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Language Delays and Child Depressive Symptoms: the Role of Early Stimulation in the Home

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Abstract The present study investigated the role of early stimulation in the home and child language delays in the emergence of depressive symptoms. Data were from a longitudinal study of at-risk children in Hawaii ($n = 587$). Low learning stimulation in the home at age 3 and language delays in first grade both significantly increased risk for child depressive symptoms in third grade. Structural equation modeling supported the hypothesized path models from home learning environment at age 3 to depressive symptoms in third grade controlling for a host of correlated constructs (maternal depression, child temperament, and child internalizing symptoms). Total language skills in the first grade mediated the effect of home learning environment on depressive symptoms. The study and findings fit well with a nurturing environment perspective. Implications for understanding the etiology of child depression and for designing interventions and prevention strategies are discussed.

Keywords Home learning environment · Language delays · Depressive symptoms · Children

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Recently, Biglan and colleagues articulated a theory of nurturing environments as a science-based framework to guide inquiry and interventions to promote child health and development (Biglan et al. 2012; Biglan and Hinds 2009; Komro et al. 2011). In this empirically grounded model, healthy cognitive, social, and emotional development is rooted in social environmental contexts that minimize toxic events, promote competence and prosociality, provide appropriate levels of monitoring, and teach psychological flexibility. In such environments, healthy development unfolds with earlier progress in each domain (cognitive, social, and emotional) serving as a precursor and catalyst to increasingly sophisticated growth. The nurturing environment framework identifies critical leverage points for preventing adverse child outcomes by pinpointing a narrow range of antecedents to dysfunction. In this paper, we examined inadequate learning stimulation in the home as an environmental precursor to child depressive symptoms.

Home Learning Environment as a Precursor to Language Development

During infancy and early childhood, cognitive and learning stimulation and positive social interactions are critical components of nurturing environments as a foundation for successful development (Barros et al. 2010; Bonnier 2008). Language skills are one of the most proximal and enduring outcomes influenced by the amount of home learning stimulation and positive adult-child interactions (Komro et al. 2011; Thorpe et al. 2003).

Although language skills are partly rooted in physiology, the social environment plays a significant role in shaping children's language development. Available research suggests that exposure to language-rich environments increases language development. For instance, Hart and Risley (1995)

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examined the differences in exposure to vocabulary in early childhood across socioeconomic groups: high, middle, and low. After over 1300 h of observation, they found that, on average, children in the high SES group were exposed to 11.2 million words in a single year, those in the middle group were exposed to 6.5 million words, and children in the lowest group, members of families on welfare, were exposed to 3.2 million words. The children's early vocabulary exposure was significantly associated with their language development in grade 3.

Research has also found that other aspects of low stimulation or deprivation in the home environment are associated with language delays. For example, a study by Horowitz et al. (2003) of 1189 children living in the New Haven area found that early language delay was associated with high parent stress, low maternal education, low socioeconomic status, and low familial language expression. La Paro et al. (2004) analyzed data from the National Institute of Child Health and Human Development Study of Early Child Care and found that poor quality interactions between mother and child, maternal depression, low family income, and a home environment lacking in stimulation and support predicted the diagnosis of a specific language impairment at age 3. A multitude of studies has confirmed that the home environment, particularly "responsive, reciprocal interaction and communication" (Puckering and Rutter 1987; p. 123–124), is essential to the development of strong language skills.

Language Delays as a Risk Factor for Depressive Symptoms

Language skills provide a foundation for social, emotional, and academic functioning. Reading skills and academic success are closely linked to language development (Nation 2010). Conversely, delays in language acquisition can disrupt development. Consequently, language delays in childhood are associated with a host of negative proximal and distal outcomes (Botting and Conti-Ramsden 2000; Cantwell and Baker 1977; Schoon et al. 2010a; Snowling et al. 2006; St. Clairet al. 2011). Low levels of language and academic competence are associated with early and enduring mental health issues (e.g., depression, anxiety) (Beitchman et al. 2001; Conti-Ramsden and Botting 2008; Herman et al. 2008; Lundervold et al. 2008). To illustrate, Joffe et al. (2012) found that students with expressive or receptive language difficulties reported more difficulties than those with typical language abilities on the Strengths and Difficulties Questionnaire (SDQ), a standardized assessment of psychiatric difficulties. In a 29-year follow-up of early language skills and psychosocial outcomes, Schoon and colleagues found that individuals with poor receptive language at age 5 reported lower mental health levels at 34 years of age than those with average language skills. Those with poor early language skills also had higher depression levels and lower life satisfaction (Schoon et al. 2010b). Identification of potent and pliable factors that guide early intervention with language delays is vital, as delays at 5 years of age increase the risk of poor mental health outcomes.

Factors Contributing to Home Learning Environments and Child Depressive Symptoms

Given the links between home environment and language development, as well as between poor language skills and adverse mental health outcomes, a reasonable prediction from a nurturing environment perspective is that language skills mediate a developmental pathway from inadequate home learning environments to child depressive symptoms. In conceptualizing the role of home learning environments and language delays as part of a developmental pathway to child depressive symptoms, it is important to consider potential third variables that may influence or even better explain the pathway. Maternal depression and child temperament are two well-established risk factors for disruptive home environments and child depressive symptoms.

First, a large body of evidence indicates that exposure to maternal depression during infancy and toddlerhood has significant deleterious effects on home environments and child development. Cogill et al. (1986) found that children whose mothers were depressed during the first year of their life had significant cognitive deficits. Analyzing data from the National Maternal and Infant Health Survey, Petterson and Albers (2001) found that maternal depression was harmful in relation to cognitive and motor development in young children. In addition, a recent meta-analysis concluded that maternal depression is a risk factor for multiple forms of childhood psychopathology including internalizing and externalizing problems (Goodman et al. 2011). Goodman and Gotlib (1999) presented an integrative model based on an extensive literature review that describes how maternal depression has deleterious effects on offspring through several mechanisms including "(a) heritability of depression; (b) innate dysfunctional neuroregulatory mechanisms; (c) negative maternal cognitions, behaviors, and affect; and (d) the stressful context of the children's lives." (p. 460).

Second, child temperament serves as a risk factor for depression and can undermine parent-child interactions (Gartstein and Bateman 2008; Shankman et al. 2011; Verstraeten et al. 2009). Temperament describes stable emotional and behavioral traits, such as negative and positive emotionality. Although biologically based, temperament can influence the environment (Ganiban et al. 2011; Saudino 2005). Specifically, negative emotionality contributes to negative parenting responses (Ganiban et al. 2011), which can affect

the home environment. In early childhood, negative emotionality is characterized as fussiness, irritability, and difficulty to soothe. Positive emotionality consists of smiling, laughing, and adaptability. Negative emotionality is related to both depression and anxiety, while low positive emotionality is associated with depression specifically (Anthony et al. 2002; Austin and Chorpita 2004; Chorpita 2002). For instance, Dougherty et al. (2010) found that children with low positive emotionality at age 3 had more depressive symptoms at age 10 compared to a normative comparison group. These findings suggest that the relationship between temperament and depression may increase over development as depressive symptoms become more prevalent with age (Dougherty et al. 2010).

Present Study

In this longitudinal study, we examined several early childhood risk factors as potential candidates for understanding the origins of child depression. Consistent with a nurturing environment perspective, our primary interest was in examining a developmental pathway linking inadequate home learning environments during the third year of life with language delays at school entry and depressive symptoms at third grade. We hypothesized that home learning environment and language skills would be associated with elevated risk for depressive symptoms. In turn, we expected that language skills would mediate the relationship between home learning environment and depressive symptoms. To test the robustness of these models, we added sociodemographic covariates and controlled for two well-established risk factors for child depression, maternal depression, and child temperament. We used structural equation modeling (SEM) to test mediation hypotheses. Because SEM is model based, it provides "more efficient and elegant estimation" of mediation effects than alternate methods (p. 22; Iocabucci 2008).

Method

Sample

Data were collected as part of a multisite, randomized trial of Hawaii's Healthy Start Program (HSP) (Duggan et al. 2004a, b), a prototype for Healthy Families America (HFA). With over 600 programs in 40 states, HFA (http://www.healthyfamiliesamerica.org) is arguably the most widely disseminated paraprofessional home visiting program that targets families of newborns at risk for child maltreatment. The study was originally designed to assess the impact of the HSP. Overall analyses found no intervention effects (Duggan et al. 2004a, 2004b). However, subgroup analyses found positive effects for mothers who entered the trial with adult attachment patterns characterized by high relationship anxiety (McFarlane et al. 2013). Participants were followed as a longitudinal, developmental sample. Eighty-one percent of eligible families agreed to participate and were allocated to intervention conditions. Final participants included 643 families enrolled in the HSP randomized trial. The mean age for participating mothers at baseline was 23 years, and over 60 % of the sample had household incomes below the poverty line. The racial/ethnic characteristics were 34 % Pacific Islander/Native Hawaiian, 28 % Asian or Filipino, 12 % Caucasian, and 27 % no primary ethnicity or unknown. The child participants were assessed each year from birth age 3 and from first through third grade. In the present study, we used data from children who completed one or more assessments from age 3 through third grade ($n = 587$).

Procedure and Measures

Home Learning Environment

Home Observation for Measurement of the Environment was used in this research to measure the quality of parenting practices and home educational environment (Bradley 1993). It is an observational measurement, which provides comprehensive information regarding the quality and quantity of stimulation and support available to a child in the home environment. The infant-toddler version of Home Observation for Measurement of the Environment (HOME) comprises 45 items. Independent raters give target family's scores on HOME. To obtain sufficient information, the rater conducts a 45- to 90-min home visit, during which the target child and the child's primary caregiver are present and awake. Higher scores indicate more favorable parenting behaviors. The test has good psychometric properties (Caldera et al. 2007). Inter-rater agreement exceeded 85 % (Adams et al. 1984). The estimates of internal consistency have been above 0.80 for the total scores (Bradley 1993); α was 0.75 in this sample. Moreover, in this sample, we found expected correlations between HOME ratings and self-reported parenting stress (−0.42) and maternal depression (−0.31) and independent ratings on the Nursing Child Assessment Teaching Scale (NCATS; Barnard 1994) (.41). For this paper, we used three subscales administered during the third year of life that focused on cognitive and learning stimulation: learning stimulation, language stimulation, and academic stimulation.

Maternal Depression

The Center for Epidemiological Studies Depression Scale (CES-D, Radloff 1977) was used to measure maternal depression. CES-D is a self-report inventory measuring the frequency of 20 depressive symptoms of individuals in the past week. The 20 items are rated on a scale of 0 to 3. The total scores are in a range from 0 to 60. The cutoff point is 16, which indicates that a score above 16 represents clinical feature of depression (Radloff 1977). The CES-D has been widely used to screen for depressive symptoms among adults (Lewinsohn et al. 1997). The CES-D has demonstrated strong psychometrics with high internal consistency (0.84 = 0.90) and test–retest reliability ($r = 0.67$ in 4-week interval) (Radloff 1977). The internal consistency (α) in this sample was 0.87. We used mother's CES-D score during her child's third year of life.

Child Temperament

The Infant Character Questionnaire was developed to assess infant's temperament (Bates et al. 1979). Parents are asked to rate infants' behaviors on a seven-point scale from 1 (optimal temperamental trait) to 7 (difficult temperament trait). The Infant Character Questionnaire (ICQ) is composed of 24 items to investigate four dimensions, which are fussy-difficult (e.g., how fussy/cry in general), inadaptable (e.g., reaction to new place), dull (e.g., smile and happy sound), and unpredictable (e.g., hunger, sleeping). The reliability and validity of ICQ was tested by numerous studies (Bates et al. 1979). The ICQ was administered from birth to age 2. We used the total temperament score at age 2 as this was the time point closest to the toddlerhood, age 3, assessments used for the other predictors in this study.

Language Skills

Child scores on a standardized language test (the *Clinical Evaluation of Language Fundamentals 3 [CELF-3]*; Semel et al. 1995) were used to assess language skills during first grade. On the CELF, each child received a standardized receptive, expressive, and total language scores. For analyses focused on language skill subgroups, the child was assigned a categorical score of 0 if the total language score was 85 or lower (e.g., one standard deviation below the mean); otherwise, a score of 1 was assigned. The CELF has high internal consistency, test–retest reliability, and inter-rater reliability, and there is sufficient evidence of content, construct, and concurrent validity (Biddle et al. 2002).

Child Behavioral Checklist

Children's depressive symptoms at age 3 were assessed with the Child Behavioral Checklist (CBCL). Parents were asked to rate 118 items on a three-point scale including 0 (not true in the past 6 months), 1 (somewhat or sometimes true), and 2 (very true or often true). The CBCL has been widely used as a screening tool to distinguish children's clinical symptoms. A large amount of data has provided strong evidence for its psychometric properties. In this study, we focused on the composite internalizing problems *T* score (Achenbach 1991; Chen et al. 1994).

Children's Depression Inventory

The Children's Depression Inventory (CDI) was used to measure children's depressive symptoms in third grade. The CDI is appropriate for children and adolescents ages 7 to 17 years and includes 27 items assessing cognitive, affective, and behavioral symptoms of depression in youth (Kovacs 1992). The CDI has been widely used in clinical and research settings (Craighead et al. 1998; Saylor et al. 1984; Smucker et al. 1986). Each item consists of three statements rated on a scale from 0 to 2. For each item, the child was asked to select the statement that characterized them best during the past 2 weeks. CDI items combine into five factors: negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem. In addition to the subscale scores, a total score of depressive symptoms can be calculated (Kovacs 1992). For analyses focused on depression cut scores, we converted raw scores into norm-referenced *T* scores for individuals based on gender and age. *T* scores of 65 and higher are interpreted as moderate clinically significant symptoms of depression (Kovacs 1992); 8.4 % of participants met this criteria in grade 3. The CDI has strong psychometrics for children as young as 6 years old (Kovacs 1992; Kovacs 2003).

Analytic Plan

Structural equation modeling was used to examine the hypothesized relationships among the latent constructs and to examine the relations between the predictors, mediators, and outcome variables. Structural equation modeling was conducted using Mplus 6.1 (Muthén and Muthén 2010), and maximum likelihood estimates were obtained. The Mplus software uses a full information maximum likelihood estimation under the assumption that the data are missing at random (MAR; Arbuckle 1996; Little 1995), which is a widely accepted way of handling missing data (Muthén and Shedden 1999; Schafer and Graham 2002). The minimum covariance coverage recommended for reliable model convergence is 0.10. In this study, coverage ranged from 0.63 to 0.94.

The measurement model was evaluated by examining factor loadings of items for each of the three latent factors in our model: home learning environment, language competence,

and depression. Items with loadings over 0.40 were retained in the final measurement model.

Structural model fit was evaluated using multiple indicators of fit: chi-squared, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean square error of approximation (RMSEA). Hu and Bentler (1999) suggested that CFI and TLI values above 0.95 and RMSEA values less than 0.08 represent acceptable fit; RMSEA values equal or less than 0.05 represent good fit (Browne and Cudek 1993).

Mediated effects were tested by calculating indirect effects within an SEM framework. Significant indirect effects were taken as evidence of mediation. We also followed guidelines outlined by Holmbeck (1997). First, the direct effect of the predictor (home learning environment) on the outcome (depressive symptoms) was assessed. Next, the fit of a model with paths from the predictor to the mediator (language skills) and from the mediators to the outcome was tested. In the preceding models, the paths from the predictor to the outcome, the predictor to the mediator, and the mediator to the outcome must be significant and in the hypothesized directions as a prerequisite for mediation. The final step in testing mediation was to compare the full mediational model under two conditions: (a) with the path from the predictor to the outcome constrained to zero (model 1) and (b) with no constraint on the path from the predictor to the outcome (model 2). A mediated effect is present if the addition of the direct path (model 2) does not improve the fit of model 1. Specifically, the previously significant direct effect of the predictor on the outcome becomes nonsignificant when the mediator is in the model. This sequence of model testing is parallel to the strategy outlined by Baron and Kenny (1986). The strength of standardized beta weights was interpreted based on conventional criteria with $\beta < 0.20$ indicating small effects, $\beta = 0.20$–0.49 indicating moderate effects, and $\beta > 0.50$ indicating strong effects (Acock 2008). Intervention status, child depressive symptoms, maternal depression, and child temperament at age 3 were controlled in all models.

Results

Descriptive Statistics

Descriptive statistics and preliminary Pearson correlation analyses were calculated to determine the univariate relations among study variables (see Table 1). HOME variables were significantly correlated with each other ($r = 0.54$ to 0.58), maternal depression ($r = -0.21$ to -0.27), child depression at age 3 ($r = -0.17$ to -0.19), total language score in first grade ($r = 0.33$ to 0.36), and child depression in third grade ($r = -0.14$ to -0.19). Child temperament was related to child depression ($r = 0.24$) and maternal depression at age 3 ($r = 0.11$). Maternal depression had significant relations with child depression at age 3 ($r = 0.35$), and total language score in first grade ($r = -0.16$). Total language score had a significant relationship with third grade depression ($r = -0.32$).

Measurement Model

Our measurement model included three latent factors: home learning environment, language competence, and depression. Home learning environment included three subscales of the HOME: language stimulation, academic stimulation, and learning environment. All three subscale loadings on the factor exceeded 0.70. Language competence comprised the two subscale scores on the CLEP: receptive and expressive language. Both score loadings exceeded 0.80. Depression included observed subscales on the CDI. Analyses revealed that the negative self-esteem subscale did not load on the depression factor (<0.40; Matsunaga 2015), so it was dropped from subsequent analyses. The final depression factor included four CDI subscales which all had loadings greater than 0.59: negative mood, interpersonal problems, ineffectiveness, and anhedonia.

Structural Model: Mediation Analyses

The first two steps of mediation analyses described above were conducted next. Home learning environment at time 1 (age 3) had a significant direct negative effect on depressive symptoms ($B = -0.23$) at time 3 (third grade) when controlling for time 1 maternal depression, child temperament, child depression, and intervention status (step 1). Additionally, time 1 home environment had a direct effect on time 2 (first grade) total language scores ($B = 0.50$) which, in turn, had a direct negative effect on time 3 depressive symptoms ($B = -0.41$) (step 2). Thus, the overall model met Holmbeck's first two criteria for a significant mediation effect. The final criterion requires a direct comparison between the full model with the direct path from academic competence to depression constrained to zero (constrained model) and the full model with this path freely estimated (freely estimated model) (see Table 2). The constrained model (model 1) yielded an adequate fit to the data, $\chi^2(57) = 77.77$, $CFI = 0.98$, $TLI = 0.98$, $RMSEA = 0.025$. Home environment had a significant direct effect on language ($B = 0.47$), language had a significant direct effect on depressive symptoms ($B = -0.43$), and the total indirect effect of home environment was significant (indirect $= -0.20$). The freely estimated model (model 2) was tested next. It also yielded an adequate fit to the

Table 1 Intercorrelations among study variables

	1	2	3	4	5	6	7	8	9
1. Y3 HOME learning	–								
2. Y3 HOME language	0.54**	–							
3. Y3 HOME academic	0.58**	0.55**	–						
4. Y3 maternal depression (CES-D)	−0.27**	−0.28**	−0.21**	–					
5. Y2 child temperament (ICQ)	0.05	0.01	0.06	0.11**	–				
6. Y3 child depression (CBCL)	−0.18**	−0.19**	−0.17**	0.35**	0.24**	–			
7. Intervention status	−0.05	−0.05	−0.02	0.02	−0.07	0.03	–		
8. G1 total language (CELF)	0.33**	0.34**	0.36**	−0.16**	0.07	−0.09	0.09	–	
9. G3 child depression (CDI)	−0.18**	−0.14*	−0.19**	0.03	0.03	0.02	−0.07	−0.32**	–

Y2 2 years old, *Y3* 3 years old, *G1* first grade, *G3* third grade, *HOME* Home Observation for Measurement of the Environment, *CES-D* Center for Epidemiological Studies Depression Scale, *ICQ* Infant Character Questionnaire, *CBCL* Child Behavioral Checklist, *CELF* Clinical Evaluation of Language Fundamentals, *CDI* Children's Depression Inventory

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

data, and all fit indices were identical to the fit for model 1: $\chi^2(56) = 75.17$, CFI = 0.98, TLI = 0.98, RMSEA = 0.024. Language competence had a significant effect on time 3 depression ($B = -0.36$) in this model; home environment did not ($B = -0.14$) (i.e., the significant direct effect of home environment on depression found in step 1 was reduced to non-significance with language competence in the model). As an additional test of the mediation effect of language competence on the home environment-depression relationship, the chi-squared difference between model 1 and model 2 was assessed. The freely estimated model did not significantly improve the model fit over the constrained model ($\chi^2(1)$ difference = 2.60, $p = 0.11$) suggesting that a direct path between home environment and depressive symptoms was not needed. Thus, the comparison provided support for a mediated model for the overall sample. The final model is depicted in Fig. 1.

Sensitivity Analyses

Although we were confident that intervention effects were minimal given prior studies and thus unlikely to influence the present findings, we conducted sensitivity analyses to confirm this assumption. We repeated the SEM analyses described above within the control participants only. Here, we found essentially the same, albeit slightly stronger, findings with significant indirect effects from home environment to child depressive symptoms (−0.23) and similar loadings on the key pathways (home environment to language = 0.40; language to depressive symptoms = 0.59). To further test for the robustness of the model, we repeated the analyses with the full sample and controlled for additional sociodemographic characteristics (poverty status, maternal education, abuse, child sex, and child race) and found that the loadings were unchanged.

Odds Ratios

To further characterize the strength of association between inadequate home learning environment and language delays as risk factors for depression, we conducted two logistic regression analyses controlling for time 1 maternal depression, child internalizing, and child temperament. For these analyses, we created binary measures of each predictor and outcome. Child CDI scores in grade 3 were separated into two categories: depressive symptoms (*T* scores ≥65) and not (*T* scores<65). The three home learning

Table 2 Goodness of fit indices for mediation models

					χ^2 (*df*) Difference
Model	χ^2 (*df*)	CFI	TLI	RMSEA	Model 1 vs. 2
Mediation model					
Model 1: mediated model, direct path constrained to 0	77.77 (57)	0.98	0.98	0.025	
Model 2: non-mediated model, direct path freely estimated	75.17 (56)	0.98	0.98	0.024	2.60 (1), $p > 0.05$

$N = 587$

CFI comparative fit index, *TLI* Tucker–Lewis index, *RMSEA* root mean square error of approximation

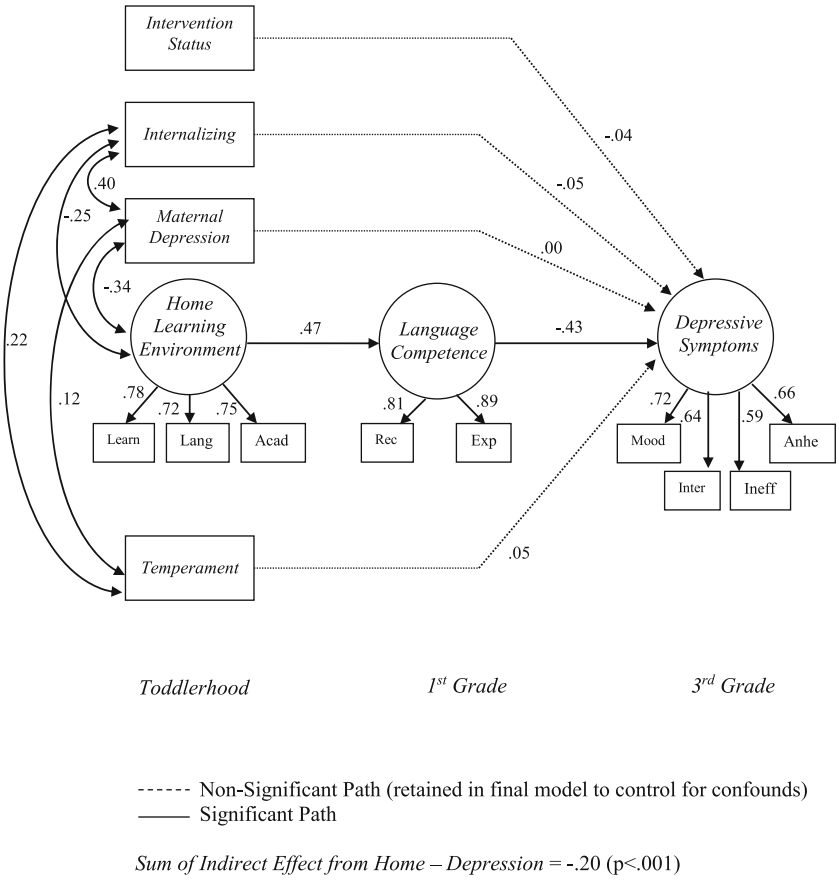

Fig. 1 Final structural model from home learning environment during toddlerhood to depressive symptoms in grade 3

environment subscales were averaged and then cut into two groups: inadequate (25th percentile or lower) or adequate (>25 percentile). Total language scores were categorized as language delay (standard score <85) or not (standard score ≥85). Children with inadequate home learning environments at age 3 were 3.36 (CI 1.48–7.63) times more likely to fall in the depressive symptom group in third grade compared to those with adequate home environments. Children with language delays at age 3 were 3.19 (CI 1.52–6.69) times more likely to be in the depressive symptom group in grade 3 compared to those without language delays (see Table 3).

Discussion

The present study investigated the link between home learning environment and depressive symptoms and, specifically, the role of language skills in mediating this relationship. Results supported the hypothesized path models from home environment at age 3 to depressive symptoms in third grade controlling for a host of correlated constructs at age 3. Language skills in first grade mediated the effect of home environment on depressive symptoms. The effects held when controlling for maternal depression, child depressive symptoms, and child temperament at age 3, suggesting that the path model was

Table 3 Odds of elevated child depression (CDI) in grade 3 based on home learning environment (age 3) and language competence (grade 1) cut scores controlling for maternal depression, child internalizing symptoms, and child temperament in toddlerhood

	β	SE	OR[c]	95 % CI	RR[d]	95 % CI
HOME learning cut score[a] (age 3)	1.12	0.42	3.36	1.48–7.63	2.42	1.33–4.32
CLEP language cut score[b] (grade 1)	1.16	0.38	3.19	1.52–6.69	1.57	1.07–2.29

HOME Home Observation for Measurement of the Environment, *CELF* Clinical Evaluation of Language Fundamentals, *OR* odds ratio, *CI* confidence interval, *RR* relative risk

[a] 25th percentile or below

[b] Below standard score of 85

[c] Controlling for maternal depression, child internalizing symptoms, and child temperament

[d] Not controlling for maternal depression, child internalizing symptoms, and child temperament

specific to home environment rather than a more general within-child or family developmental pathway.

The findings are consistent with a nurturing environment perspective. An effective home learning environment is a vital aspect of early childhood development that serves as a catalyst for subsequent development. In turn, inadequate home learning stimulation may be viewed as a precursor to child depressive symptoms by way of its interference with cognitive and language development. As much prior literature has indicated, language delays further undermine child academic, emotional, and social development and place children at risk for depressive symptoms in both the short and long term. The present study adds to this literature by supporting the hypothesized mediation model and characterizing the strength of relations of a developmental pathway from poor home learning environments and child depressive symptoms through language delays. Each link along the structural path model can be described as moderate in strength. Odds ratios of greater than 3, as observed in the present study, also suggest that these links are meaningful.

More generally, the findings give insight into strategies for the prevention of child depressive symptoms. Early identification of and interventions for language delays hold promise for lowering children's risk for depressive symptoms. Likewise, fostering language-rich and academically stimulating home (and other learning) environments not only reduces risk for language delays but also may prevent future depressive symptoms.

As one example, home visiting programs are a well-established method for fostering nurturing home environments during early childhood. A recent review identified seven distinct home visiting approaches that met US Department of Health and Human Services criteria as evidence-based interventions (e.g., high- or moderate-quality studies showing significant impact on two or more outcomes), and nearly all of these approaches had evidence to support their impact on proximal primary outcomes including child development and parenting behaviors (Avellar et al. 2013). Early Head Start-Home Visiting, HFA, and Nurse Family Partnership were among the programs meeting these evidence-based criteria. Critical aspects of the home learning environment—including promoting effective parent-child interactions, child cognitive and language development, and cognitive stimulation and language-rich contexts—are often targeted and enriched by these programs. For instance, in a randomized experimental study, Caldera et al. (2007) found that participation in the Healthy Families Alaska program, a home visiting intervention, was associated with higher levels of parenting efficacy and improved home learning environments. Based on this extensive literature base, there has been a large federal investment in the dissemination of home visiting programs, most notably through the Maternal, Infant, and Early Childhood Home Visiting (MIECHV) Program grants through Health Resources and Services Administration. The MIECHV Program's scale up of evidence-based home visiting is in line with findings from the present study and suggests the need to study the distal benefits of home visiting on child emotional health including the prevention of depressive symptoms. The Home Visiting Research Network's national collaborative of local programs and investigators provides the infrastructure for multisite, trans-model research to this end (Duggan et al. 2013).

Social class is a prominent risk factor for low language exposure during toddlerhood. When Hart and Risley (1995) counted the average number of words heard by young children across socioeconomic strata, they found that social class predicted both early childhood language exposure and subsequent academic achievement. Reardon (2011) examined the development of a widening achievement gap between children of rich and poor families over the past 50 years and suggested that a major causal factor behind this trend is the increasing investment by upper class parents in the cognitive development of their offspring at an early age. The emergence of this trend indicates that the implementation of comprehensive early childhood education programs, particularly for children at risk for exposure to a home environment with low levels of stimulation, may bolster language development and function as a protective factor in relation to the development of depression.

Subsequent studies are needed to further clarify the path from language delays to child depressive symptoms. It is likely that language delays undermine children's actual and perceived competence in social and academic domains. Further research is needed to identify the role of skills in these domains during early childhood in shaping children's immediate and persistent self-perceptions, including depressogenic cognitions as hypothesized by competency models of depression (Cole and Turner 1993).

The present study used a large, community sample of an understudied population which may be viewed an asset. Additionally, the study extended prior research by analyzing longitudinal data from toddler years to middle childhood. The study relied on continuous measures of key study variables rather than diagnostic data; thus, it is unknown if the relationships described apply equally well to children with clinical diagnoses. However, subsequent analyses using categories of depression found evidence that both inadequate learning environment and language competence were associated with elevated risk for more serious depressive symptoms.

Although the study tested causal models of development, no experimental manipulations occurred, so causal inferences are limited. The conceptual framework, longitudinal design, moderate relations among key variables, and consideration of additional correlated variables helped establish temporal sequence and rule out potential confounds. Still, future studies are needed to confirm the causal implications. For instance, interventions to increase home learning environments can be tested for their impact on reducing language delays and future

risk for depression. Additionally, researchers who study interventions designed to alleviate language delays should also monitor effects on child depressive symptoms. It is also important to note that it is unknown how the findings from the present study will generalize to other settings. The study occurred in Hawaii with mostly low-income families of Asian-American or Pacific Islander ethnicity. In this study, we elected to examine each construct at a single point in time. This was reasonable given that depression or language delays even at one point in development are associated with future dysfunction. An alternative for future studies, however, will be to examine each of the constructs using multiple time point assessments (e.g., growth modeling) that may improve the reliability of assessments and estimates.

The study provides guidance to researchers interested in the etiology and prevention of enduring emotional symptoms during early childhood. Future studies are needed to examine the relationships between the variables in the present investigation and other related variables. Further clarification of the developmental pathway to depressive symptoms for children may lead to improved prevention and treatment interventions for these children.

Ethical Statements

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. Preparation of this manuscript was supported in part by grants from the Federal Maternal and Child Health Bureau (grant R40 MC 00029, formerly grant MCJ-240637, and grant R40 MC 00123, formerly grant MCJ-240838), the Robert Wood Johnson Foundation (grant 18303), the Annie E. Casey Foundation (grant 94-4041), the David and Lucile Packard Foundation (grants 93-6051, 94-7957, 97-8058, and 98-3448), and the Hawaii State Department of Health (grant 99-29-J) awarded to Dr. Anne Duggan.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no other conflicts of interest.

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