, & Spiker, 2001); however, this may not be the case due to the cultural specificity of the actions, activities, and relationships within the home environment (Bradley & Corwyn, 2005). Across diverse settings, the items in the HOME Inventory may not adequately reflect the manner in which, for example, parental sensitivity to a child's needs and behavior is expressed. For instance, within some societies, a child is not seen as an interactive partner for adults, and parents do not play with their children (Bornstein, 2007). In other societies, adults do not consider it appropriate for a child to be independent, assertive, and inquisitive (Aina, Agiobu-Kemmer, Etta, Zeitlin, & Setiloane, 1993; Greenfield, 1994). On the other hand, some activities which are not included in the HOME Inventory may be just as important to children's well-being among families living in different contexts (Lancy & Grove, 2011; Shweder, 1995). These differing expectations may lead to home environments being described as "limited, deprived or deficient rather than different" (Bernstein, Harris, Long, Iida, & Hans, 2005) and contribute to the limitations seen in the cross-cultural application of the HOME. Such limitations, which are part of a larger problem of how to select indicators to characterize the resources and events present in diverse contexts or with diverse groups (Hagerty & Land, 2007), may compromise the validity of the measure.

Research on child development has consistently shown that the home environment has strong links with child outcome across several spheres (Hart & Risley, 1995; Sarsour et al., 2011). In addition, among those identified as being most at risk for poor developmental outcomes are those living in poverty in resource-poor settings. Although the HOME Inventory has been used in several scientific studies worldwide (Baker-Henningham, Powell, Walker, & Grantham-McGregor, 2003; Bradley & Caldwell, 1981; Bradley et al., 2001; Burston, Puckering, & Kearney, 2005; Caughy, Randolph, & O'Campo, 2002; Hamadani et al., 2010; Pessanha & Bairráo, 2003) and as part of numerous efforts to evaluate programs for parents and children (Bradley & Putnick, 2012), one major limitation is the overconcentration on children younger than school age (Bradley & Corwyn, 2005). Furthermore, few studies have applied this measure in sub-Saharan Africa (Aina et al., 1993; Bangirana et al., 2009; Goldberg, 1977; Holding, Abubakar, Obiero, & Van de Vijver, 2011; Richter & Grieve, 1991; Sigman et al., 1989). The need for a measure that accurately assesses the proximal processes within the rural child's environment from an ecological perspective provided the impetus for the current study.

Our primary objective was twofold. Through Study 1, we sought to identify the specific actions, objects, events, and conditions within households that influence child well-being. In line with Bronfenbrenner's bioecological theory (Bronfenbrenner & Ceci, 1994), we expected an association between child characteristics, the processes within the home environment, and distal contexts. We aimed to establish the reliability of the modified indicators and whether or not patterns of response varied by age and gender of the school-age child. We also examined the extent to which the quality of the home environment (in terms of availability of stimulating materials, aspects of physical surroundings, and parental nurturance) differed according to child nutritional status and an index of household wealth. In so doing, we sought to obtain preliminary evidence for the validity of the home measure. In Study 2, we validated the modified measure by investigating the associations between the home environment and child outcomes. We set up a model with all the variables in Study 1 (except nutritional status), as well as two child outcomes (language and

motor development) included. The identification of discrete components of the home environment that influence outcome will facilitate the formulation of interventions in a more targeted and effective manner.

Method

Study Site and Sample Selection

The study was carried out in Kilifi County (formerly Kilifi District in the Coast Province of Kenya). More than half of the district's population lives below the poverty line (Kahuthu, Muchoki, & Nyaga, 2005) with incomes of less than $2 USD a day. The majority (>80%) of the population is engaged in agricultural activities that include crop cultivation and rearing of livestock. Other sources of income include trade and services, tourism, fishing, and mining.

A typical home in Kilifi comprises a large homestead with several small huts in which extended family members live together and share in the daily household chores. It is not uncommon for members from different generations to share in child-rearing duties. Children of school-going age spend a lot of their time outdoors with near-age siblings or peers. Boys have more unstructured time engaging in mostly play activities, while girls attend to household chores such as fetching firewood and water and helping their mothers in the fields (Wenger, 1989).

The participants in this cross-sectional study comprised a subgroup of 146 children aged 8–10 years who were part of a larger program on the development of psychological assessment materials for school-age children (Kitsao-Wekulo, Holding, Taylor, Abubakar, & Connolly, 2013a). Children were included in the main study if they lived within a 5 km radius of five schools randomly chosen to represent a cross section of schools in the district. For the HOME Inventory sub-sample, attempts were made to ensure an equal representation of boys and girls and an appropriate cross section of residential areas. A detailed description of the study area is presented elsewhere (Kitsao-Wekulo et al., 2013a).

Study 1: Tool Development

For the adaptation and modification of the home environment measure, we followed the systematic test adaptation procedure recommended by Holding, Abubakar, and Kitsao-Wekulo (2009).

Item Pool Modification All the items of the original MC-HOME Inventory were translated into Kiswahili, the *lingua franca* of the region, using the descriptions provided in the original manual. We made use of conceptual translations because some words or phrases could not be translated directly. At each stage of translation, we grouped the items into sets and then evaluated them through an iterative process where each set was presented to different respondents.

Initial interviews were conducted with three willing parents to establish the clarity and face validity of the items. A focus group discussion was also held with eight mothers of school-age children to establish their understanding of the item content and if the items would be answered without hesitation. Their responses suggested that some of the items needed further clarification. Our own observations made during data collection pointed to the perceptual richness of the environs of the household. We therefore incorporated an additional item as an indicator of environmental stimulation.

After this process, some of the original content was retained, while other items were modified to take into account the cultural milieu of the study. The Kiswahili version was evaluated for clarity and then back translated by a panel of professionals (a psychologist, a community pediatric nurse, and two teachers) with detailed knowledge of the cultural and linguistic context.

Training of Interviewers Prior to the main study, the principal investigator (PH) trained three interviewers to administer the MC-HOME Inventory. For the purpose of this study, the interviewers were referred to as home "visitors." The interviewers familiarized themselves with the content and structure of the MC-HOME Inventory which were then explained to them in depth. They were provided with information on how 6–10-year-old

children develop and important influences on their development. The interviewers were also instructed on interviewing techniques.

Practical training began with the principal investigator observing each "visitor" administering the inventory. She provided feedback to ensure that the "visitors" understood interview procedures. The "visitors" then conducted mock interviews with selected caregivers while being observed by a trained member of the assessment team. One source of homogeneity in responding was the tendency for interviewees in this community to simply agree with the interviewer. Developing the skills of potential interviewers to elicit responses in a more conversational method was identified as a way of circumventing this problem and obtaining more informative responses. An interview guide with additional prompts and probes was therefore developed and used during the interview to maintain the flow of the conversation. More specific examples of relevant activities were included to facilitate the coding of each item. This guide was modified and updated with relevant information throughout the one-month training period. Throughout the training process, the interviewers recorded their observations and caregiver responses to interview questions. They then used this information to rate the interviews.

Piloting Phase After final selection and refinement of items, further piloting took place in the homes of seven children randomly identified from a census database of the study area population available at the Kenya Medical Research Institute. The purpose of these interviews was to evaluate the acceptability of the interview procedure, clarity of the modified items, feasibility of completing the observational items, and variability in responses.

In the initial analysis of pilot data, more than one-third of the items demonstrated a lack of variability, suggesting the need to investigate alternative indicators of inter-household variability. The scoring procedure was expanded to a three-point rating scale (not at all = 0, sometimes = 1, most of the time = 2) and tested on 15 literate parents. Descriptive analysis of the total scores and responses to individual items indicated that this method yielded greater response variability. This version of the MC-HOME Inventory was then administered to 24 respondents. Across these participants, 94% of the items received multiple ratings.

All the interviews were carried out outside children's homes as it is uncommon for visitors to be invited into the house. Caregivers (most frequently, mothers) were asked to talk about each item as it related to the target child and family. At the end of the interview, the caregiver was asked for permission to escort the interviewer into the house to see the living conditions inside the family home.

Materials and Procedures

Home Environment Measure The final modified version was renamed the Kilifi-Home Inventory for Primary School Children (Kilifi-HIPSC). The Kilifi-HIPSC was administered to selected primary caregivers who were interviewed at home in the presence of the target child at prearranged times. The "visitors" completed a form on which they recorded the caregivers' responses verbatim. When specific objects that were not clearly visible were mentioned during the interview (e.g., toys and books that the family possessed), the "visitor" asked the caregiver to show her the items. The interview took about one hour to administer. Appendix 1 presents a summary of the proportion of respondents who selected each rating level and highlights items that were retained from, modified from, or added to the original version. Inter-rater reliability data were collected for all the interviews conducted. The written responses of one observer were reviewed and recoded by a second rater. Discrepancies in coding were discussed with a third coder until consensus on the correct score was reached (De Temple & Snow, 1998).

Other Measures Information on child gender, age, and household wealth was collected using a standard questionnaire. Birth records were used,

where available, to confirm the child's date of birth. In the cases where records were not available, the procedure outlined by Kitsao-Wekulo and colleagues (2013a) was followed where parents were asked to recall major events that occurred around the time of the child's birth. For the purpose of this study, an age variable in 6-month increments was created. Children's heights were measured to the nearest centimeter using a stadiometer, and height-for-age indices to determine nutritional risk were calculated using Epi Info (Centers for Disease Control and Prevention, Atlanta, GA). Growth retardation was defined as height that was more than two standard deviations below the levels predicted for age according to the World Health Organization standards (WHO Multicentre Growth Reference Study Group, 2006).

During the visit, additional information was obtained on aspects of household SES which was calculated as a composite index of six indicators: parental education (mothers and fathers separately—"0" = no education, "1" = <8 years of education, "2" = 8 years of education, "3" = 9–12 years of education, "4" = >12 years of education); parental occupation (mothers and fathers separately—"0" = not known/deceased, "1" = unemployed/housewife, "2" = subsistence farvmer, "3" = unskilled/petty trader, "4" = semi-skilled, to "5" = skilled), ownership of small livestock ("0" = none, "1" = <5, "2" = 5+); and, type of windows (a proxy for housing quality among homesteads characterized mainly by grass-thatched mud-walled dwellings) in the child's dwelling ("0" = none, "1" = open, "2" = small, "3" = wooden, "4" = wire, "5" = glass). (Household windows, a proxy for housing quality, demonstrated variability among households characterized mainly by grass-thatched mud-walled dwellings). These items were selected from a review of SES indicators made in the study population. Previous research had revealed a significant positive association of these indices with children's final school examination score (Holding, personal communication, 2003). We derived an index of household wealth that divided the sample into three approximately equal groups—least wealthy (level 1), moderately wealthy (level 2), and the wealthiest (level 3).

Study 2: Tool Validation

The measures included in developing a model of influences of child characteristics and environmental factors on children's language and motor skills are listed in Table 3.1.

Child Outcomes A battery of neuropsychological tests was used to assess children's language skills and motor abilities (Kitsao-Wekulo et al., 2013a).

Language Skills The Kilifi Naming Test (KNT), a test of confrontation naming, was used to assess expressive vocabulary (Kitsao-Wekulo et al., under review). In the KNT, the child is asked to spontaneously give one-word responses when presented with a black and white line drawing of a familiar object. Correct responses were coded as "1." A stimulus cue was provided when no response was given, the child stated that they did not know the name of the item, or the item was perceived incorrectly. If the child did not provide a correct response after the stimulus cue, the word that was provided was recorded verbatim. The test was discontinued after six incorrectly named consecutive items. The final score was calculated by summing the number of spontaneously correct items and the number of correct items following a stimulus cue.

Motor Abilities Children's motor abilities were assessed using five tests of gross motor abilities covering two areas of motor performance—static and dynamic balance—and three timed tests of fine motor coordination and manual dexterity (Kitsao-Wekulo et al., 2013b). Maximum likelihood factor analysis with oblique rotation was then applied to the *z*-scores to reduce the multiple motor scores to ability composites (Ackerman & Cianciolo, 2000). Factor analysis yielded support for a two-factor solution; four tests were loaded on the motor coordination factor, while the remaining four tests were loaded on the static and dynamic balance factor. Factor scores were defined as the mean of the *z*-scores for the tests loaded on each factor. Overall motor index was defined as the mean of the two factor scores.

Table 3.1 Explanation of variables in the structural equation model

Indicator	Represents: (concept)	*N*	Measurement of variable	Type of variable	Derived from
1. Household wealth	Socioeconomic status	308	Interview schedule	Continuous	Summation of six SES indicators
2. Age	Maturation	308	Interview schedule	Continuous	Birth records or parental report
3. Gender	Biological differences and/or cultural socialization	308	Interview schedule	Categorical	Observation
4. Kilifi-HIPSC scores	Opportunities for stimulation	146	Modified HOME Inventory	Continuous	Summation of scores from five subscales
5. Language scores	Expressive vocabulary or confrontation naming abilities	308	Kilifi Naming Test	Continuous	Summated score for 61 items
6. Motor scores	Balance and coordination skills	292	Five gross and three fine motor tests	Continuous	Average of two factor scores

Test Administration

All the tests were administered at a school near the child's home. Each child was tested individually in a quiet area within sight of other children and in familiar surroundings to minimize test anxiety. Observations by the assessors suggested that none of the children was unduly anxious during the test sessions.

Analysis

Study 1 We described the characteristics of the study sample using frequencies and proportions. To establish consistency among raters, we used the kappa statistic. In order to ensure that items had acceptable variability, an item analysis was conducted. Items were clustered into six groups of connected items to derive conceptually meaningful subscales. The relationship of each item to the subscale as a whole was evaluated by examining point-biserial correlations. We used a minimum threshold value of 0.15, and the items whose item-to-subscale correlations fell below this level were dropped from the subscale, except in the case where there were strong conceptual grounds for retention or they contributed to internal consistency (Han, Leventhal, & Linver, 2004). Internal consistency reliability levels of each of the six subscales were also examined.

The association between the scores on the final subscales and age and gender was tested using an independent samples t-test and analysis of variance. In order to assess convergent validity, we measured correlations between the Kilifi-HIPSC subscales, total score, child nutritional status, and socioeconomic indicators. Correlation and multiple regression analyses were conducted to examine the relationship between Kilifi-HIPSC scores and various potential predictors. We carried out all analyses using SPSS Version 16 and set an alpha level of 0.05 for statistical significance.

Study 2 Structural equation modeling (SEM) was conducted by developing and testing a path analysis model based on logic and theory about how gender, age, and environmental factors (home environment and SES) would be expected to influence children's language and motor skills. The initial model depicting anticipated paths between predictors and these skills is presented in Fig. 3.1. Only the children who had all measures were included in this analysis ($N = 146$). Specific procedures for model development were to remove nonsignificant ($p \geq 0.05$) paths and

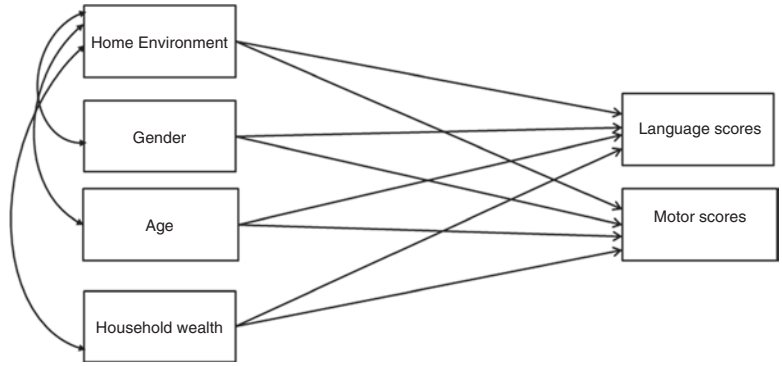

Fig. 3.1 Hypothesized model of the association between the home environment and child outcomes

use modification indices as suggested by the AMOS SEM program (Arbuckle, 1988) to add paths or correlations that would improve model fit. Chi-square analysis was conducted in initial examination of the goodness of fit to ensure nonsignificance. However, because this method is sensitive to sample size, other indices of goodness of fit included the Tucker-Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) (Bentler & Chou, 1987; Browne & Cudeck, 1993). Acceptable fit was defined as TLI and CFI >0.90 and RMSEA < 0.08 and an excellent fit as TLI and CFI >0.95 and RMSEA < 0.05.

Results

Study 1

Sample Description Children were on average 9.0 years old (range, 6.5–13 years) and 52.1% were boys. The majority of children were rural residents; 16% lived in a peri-urban area, on the outskirts of the main town. Only 21 (14.4%) children were not attending school (Table 3.2). Children to whom the Kilifi-HIPSC was administered were not significantly different from the remainder in the main study in terms of gender distribution, age, area of residence, nutritional status, and household wealth. However, the Kilifi-HIPSC subsample had significantly less number of years of exposure to school, $t(306) = 2.574$, $p = 0.011$.

Item Analysis The observed agreement for the raters across all the 60 items ranged from 0.69 to 0.99, and the average percentage agreement was 93.4%. Kappas ranged from 0.38 to 0.99, and the overall inter-rater reliability was found to be kappa = 0.87, 95% CI (0.838, 0.893) (Table 3.3). The mean total score on all the 60 items of the Kilifi-HIPSC was 64.46 (SD = 11.61; range, 37–97) out of a possible maximum score of 120.

A descriptive analysis of the responses revealed that items 8, 10, 14, 17, and 39 were endorsed at levels of >95% at any one of the three ratings. These five items were excluded from further analysis based upon extremely infrequent or frequent endorsement (Clark & Watson, 1995). The final 45 items were grouped into clusters according to the manner in which they cohered conceptually. The groupings in the original MC-HOME Inventory guided this process which yielded six subscales representing language stimulation, parental concern, emotional support, provision for/involvement in activities, cognitive stimulation, and physical environment (Fig. 3.2). All items had acceptable item-to-subscale correlations except for item 27, "Child has free access to musical instrument," in the provision for/involvement in activities subscale. This item was retained because it differentiated households from each other. Cronbach's alphas of the subscales ranged from 0.593 to 0.707. Subscales for emotional support and physical environment had the greatest internal consistency levels (Table 3.4). Significant correlations among the subscales ranged between 0.171 and 0.544.

Table 3.2 Characteristics of the Kilifi-HIPSC subsample

	HOME subsample		Non-HOME sample	
Variable	*N*	%	*N*	%
Gender				
Boys	76	52.1	72	44.4
Girls	70	47.9	90	55.6
Area of residence				
Rural	123	84.2	122	75.3
Peri-urban	23	15.8	40	24.7
Nutritional status				
Stunted	38	26.0	36	22.2
Not stunted	108	74.0	126	77.8
Variable	M	SD	M	SD
Age (years)	8.99	1.12	9.16	1.11
Range	6.5–13.0		5.00–13.50	
School experience (years)	2.47	1.72	2.96	1.63
Range	0–7		0–6	
Household wealth	8.98	4.09	8.48	3.79
Range	1–21		1–19	

Associations with Background Variables Correlations between age, gender, and the Kilifi-HIPSC subscale and total scores were all nonsignificant. The language stimulation, provision for/involvement in activities, and cognitive stimulation subscales as well as the total scale score were moderately correlated with height-for-age *z*-scores, such that lower scores were associated with poorer nutritional status. Household wealth positively correlated with all the Kilifi-HIPSC subscales (correlations ranged from 0.280 to 0.567), with the exception of the emotional support subscale (Table 3.5).

Significant Predictors The multiple regression model with the two predictors, nutritional status and household wealth, produced $R^2 = 0.220$, $F(4, 142) = 21.301$, $p < 0.001$ for the language stimulation subscale; $R^2 = 0.066$, $F(4, 142) = 6.089$, $p = 0.003$ for the parental concern subscale; $R^2 = 0.133$, $F(4, 142) = 12.007$, $p < 0.001$ for the activities subscale; $R^2 = 0.333$, $F(4, 142) = 37.025$, $p < 0.001$ for the cognitive stimulation subscale; and $R^2 = 0.095$, $F(4, 142) = 8.549$, $p < 0.001$ for the physical environment subscale. Nutritional status and household wealth also predicted nearly 26% of the variance on the combined Kilifi-HIPSC score, $R^2 = 0.255$, $F(4, 142) = 25.655$, $p < 0.001$. Table 3.6 summarizes the results of the regression analysis.

Study 2

Descriptive Data and Variable Intercorrelations Descriptive data for each of the variables and variable intercorrelations are presented in Tables 3.7 and 3.8, respectively. Gender differences favored boys ($t(144) = 1.248$, $p = 0.214$) on the language test and girls on both the motor, $t(144) = -0.014$, $p = 0.989$, and Kilifi-HIPSC, $t(131) = -0.545$, $p = 0.587$, scores. These differences were however not significant. Age had a significant effect on the language, $F(2, 145) = 6.61$, $p = 0.002$, $\eta^2 = 0.085$, and motor test scores, $F(2, 145) = 8.48$, $p < 0.001$, $\eta^2 = 0.106$, but not on Kilifi-HIPSC scores, $F(2, 145) = 2.574$, $p = 0.08$, $\eta^2 = 0.04$. Household wealth differences in language skills, $F(2, 145) = 0.884$, $p = 0.416$, $\eta^2 = 0.01$, and motor abilities, $F(2, 145) = 2.05$, $p = 0.133$, $\eta^2 = 0.03$, were significant only for the Kilifi-HIPSC scores, $F(2, 145) = 21.74$, $p < 0.001$, $\eta^2 = 0.23$.

Age showed weak to moderate correlations with household wealth and the two child outcomes. The two environmental variables were moderately correlated with each other, as were the two child outcomes.

Model Development The initial model did not result in a good fit. Several revisions to the model were then made by deleting nonsignificant paths. Modification indices did not suggest the need for additional paths or correlations. The final model, shown in Fig. 3.3, provided a good fit to the data, χ^2 (9, $N = 146$) = 10.05, $p = 0.35$, TLI > 0.95, CFI > 0.95, RMSEA < 0.05. This model included direct paths from the Kilifi-HIPSC scores to both language and motor scores indicating associations of more enriched home environments with higher scores on both language abilities and motor skills. While higher family resources as assessed by the index for

Table 3.3 Kappa coefficients for Kilifi-HIPSC items

Items	Percent of overall agreement	Free-marginal kappa	Items	Percent of overall agreement	Free-marginal kappa
HP01	0.986	0.979	HP31	0.959	0.918
HP02	0.884	0.767	HP32	0.993	0.986
HP03	0.979	0.959	HP33	0.979	0.959
HP04	0.904	0.808	HP34	0.952	0.904
HP05	0.966	0.932	HP35	0.904	0.808
HP06	0.932	0.863	HP36	0.952	0.904
HP07	0.966	0.932	HP37	0.952	0.904
HP08	0.979	0.959	HP38	0.938	0.877
HP09	0.952	0.904	HP39	0.973	0.945
HP10	0.979	0.959	HP40	0.973	0.945
HP11	0.863	0.726	HP41	0.986	0.973
HP12	0.849	0.699	HP42	0.973	0.945
HP13	0.904	0.808	HP43	0.966	0.932
HP14	0.959	0.918	HP44	0.918	0.836
HP15	0.973	0.945	HP45	0.959	0.918
HP16	0.979	0.959	HP46	0.918	0.836
HP17	0.973	0.945	HP47	0.897	0.794
HP18	0.890	0.781	HP48	0.945	0.890
HP19	0.925	0.849	HP49	0.829	0.658
HP20	0.692	0.383	HP50	0.945	0.890
HP21	0.959	0.918	HP51	0.767	0.534
HP22	0.945	0.890	HP52	0.959	0.918
HP23	0.966	0.932	HP53	0.883	0.767
HP24	0.890	0.781	HP54	0.973	0.945
HP25	0.932	0.863	HP55	0.986	0.973
HP26	0.925	0.849	HP56	0.973	0.945
HP27	0.843	0.685	HP57	0.938	0.877
HP28	0.884	0.767	HP58	0.973	0.945
HP29	0.932	0.863	HP59	0.973	0.945
HP30	0.925	0.849	HP60	0.959	0.918

household wealth were correlated with more enriched home environments, direct paths from the wealth index to the language and motor measures were not significant. Higher age at assessment was related to both higher language and motor scores. Gender was not significantly related to either score. Finally, correlation of the structural errors for the two test scores documents the correlation between these two measures. The full model predicts 15% and 17% of the variance in language and motor scores, respectively. The model parameters and covariances depicted in the final model were all significant.

Discussion

Study 1

This study highlights the unique contribution of specific components of the home environment that could be targeted to improve children's outcomes in a more effective manner. The Kilifi-HIPSC is a 45-item scale (for the use in middle childhood) that consists of items modified from the original MC-HOME Inventory with regard to content, format, and the examples used. The tool which assesses the quality and quantity

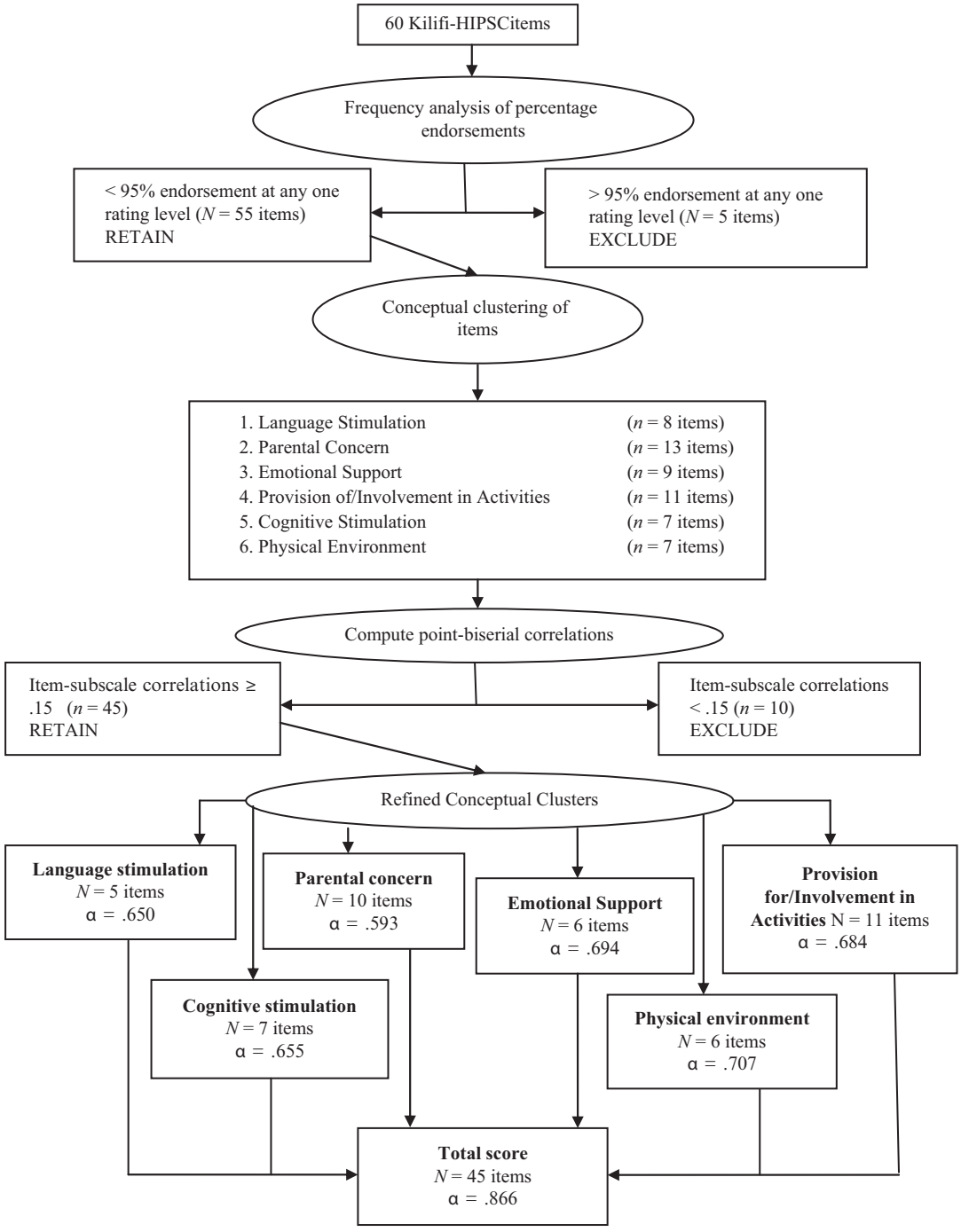

Fig. 3.2 Flow diagram of the formation of conceptual clusters for the Kilifi-HIPSC items

of stimulation within the home environment was designed to fit the cultural context of the current study setting. The increasing importance of outside environments during this developmental period (Bronfenbrenner & Ceci, 1994) necessitated the inclusion of an additional item concerned with the immediate surroundings of the household. Trained interviewers who underwent an

Table 3.4 Characteristics of Kilifi-HIPSC subscales

Subscales	# items	ICC	*M* (SD)	Range item-subscale *r*s
Language stimulation	5	0.650	3.73 (2.676)	0.241–0.581
Parental concern	10	0.593	7.34 (2.878)	0.168–0.419
Emotional support	6	0.694	10.12 (1.906)	0.310–0.740
Provision for/involvement in activities	11	0.684	6.40 (3.916)	0.144–0.491
Cognitive stimulation	7	0.655	5.29 (2.704)	0.198–0.524
Physical environment	6	0.707	8.34 (2.405)	0.183–0.733

Table 3.5 Correlations between Kilifi-HIPSC subscale and total scores and background variables

Subscale	Gender	Age (years)	Height-for-age *z*-scores	Household wealth
Language stimulation	ns	ns	0.288**	0.442**
Parental concern	ns	ns	ns	0.280**
Emotional support	ns	ns	ns	ns
Provisions for/involvement in activities	ns	ns	0.237**	0.344**
Cognitive stimulation	ns	ns	0.280**	0.567**
Physical environment	ns	ns	ns	0.317**
HOME combined score for 45 items	ns	ns	0.242**	0.499**

*$p < 0.05$, **$p < 0.01$, *ns* non-significant

intensive training program generated responses on the items through caregiver reports and observer ratings. We developed a more detailed format than the original semi-structured interview to facilitate data collection. We changed the coding system from a two- to a three-point scale to increase variability in responses. The Kilifi-HIPSC subsample was representative of rural school-age children. Our sample included a sizable proportion of out-of-school children despite the fact that they were more often resident further away from schools and hence less accessible. For school-going children who were in school for most of the day, the requirement of having both the child and the primary caregiver present during the interview may have posed a challenge. However, we scheduled numerous visits to selected homes and visited homes when families were engaged in nondemanding tasks.

The current study contributes to the existing literature in several important ways. First, the Kilifi-HIPSC was reduced in length, and yet its psychometric properties remained acceptable. Inter-rater reliability for all items ranged from moderate to nearly perfect agreement illustrating the utility of the three-point coding system. Conceptual coherence of items was the primary basis for organizing indicators into meaningful groups. In a previous application of the HOME Inventory within a similar context (Holding et al., 2011), no common underlying structure was found for the components derived from a factor analysis. In line with this earlier study, we therefore did not expect the original factor clusters to be replicated within this population largely due to differences in cultural contexts and the range of behaviors sampled.

Internal consistency reliability levels of the conceptually derived Kilifi-HIPSC subscales ranged from 0.6 to 0.7, consistent with those of the original MC-HOME Inventory (Bradley, Caldwell, Rock, Hamrick, & Harris, 1988). It was not surprising that moderate alpha levels were recorded for some of the subscales; as

Table 3.6 Regression of nutritional status and household wealth against Kilifi-HIPSC subscale and total scores

	Nutritional status			Household wealth		
Subscales	*b*	*β*	*t*	*b*	*β*	*t*
Language stimulation	0.495	0.203	2.699**	0.258	0.394	5.224***
Parental concern	−0.030	−0.011	−0.138	0.201	0.283	3.435**
Emotional support	−0.153	−0.088	−1.029	0.030	0.064	0.749
Activities	0.612	0.171	2.157*	0.293	0.305	3.834***
Cognitive stimulation	0.410	0.167	2.398**	0.348	0.526	7.555***
Physical environment	0.147	0.067	0.824	0.182	0.307	3.780***
Kilifi-HIPSC total score	1.481	0.142	1.924	1.312	0.466	6.325***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 3.7 Descriptive data for Kilifi-HIPSC scores and child outcomes

	N	Kilifi-HIPSC scores		Language scores		Motor scores	
		M	SD	*M*	SD	*M*	SD
Gender							
Boys	76	40.72	10.1	−0.001	1.03	−0.09	0.65
Girls	70	41.77	12.84	−0.212	1.01	−0.09	0.65
Age (years)							
≤8.0	41	44.58	11.67	−0.46	0.87	−0.30	0.53
8.5–9.0	52	39.58	10.79	−0.19	0.96	−0.20	0.64
≥9.5	53	40.34	11.62	0.26	1.09	0.18	0.66
Household wealth							
Level 1	58	35.69	10.51	−0.17	0.99	−0.10	0.68
Level 2	45	40.84	9.19	−0.19	0.98	−0.22	0.68
Level 3	43	49.09	10.47	0.07	1.11	0.06	0.56

Bradley (2004) postulates, this is not a problem given that there may be no inherent connection between the indicators that we grouped together. What was more important was the inclusion of all (rather than a sample of) causal indicators used to derive our latent constructs to be sure that they were sufficiently representative (Bollen & Lennox, 1991).

After a process of identifying features of the home environment which support child development, we established face validity of the modified measure through parental assessments of the cultural appropriateness and clarity of the items. This step was necessary in a context of low literacy levels, to preclude the limitation of participants responding incorrectly because the items cause confusion or are incomprehensible. We speculated that parents presumably manifest the beliefs, goals, and patterns of behavior that pervade life in the larger society and therefore had a general idea of the actions, events, behaviors, and conditions that promote their children's well-being (Bradley, 2004). The low to moderate correlations with the index of household wealth and with nutritional status provided evidence for convergent validity of the Kilifi-HIPSC. These positive associations are in line with results from the broader research literature and from other studies in similar contexts (Elardo, Bradley, & Caldwell, 1975; Holding et al., 2011; Kaur & Kalaramna, 2004; Masud, Luster, & Youatt, 1994; Sarsour et al., 2011). Comparisons between the current study and earlier ones should however be made cautiously because many of

Table 3.8 Variable intercorrelations

	1	2	3	4	5
1. Gender	1				
2. Age	0.037	1			
3. Household wealth	0.022	−0.177*	1		
4. Language scores	−0.103	0.311**	0.084	1	
5. Kilifi-HIPSC scores	0.046	−0.119	0.499**	0.151	1
6. Motor scores	0.001	0.334**	0.123	0.561**	0.160

*$p < 0.05$, **$p < 0.01$

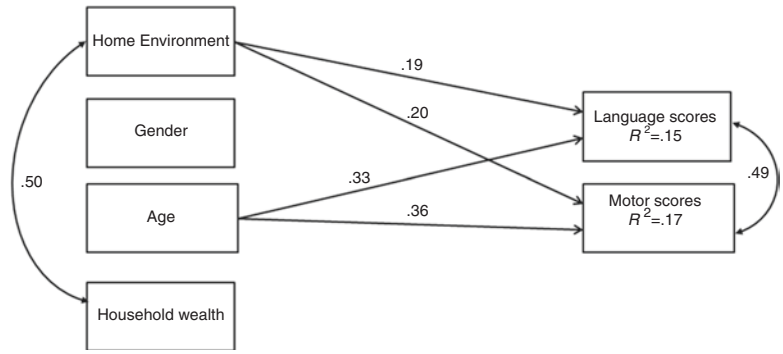

Fig. 3.3 Final estimated model

these earlier studies were conducted among younger populations.

Second, given the evidence of modest but significant correlations among the Kilifi-HIPSC subscales, we suggest that the modified measure is measuring distinct yet related aspects of the home environment, highlighting their importance. Because they are focused in content, subscales may allow very specific hypotheses about the home environment to be tested (Linver, Brooks-Gunn, & Cabrera, 2004). These newly developed subscales therefore offer an advantage over using the full MC-HOME or factor analysis-derived subscales, as they determine discriminatory features of the home environment. Such information made it possible to distinguish between families providing adequate levels of support and those that offer little or no support.

Third, nonsignificant differences in the patterns of response for boys and girls illustrate the applicability of the measure across both genders. This finding was as expected and suggests that we do not need to make different interpretations in the scores for boys and girls. An earlier study (Hannan & Luster, 1991) similarly reported little effect of the child's gender on the quality of the home environment. Contrasting findings have however been reported by Baharudin and Luster (1998) who found that female children received more supportive care than their male counterparts. As the authors themselves highlight, these differences may have arisen because they used a short form of the HOME Inventory. Noteworthy differences between the current and earlier study are the paths followed in the derivation of the short forms of the home measure; the items comprising each version were therefore necessarily different.

Fourth, we demonstrated that scores did not vary significantly across the different age groups studied. Age effects have been previously illustrated by Bradley and colleagues (2001) who compared the frequency with which children were exposed to particular activities in their life experiences from infancy through adolescence. Age differences would have more likely been

evident if the age spread covered in the current study was larger—our study only included children aged approximately between eight and ten years. The lack of an association between the home environment scores and age may therefore be attributed to the restricted age range of the children in the current study. Our findings suggest that the measure is equally applicable across the age range for which it is intended.

Nutritional status and household wealth predicted higher scores on all the subscales (except for emotional support) and total Kilifi-HIPSC scores. Associations of subscale and total scores with household wealth were however stronger and more consistent than those with nutritional status. These findings are consistent with the bioecological theory which stipulates that distal contexts, represented by household wealth, have a substantial effect on the proximal processes within the child's home environment (Bronfenbrenner & Ceci, 1994). Gutman et al. (2003) point to a cognitively stimulating environment as being a protective factor against risk factors such as socioeconomic disadvantage and poor nutritional status. In view of this suggestion, it will be worthwhile to facilitate the identification of particular aspects which are amenable to change, so as to improve the home environments of children living under adverse conditions.

Study 2

The results from the structural equation model confirm that the home environment is an important influence of child outcomes within the current study setting. The association between the home environment and household wealth illustrates, as have other studies in similar and non-similar contexts (Baharudin & Luster, 1998; Totsika & Sylva, 2004), that the greater the socioeconomic disadvantage in a family, the less stimulating the home environments are for children. As has been stipulated earlier, household wealth exerts its effects on child outcomes through other more proximal variables such as the processes within the home environment. Moreover, the lack of significant associations between household wealth and child outcomes is not without precedence within this setting (Abubakar et al., 2008). These results suggest that within the current study context, a stimulating home environment has a more pronounced effect on child functioning than the family's socioeconomic status.

As Bradley and Corwyn (2005) have highlighted, an examination of the association between the Kilifi-HIPSC and child outcomes enables us to establish the cultural implications of the changes we made to our tool. Our study findings demonstrate that the Kilifi-HIPSC is a viable and rich alternative to the original MC-HOME Inventory. The brevity of the scale facilitates a quick screening of the promotive aspects of a child's home environment. Furthermore, the derivation of subscales reveals a more precise picture of the proximal processes within the child's home environment. We omitted several items either due to restricted variability or because they did not make a substantial contribution to internal consistency. Nondiscriminative items may however have clinical significance for this population, as it may be the rarity of an event that makes it meaningful. Weak, poorly performing items may provide clues on those aspects of the home environment that need more complete documentation.

Our study demonstrated that the paths linking the home environment and language and motor outcomes in school-age children were of similar magnitude. In addition, although poverty threatens children's development, we were able to demonstrate that it is what happens within the home environment, rather than the resources available to families, that has a more significant effect on child outcomes. The structural equation model presented however accounted for a small proportion of the variance in children's outcomes. These findings may be explained by the limited number of background variables included in the current study. Examination of the influence of maternal characteristics such as age of the mother at first birth and maternal intelligence, contextual factors such as the number of children and the presence of a spouse or a partner, and child characteristics such as birth weight and temperament on the home environment will expand the findings of the current study. We recommend the inclusion of these factors in future studies within similar settings.

Appendix 1

Modifications made on the Kilifi-HIPSC

Original version	Adapted version	Percentage endorsement		
		0	1	2
Changes in item format				
(26) Parent buys and reads a newspaper daily	(29) A member of the family reads a newspaper	59.6	24.7	15.8
(34) Family has a TV and it is used judiciously, not left on continuously	(34) Do you own a TV? Child is allowed free access and it is used judiciously, not left on continuously	26.7	58.2	15.1
(36) Child is regularly included in family's recreational hobby	(36) What do family members do when they have no chores? Is the child involved in that activity?	75.3	15.8	8.9
(37) Family provides lessons or organizational membership to support child's talents (Y membership, gymnastic lessons, art center, etc.)	(37) Family gives training through membership of registered organizations and/or at home to support the child's talents	88.4	6.2	5.5
(38) Child has ready access to at least two pieces of playground equipment in the immediate vicinity	(38) There are already things in the compound for the child to play with	44.5	37.7	17.8
(39) Child has access to library card, and family arranges for child to go to library once a month	(39) Child regularly attends an activity out of the home	96.6	1.4	2.1
(42) Family visits or receives visits from relatives or friends at least twice a month	(42) Family visits or receives visits from relatives or friends	39.0	24.0	37.0
(48) Father (or father substitute) regularly engages in outdoor recreation with the child	(48) Father (or father substitute) engages child in games to pass time, for example, football	91.1	7.5	1.4
(56) There is at least 100 square feet of living space per person in the house	(56) Number of rooms in the house and number of people in each room	0	39.7	60.3
Changes in item content				
(4) Child is encouraged to read on his own	(4) Child is encouraged to read. With whom does the child read?	45.9	15.8	38.4
(27) Family has a dictionary and encourages child to use it	(31) Family has a Kiswahili dictionary and encourages child to use it	89.7	10.3	0
(31) Child has free access to at least ten appropriate books	(28) Child has free access to children's books	71.2	8.2	20.5
(32) Child has free access to desk or other suitable place for reading or studying	(30) Child has an appropriate place to read and write	34.2	19.2	46.6
(43) Child has accompanied parent on a family business venture 3–4 times within the past year (to garage, clothing shop, appliance repair shop, etc.)	(43) Child has accompanied parent on a family business trip within the past year (to buy clothes, etc.)	74.7	15.1	10.3
(46) Parents discuss TV programs with child	(46) Parents discuss news about happenings in the neighborhood, country, or world with child	45.9	11.0	43.2
(52) Child's room has a picture or wall decoration appealing to children	(52) Efforts have been made to have or make equipment which is pleasing and stimulating to the child	91.8	7.5	0.7
Changes in examples used in the item				
(2) Parent sometimes yields to child's fears or rituals (allows night light, accompanies child to new experiences, etc.)	(2) Parent sometimes yields to child's fears or rituals (escorting child out at night, leaving light on at night)	11.0	6.2	82.9

Original version	Adapted version	Percentage endorsement		
		0	1	2
(13) Child puts his outdoor clothing, dirty clothes, and night clothes in special place	(13) Child knows how to keep school uniform or play clothes and "Sunday best" in a special place	15.8	18.5	65.8
(30) Child has free access to musical instrument (piano, drum, ukulele, guitar, etc.)	(27) Child has free access to musical instrument (*kayamba*, drum, guitar, etc.)	78.1	3.4	18.5
(44) Family member has taken child to (or arranged for child to attend) some type of live musical or theater performance	(44) Family member has taken child to (or arranged for child to attend) some national celebrations, wedding, choir presentation, or theater performance	73.3	17.8	8.9
(47) Parent helps child to achieve motor skills—ride a two-wheel bicycle, roller skate, ice skate, play ball, etc.	(47) Parent helps child to achieve motor skills—pounding maize, carrying a load on the head, riding a bicycle, or swimming	1.4	13.0	85.6
(58) Building has no potentially dangerous structural or health defects (e.g., plaster coming down from the ceiling, stairway with boards missing, rodents, etc.)	(58) Building has no potentially dangerous structural or health defects (e.g., broken wall plastering, falling walls, leaking roof, etc.)	4.1	11.6	84.2
(14) Parents set limits for child and generally enforce them (curfew, homework, before TV, or other regulations that fit family pattern)	(14) Parents set limits for child and generally enforce them (school work, other regulations depending on family routines, e.g., playing near the road)	1.4	2.7	95.9
(1) Family has fairly regular and predictable daily schedule for the child (meals, day care, bedtime, TV, homework, etc.)	(1) Family has fairly regular and predictable daily schedule for the child (meal times, bedtime, domestic work, etc.)	0.7	7.5	91.8
(53) The interior of the apartment is not dark or perceptually monotonous	(53) The interior of the house is not dark or perceptually monotonous	21.2	69.9	8.9
Deletion of item content				
(29) Child has free access to record player or radio	(26) Do you own a radio? Does your child listen to the radio? How often?	1.4	17.1	81.5
(41) Family member has taken the child on (or arranged for child to take) a plane, train, or bus trip within the past year	(41) Family member has taken the child on (or arranged for child to take) a bus trip within the past year	28.8	24.7	46.6
Additional item				
	(60) Compound provides a variety of perceptual experiences	59.6	20.5	19.9
Other items				
(3) Child has been praised at least twice during the past week for doing something		31.5	8.9	59.6
(5) Parent encourages child to contribute to the conversation during visit		45.9	12.3	41.8
(6) Parent shows some positive emotional responses to praise of child by visitor		8.9	5.5	85.6
(7) Parent responds to child's questions during visit		85.6	4.8	9.6
(8) Parent uses complete sentence structure and some long words in conversing		0	0	100.0
(9) When speaking of or to child, parent's voice conveys positive feelings		2.7	3.4	93.8
(10) Parent initiates verbal interchanges with visitor, asks questions, makes spontaneous comments		0	0	100.0
(11) Family requires child to carry out certain self-care routines, e.g., make bed, clean room		1.4	73.3	25.3
(12) Family requires child to keep living and play area reasonably clean and straight		9.6	56.8	33.6
(15) Parent introduces the visitor to the child		92.5	4.1	3.4
(16) Parent is consistent in establishing or applying family rules		3.4	2.1	94.5

Original version	Adapted version	Percentage endorsement		
		0	1	2
(17) Parent does not violate rules of common courtesy during visit		0.7	0	99.3
(18) Parent has not lost temper with child more than once during previous week		4.1	13.7	82.2
(19) Parent reports no more than one instance of physical punishment occurred during the past month		5.5	19.9	74.7
(20) Child can express negative feeling toward parents without harsh reprisals		16.4	4.1	79.5
(21) Parent has not cried or been visibly upset in child's presence more than once during the past week		76.7	17.8	5.5
(22) Child has a special place in which to keep his/her possessions		69.9	8.9	21.2
(23) Parent talks to child during visit (beyond correction and introduction)		34.2	30.8	34.9
(24) Parent uses some term of endearment or some diminutive for the child's name when talking about child at least twice during visit		8.2	72.6	19.2
(25) Parent does not express overt annoyance with or hostility toward the child (complains, describes child as "bad," says child won't mind, etc.)		3.4	7.5	89.0
(32) (28) Child has visited a friend by him/herself in the past week		22.6	12.3	65.1
(33) House has at least two pictures or other type of art work on the walls		79.5	7.5	13.0
(35) Family encourages child to develop and sustain hobbies		83.6	8.9	7.5
(40) Family member has taken the child to (or arranged for child to visit) a scientific, historical, or art museum within the past year		91.1	6.8	2.1
(45) Family member has taken the child to (or arranged for child to take) a trip of more than 50 miles from home (50 miles radial distance, not total distance)		43.2	26.0	30.8
(49) Child sees and spends some time with father or father figure 4 days a week		19.9	65.8	14.4
(50) Child eats at least one meal per day, on most days, with mother and father (or mother and father figures)		30.8	15.8	53.4
(51) Child has remained with this primary family group for all his life aside from 2- to 3-week vacations, illnesses of mother, visits of grandmother, etc.		13.0	10.3	76.7
(54) In terms of available space, the rooms are not overcrowded with furniture		18.5	8.2	73.3
(55) All visible rooms of the house are reasonably clean and minimally cluttered		24.7	17.8	57.5
(57) House is not overly noisy—shouts of children, radio, etc.		5.5	70.5	24.0
(59) Child's outside play environment appears safe and free of hazards		5.5	23.3	71.2

*The figures in parentheses are the item numbers on the original and adapted versions of the HOME Inventory

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