Using SEM to Identify Direct and Indirect Influences on Cognitive and Language Development of Toddlers from Low-Income Families

Teresa M. Ober and Patricia J. Brooks

1. Introduction

Children growing up in poverty have elevated risk of cognitive and language delays relative to their peers from more affluent families (Merz, Wiltshire, & Noble, 2019). Poverty impacts neural development from infancy, placing infants reared in economically disadvantaged and stressful environments at risk of compromised neurocognitive development (Ursache & Noble, 2016). For such children, factors such as poor prenatal care, low maternal educational attainment, teenage pregnancy, food and housing insecurity, and parenting stress tend to co-occur, with far-reaching impact on developmental trajectories for cognition and language (Evans, Li, & Whipple, 2013). Cumulative risk indices may be more predictive of children’s developmental outcomes than any single factor and contribute to developmental cascades in abilities as they unfold over time (Cutuli et al., 2017; Masten & Cicchetti, 2010).

The current study aimed to increase an understanding of structural relations among factors influencing developmental trajectories of infants growing up in poverty, with the goal of distinguishing direct and indirect influences of contextual (home environment), maternal (educational attainment, maternal distress), interactional (joint attention, negative interaction), and child (gestational age, gender) factors on cognitive and language development. Building on prior work (Poulakos, 2013), we developed a structural equation model (SEM) of cumulative risk, using measures taken at age 14 months to predict individual differences in cognitive and language outcomes at age 36 months. The models examined developmental trajectories of 672 children (49.7% male) from the Early Head Start Research and Evaluation Project (EHSRE; United States Department of Health and Human Services Administration for Children and Families, 2011). The EHSRE was a longitudinal randomized-control evaluation study of the impact of enrollment in Early Head Start programs on social and cognitive outcomes from infancy through childhood. The EHSRE Birth to Three Phase involved administration of comprehensive assessments related to children’s cognitive and communicative functioning, parenting stress, parent-child

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interactions, home environment, and family background collected when children were 14, 24, and 36 months of age. For our study, we restricted the dataset to the control group to avoid confounds associated with varying characteristics of Early Head Start programs.

Our SEM included latent variables for maternal distress, joint attention, and negative interactions involving the child. Maternal distress encompassed variables related to maternal depressive symptoms, parenting stress, and dysfunctional interactions with the child. Previous work indicates that children exposed to maternal distress and depressive symptoms in infancy tend to have lower receptive vocabulary knowledge relative to their peers (Ahun et al., 2017; Letourneau, Tramonte, & Willms, 2013). Joint attention subsumed measures of child sustained attention, child engagement of the parent, and parental supportiveness in the context of semi-structured toy play protocol. Infants’ ability to sustain attention to toys while engaged with a parent has been shown to predict their subsequent vocabulary knowledge (Yu, Suanda, & Smith, 2019). Other research emphasizes the importance of parental support and responsiveness to children’s communicative bids in fostering cognitive and language development (Tamis-LeMonda, Bornstein, & Baumwell, 2003). Negative interaction subsumed measures of parental intrusiveness, parental negative regard, and child negativity towards the parent. Negative parenting behaviors have been found to be associated with diminished language development, particularly in infants exhibiting negatively valanced affective responses (Laake & Bridgett, 2018).

In addition to the latent variables, our SEM included indices of the quality of the home environment as the home is the primary context for development during infancy. The extent to which the home contains age-appropriate toys and books has been linked with language development outcomes (Melvin et al., 2017). We included gestational age and gender in the models, as infants born prematurely are at heightened risk of developmental delays (Bee et al., 1982). Gender was also included as girls have been observed to outperform boys on language measures (Bornstein, Hahn, & Haynes, 2004). Maternal education was also included as it has been linked with children’s language development (Dollaghan et al., 1999), and with associated factors including maternal responsiveness and the quality of the home environment (Magnuson et al., 2009). After establishing the fit of the SEM in predicting children’s cognitive and language outcomes at age 36 months, we tested whether the model effectively accounted for variation in outcomes for children of minority and non-minority parents. Determining the generalizability of the SEM to different participant subgroups is important as parenting behaviors associated with children’s cognitive and communicative development may vary across racial/ethnic groups (Brooks-Gunn & Markman, 2005).

2. Method
2.1. Participants

The sample consisted of a subset of participants recruited from low-income families for the EHSRE project (United States Department of Health and Human
Services Administration for Children and Families, 2011). The subset consisted of children in the control group (i.e., not enrolled in Early Head Start programs) who did not have missing data for the 36-month receptive vocabulary outcome \(N = 672\); 327 boys and 345 girls). For the sample used here family income was on average 60.2\% \((SD = 49.6\%)\) of the poverty threshold.

Several key demographic variables were provided by maternal caregivers. Mothers self-identified their race/ethnicity as follows: 46.4\% identified as White/Caucasian, 37.1\% as Black/African-American, 11.6\% as Hispanic/Latino, and 5.0\% as Other. Race/ethnicity of the child’s caregiver was re-coded as a binary variable (1=minority, 0=non-minority). Mothers indicated their highest educational attainment by selecting one of three possible choices: 41.3\% attended some high school, 31.9\% obtained a high school degree/GED, and 26.8\% obtained a degree higher than high school or GED diploma. Mothers also reported the child’s approximate gestational age by selecting one of four choices. The infants’ gestational age was reported by the mother, with responses indicating that most infants (85.2\%) were born on time; 1.4\% were born >2 months early, 11.4\% were born >3 weeks early, and 1.9\% were born >3 weeks late. Many mothers (41.7\%) had given birth to the focal child before the age of 18. The majority (58.7\%) were neither married nor living with partner during the course of the study. A subset (9.3\%) of mothers reported speaking a language other than English at home.

2.2. Measures

2.2.1. Cognitive Ability and Vocabulary Knowledge

The child’s cognitive abilities were assessed at ages 14 and 36 months using standardized scores from the Bayley Mental Development Index (MDI), a subscale of the Bayley Scales of Infant Development, 2\textsuperscript{nd} Edition (Bayley, 1993). The MDI measures cognitive, communicative, and social-emotional development of children under age 41 months. The child’s language ability was assessed at age 36 months using the Peabody Picture Vocabulary Test, 3\textsuperscript{rd} Edition (PPVT; Dunn & Dunn, 1997), an untimed assessment of receptive vocabulary. Four pictures are presented at a time with the child asked to point to the one that matches a word spoken aloud. Standardized scores for the Bayley MDI and the PPVT were derived for each participant based on population norms, \(\mu = 100, \sigma = 15\).

2.2.2. Child and Maternal Characteristics

Demographic factors related to both the child and their mother were included in the analyses; these variables were derived from a parent questionnaire administered when the child was 14 months old. Child characteristics included gender, coded as a binary variable (0=female, 1=male), and approximate gestational age. Maternal characteristics included the mother’s level of educational attainment and a set of measures used to create a latent variable for \textit{maternal distress}. The measures encompassed the 20-item Center for Epidemiological Studies Depression (CES-D) Scale (Radloff, 1977), a self-report
assessment of depression symptoms experienced over the past week, and two subscales of the short-form version of the Parental Stress Index (PSI-SF; Abidin, 1995). The 12-item Parent-Child Dysfunctional Interaction subscale indicates whether the mother perceives her child to abuse or reject her or feels disappointed in or alienated from her child. The 12-item Parental Distress Index indicates the mother’s level of distress in the role of parent, stemming from personal factors, e.g., a low sense of parenting competence, or stress due to perceived restrictions associated with parenting, depression, or general lack of social support.

2.2.3. Home Environment

Examiners completed the Home Observation for the Measurement of the Environment (HOME Inventory; Caldwell & Bradley, 1984), which uses a combination of maternal self-report and observed measures to assess the quality of cognitive stimulation and emotional support provided by the child's family at home. For our analyses, 6p used the total score on the HOME Inventory.

2.2.4. Joint Attention and Negative Interaction

Two latent variables were derived from the 3-bag task, a semi-structured play procedure where the parent and child are given three bags of interesting toys and asked to play with the toys in a sequence (Early Head Start, 2005). The interaction was videotaped with child and parent behaviors scored in accordance with the 3-bag task coding scales (Ware et al., 1998). The coding scales focused three positive and four negative aspects of parent-child interaction (possible scores for each scale ranging from 1 to 7). The latent variable for joint attention was derived from scales assessing child sustained attention, child engagement of the parent, and parent supportiveness. The latent variable for negative interaction was derived from scales assessing parent intrusiveness, parent negative regard towards the child, child negativity toward parent. Parent detachment was dropped from the latent variable as its loading yielded a standardized estimate < .30.

3. Results
3.1. Descriptive Statistics

Table 1 provides descriptive statistics for measures taken at ages 14 and 36 months of age for the overall sample and subgroups; Ns vary due to missing data. Note that six mothers did not report race/ethnicity. Standardized scores on the Bayley MDI at 14 months approximated the normed population mean of 100. However, at 36 months of age, standardized scores on both the Bayley MDI and the PPVT were well below the normed population mean, suggesting delays in cognitive and communicative development, with more than half of the children scoring > 1 SD below the population mean of 100 on each of these tests. Scores on the Bayley MDI and PPVT measured at 36 months of age were moderately correlated, r(620) = .58, p < .001.
Table 1. Descriptive Statistics for Measures at 14 and 36 Months.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Overall Sample</th>
<th>Minority</th>
<th>Non-Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>M (SD)</td>
<td>N</td>
</tr>
<tr>
<td><strong>14-month measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal Distress Inventory</td>
<td>606</td>
<td>27.2 (9.4)</td>
<td>321</td>
</tr>
<tr>
<td>Parent-Child Dysfunction</td>
<td>604</td>
<td>17.3 (5.7)</td>
<td>319</td>
</tr>
<tr>
<td>CES Depression Scale</td>
<td>599</td>
<td>13.6 (9.8)</td>
<td>316</td>
</tr>
<tr>
<td>HOME Inventory</td>
<td>575</td>
<td>26.5 (3.3)</td>
<td>298</td>
</tr>
<tr>
<td>3-bag Task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Sustained Attention</td>
<td>540</td>
<td>5.0 (1.0)</td>
<td>280</td>
</tr>
<tr>
<td>Child Engagement</td>
<td>540</td>
<td>3.5 (1.1)</td>
<td>280</td>
</tr>
<tr>
<td>Parent Supportiveness</td>
<td>540</td>
<td>4.0 (1.0)</td>
<td>280</td>
</tr>
<tr>
<td>Parent Intrusiveness</td>
<td>540</td>
<td>2.4 (1.2)</td>
<td>280</td>
</tr>
<tr>
<td>Parent Negative Regard</td>
<td>540</td>
<td>1.4 (0.8)</td>
<td>280</td>
</tr>
<tr>
<td>Child Negativity</td>
<td>540</td>
<td>2.1 (1.1)</td>
<td>280</td>
</tr>
<tr>
<td><strong>Bayley MDI</strong></td>
<td>518</td>
<td>98.4 (10.8)</td>
<td>260</td>
</tr>
<tr>
<td><strong>36-month measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bayley MDI</td>
<td>622</td>
<td>90.3 (12.7)</td>
<td>326</td>
</tr>
<tr>
<td>PPVT</td>
<td>672</td>
<td>82.3 (16.3)</td>
<td>357</td>
</tr>
</tbody>
</table>

3.2. Regression Analysis

We used regression analyses to examine the cumulative impact of the variables as measured at 14 months in accounting for communicative and abilities in children at 36 months of age, see Table 2. The regression analyses were conducted with multiple imputation (10 iterations) in R (R Core Team, 2019) using the MICE package (Van Buuren & Groothuis-Oudshoorn, 2011). Inspection of a missing data plot suggested that data were missing at random for the selected variables of interest. The regression model predicting Bayley MDI scores at 36 months was statistically significant, $F(14, 657) = 22.68, p < .001, R^2 = .33$. The regression model predicting PPVT at 36 months was also significant, $F(14, 657) = 16.65, p < .001, R^2 = .26$.

The results of the regression models for the two 36-month outcomes were similar. Both models indicated significant effects of maternal education, home environment (HOME Inventory), child sustained attention, parent supportiveness, and infant cognitive ability (Bayley MDI at 14 months) in predicting individual differences in cognitive and language outcomes at 36 months. The model predicting scores on the Bayley MDI at 36 months also showed significant effects of child gender (favoring girls) and gestational age, as well as a significant negative effect of parent-child dysfunction. Note that despite the non-significance of some of the variables, we retained the full set of 14-month variables as predictors of 36-month outcomes, as preliminary analyses indicated patterns of co-variance that would be accounted for in the SEM.
Table 2. Standardized regression coefficients for predictors of Bayley MDI and PPVT scores at 36 months; all predictors were assessed at 14 months (N = 672).

<table>
<thead>
<tr>
<th>predictor</th>
<th>Bayley MDI</th>
<th>PPVT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Education</td>
<td>.12 ***</td>
<td>.13 ***</td>
</tr>
<tr>
<td>Child Gender (1 = Male)</td>
<td>-.08 *</td>
<td>-.06 †</td>
</tr>
<tr>
<td>Child Gestational Age</td>
<td>.07 *</td>
<td>.03</td>
</tr>
<tr>
<td>HOME Inventory</td>
<td>.14 ***</td>
<td>.16 ***</td>
</tr>
<tr>
<td>Maternal Distress Variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Distress Inventory</td>
<td>-.03</td>
<td>-.08 †</td>
</tr>
<tr>
<td>Parent-Child Dysfunction</td>
<td>-.12 **</td>
<td>.01</td>
</tr>
<tr>
<td>CES Depression Scale</td>
<td>.02</td>
<td>.04</td>
</tr>
<tr>
<td>3–bag Task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child Sustained Attention</td>
<td>.09 *</td>
<td>.20 ***</td>
</tr>
<tr>
<td>Child Engagement of Parent</td>
<td>.03</td>
<td>.04</td>
</tr>
<tr>
<td>Parent Supportiveness</td>
<td>.20 ***</td>
<td>.10 *</td>
</tr>
<tr>
<td>Parent Intrusiveness</td>
<td>-.01</td>
<td>.00</td>
</tr>
<tr>
<td>Parent Negative Regard</td>
<td>-.04</td>
<td>.01</td>
</tr>
<tr>
<td>Child Negativity</td>
<td>-.01</td>
<td>.02</td>
</tr>
<tr>
<td>Bayley MDI (14 months)</td>
<td>.19 ***</td>
<td>.18 ***</td>
</tr>
</tbody>
</table>

Note: ***p < .001, **p < .01, *p < .05, † p < .10

3.3. Structural Equation Modeling

As a first step in building the SEM, we used confirmatory factor analysis (CFA) to evaluate the adequacy of the latent variables serving as indices of maternal distress, joint attention, and negative interaction. CFA and SEM analyses were conducted in the lavaan package (Rosseel, 2012) in R (R Core Team, 2019). The latent variables had acceptable model fit indices. Standardized loadings for manifest variables were > .50 for maternal distress and joint attention, and > .40 for negative interaction; see Figure 1.

Our SEM tested for direct and indirect influences of variables assessed at 14 months in predicting Bayley MDI and PPVT scores at 36 months. We used full information maximum likelihood estimation to handle missing data (0%–24% for variables at 14 months; 0%–7% for variables at 36 months) to reduce potential bias resulting from listwise deletion (Acock, 2012). Model fit was assessed using the chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). After building a SEM for the full sample and trimming non-significant paths, we conducted a measurement invariance analysis to test the adequacy of the SEM for minority and non-minority subgroups. Measurement invariance analysis tests assumptions of psychometric equivalence by comparing the model fit of two groups against a theoretical model using a series of models with increasingly constrained parameters (Putnick & Bornstein, 2017).
The SEM used to predict Bayley MDI scores at 36 months had acceptable model fit indices using unconstrained factor loadings and intercepts; $\chi^2(df = 80, n = 672) = 178.56$, $CFI = .94$, $TLI = .92$, $RMSEA = .04 [0.03, 0.05]$, $SRMR = .05$, $R^2$ Bayley MDI (36m) = .345. Direct effects of joint attention, $B = .37, z = 7.18, p < .001$, 14-month cognitive ability, $B = .27, z = 6.46, p < .001$, maternal distress, $B = -.16, z = 3.38, p < .01$, and maternal education, $B = .11, z = 2.94, p < .01$, on 36-month Bayley MDI scores were observed. Additionally, there were significant indirect effects of the home environment, $B = .04, z = 3.34, p < .01$, gender, $B = -.02, z = -2.06, p < .05$, and gestational age, $B = .04, z = 3.27, p < .01$, via 14-month cognitive ability, as well as of the home environment, $B = .14, z = 5.28, p < .001$, and maternal education, $B = .05, z = 3.16, p < .01$, via joint attention.

The same SEM used to predict PPVT scores at 36 months also had acceptable model fit indices using unconstrained factor loadings and intercepts; $\chi^2(df = 80, n = 672) = 178.56$, $CFI = .94$, $TLI = .92$, $RMSEA = .04 [0.03, 0.05]$, $SRMR = .05$, $R^2$ PPVT (36m) = .247. The model indicated significant direct effects of joint attention, $B = .33, z = 6.54, p < .001$, 14-month cognitive ability, $B = .21, z = 5.13, p < .001$, maternal education, $B = .11, z = 2.84, p < .01$, and maternal distress, $B = -.10, z = -2.32, p < .05$, in predicting 36-month PPVT scores. Again, there were significant indirect effects of the home environment, $B = .03, z = 2.94, p < .01$, and gestational age, $B = .03, z = 2.86, p < .01$, via 14-month cognitive ability, and of the home environment, $B = .10, z = 4.06, p < .001$, and maternal education, $B = .04, z = 2.84, p < .01$, via joint attention. The indirect effect of gender via 14-month cognitive ability approached significance, $B = -.02, z = -1.94, p = .05$. 

Fig. 1. Standardized factor loadings for the three latent variables: maternal distress, joint attention, and negative interaction.
For each subgroup and outcome measure, we established partial invariance after relaxing constraints on the loadings and residuals for several parameters of the SEM. The model fit indices were acceptable for both minority and non-minority subgroups; see Figures 2a, 2b for models predicting Bayley MDI and Figures 3a, 3b for models predicting PPVT scores. Standardized estimates shown
in bold in the figures indicate significant differences between subgroups; all coefficients ≥ .09 were statistically significant ($p < .05$).

**Fig. 3a.** SEM predicting PPVT scores at 36 months in the minority subsample; $\chi^2(\text{df} = 194, n = 357) = 131.50$, $CFI = .92$, $TLI = .91$, $RMSEA = .05$, $SRMR = .06$, $R^2 = .207$.

**Fig. 3b.** SEM predicting PPVT scores at 36 months in the non-minority subsample; $\chi^2(\text{df} = 194, n = 309) = 186.37$, $CFI = .92$, $TLI = .91$, $RMSEA = .05$, $SRMR = .06$, $R^2 = .208$.

The models indicate considerable stability in relations between 14-month and 36-month measures across subgroups, and the importance of joint attention, cognitive ability (Bayley MDI), maternal education, and maternal distress as
4. Discussion

For children growing up in poverty, individual differences in developmental outcomes have been linked to factors that originate in the first years of life (Ursache & Noble, 2016). The current study used SEM to tease apart direct and indirect influences of child and maternal characteristics, home environment, and parent-infant interactional dynamics in infancy in predicting cognitive and language outcomes of low-income minority and non-minority children at age 36 months. We conducted preliminary regression analyses to identify 14-month variables of interest and used CFA to test the adequacy of three latent variables serving as indices of maternal distress, joint attention, and negative interaction between mother and infant. After testing the adequacy of the latent variables, we established a best-fitting SEM for the full sample. We trimmed non-significant paths from the full model, and then conducted a measurement invariance analysis to determine whether the SEM showed acceptable fit indices for subgroups comprising children from minority and non-minority backgrounds. Testing for measurement invariance is important as children from minority groups experience differential hardship and risk due to structural inequalities and societal prejudice, which may affect psychometric equivalence (Brooks-Gunn & Markman, 2005; Putnick & Bornstein, 2017).

The two outcome measures—Bayley MDI and PPVT scores—were moderately correlated at 36-months. The Bayley MDI encompasses measures of cognitive, social-emotional, and communicative skills (Bayley, 1993); hence one would expect scores on this measure to be associated with receptive vocabulary knowledge. Importantly, the SEMs reported in this paper yielded similar findings across outcome measures (i.e., evidence of replication). Thus, the observed direct and indirect relations between 14-month variables and cognitive and language abilities at 36 months were not tied to results from a specific standardized test.

Starting with the child factors, we observed a direct effect of 14-month cognitive ability (Bayley MDI) on 36-month cognitive and language outcomes (Bayley MDI and PPVT), indicating considerable stability in intellectual abilities over the first years of life (Bornstein et al., 2004). Both of the other child factors, gestational age and child gender, had significant indirect effects on 36-month outcomes via 14-month cognitive ability. Prior research indicates long-term impact of prematurity on language development (Bee et al., 1982; Putnick et al., 2017). Our findings suggest that early differences in general cognitive abilities mediate the impact of prematurity on vocabulary development. Gender (favoring girls over boys) has also been linked with individual differences in language abilities at 2 to 5 year of age (Bornstein et al., 2004). Our findings again suggest that early differences in general cognitive abilities mediate this relation.

With regard to maternal characteristics, both maternal educational attainment had a significant direct effect in predicting children’s 36-month outcomes, while
the latent variable *maternal distress* did not appear to. The two maternal variables exhibited significant negative covariance and contributed in opposite ways to the quality of the home environment. Previous research has found that infants with mothers exhibiting a great number of depressive symptoms tend to later possess lower receptive vocabulary knowledge (Ahun et al., 2017; Letourneau, Tramonte, & Willms, 2013). Our findings concur and provide some evidence that the association is direct and relatively stable across subgroups, albeit somewhat weak when other factors are taken into consideration. In line with previous research (Christian et al., 1998; Dollaghan et al., 1999), we found maternal educational attainment to be positively associated with children’s development outcomes at 36 months. Taken together, these results indicate the importance of supporting maternal mental health and educational opportunities for mothers living in low income communities as an effective means of fostering their children’s cognitive and academic skill development.

Of all of the variables in the model, the latent variable *joint attention* had the strongest direct effect on 36-month outcomes. Joint attention consisted of measures of child’s sustained attention, child engagement of parent, and parent supportiveness taken from the 3-bag task, an observational measure of parent-infant interaction at 14 months. As indicated by the CFA, these three measures were closely linked, as was expected (Adamson et al., 2019). In our preliminary regression models, both child’s sustained attention and parent supportiveness emerged as significant predictors of 36-month cognitive and language outcomes (see also Brooks, Flynn, & Ober, 2018). In the context of joint attention, supportive parents may aid children’s cognitive and linguistic development by providing vocabulary that is relevant to the child’s focus of attention (Tamis-LeMonda et al., 2001; Yu et al., 2019).

In addition to the longitudinal associations with cognitive and language development, joint attention exhibited a significant concurrent association with 14-month cognitive ability. We interpreted this relation as bidirectional, given that joint attention is thought to promote infants’ cognitive, social-emotional, and communicative skills and vice versa (Adamson et al., 2019; Yu et al., 2019). Notably, joint attention also had a significant negative covariance with the latent variable *negative interaction*, consisting of measures of parent intrusiveness, parent negative regard toward the child, and child negativity taken from the 3-bag task. Previous research indicated that parental support and responsiveness to infants were associated with advances in children’s language development (Tamis-LeMonda et al., 2003) whereas parental negativity towards the child was associated with decrements (Laake & Bridgett, 2018). However, in our models there was no direct effect of negative interaction on 36-month outcomes. Thus, intrusive parenting behaviors and negativity on the part of the parent towards the child appeared to influence later outcomes only by diminishing opportunities for joint attention.

Two other variables, maternal education and the quality of the home environment, both had significant indirect effects on 36-month outcomes via joint attention. That is, joint attention was enhanced for children of mothers with
greater educational attainment and for children living in more emotionally supportive and cognitively stimulating homes. The quality of the home environment has been found to have a significant and stable association with language development, even after accounting for socio-economic status (SES; Melvin et al., 2016). We found this to be true in regression analyses. However, when entered into the SEM, the quality of the home environment unexpectedly did not have a significant direct effect on 36-month outcomes. In addition to its indirect effect via joint attention, the home environment also had a significant indirect effect via 14-month cognitive ability.

The observed relations were not only stable across outcome measures, but also for both minority and non-minority subgroups. The results of the measurement invariance analysis suggested that the relations between 14-month factors and 36-month outcomes were largely the same across the two subgroups, even though a few of the parameters were left unconstrained (Steenkamp & Baumgartner, 1998) and some of the standardized estimates varied in magnitude.

4.1. Conclusions

The SEMs served to highlight pathways through which individual differences in developmental trajectories emerge and identify targets for early intervention. We found that after accounting for the influence of various factors related to the child, parent, and home environment, joint attention in infancy remained the strongest predictor of subsequent cognitive and receptive vocabulary skills. The observed direct and indirect influences on cognitive and language development were largely stable across minority and non-minority subgroups. Although the SEM models indicated a number of factors influencing developmental trajectories of children growing up in poverty, the models did not aim to be comprehensive in accounting for effects of SES as all of the children in the EHSRE study were raised in low-income circumstances (i.e., there was restricted range on variables associated with income). Within this low-income sample, risk factors appeared to be heightened for minority children, which likely reflects systemic inequality in our society (Ursache, & Noble, 2016). Further analyses of the EHSRE dataset should examine how the constellation of factors considered here at 14 months continue to influence children’s later cognitive and communicative abilities beyond pre-school entry. Additional work is needed to understand more fully how factors associated with poverty impact children’s developmental trajectories and evaluate strategies for helping children overcome obstacles to their success.

References


