CHILD DEVELOPMENT

Child Development, March/April 2011, Volume 82, Number 2, Pages 583–600

Developmental Pathways to Integrated Social Skills: The Roles of Parenting and Early Intervention

Catherine Ayoub
Harvard Medical School

Claire D. Vallotton
Michigan State University

Ann M. Mastergeorge
University of California

Dynamic skill theory was utilized to explain the multiple mechanisms and mediating processes influencing development of self-regulatory and language skills in children at 14, 24, and 36 months of age. Relations were found between family risks, parenting-related stresses, and parent–child interactions that contribute either independently or through mediation to the child's acquisition of self-regulatory skills even when accounting for the influence of language development. Variation in impacts between control and Early Head Start (EHS) intervention samples was compared to explore the sequence of developmental mechanisms over time. Findings indicate that EHS protects parenting, child language, and self-regulatory development from the effects of demographic risks and parenting stress, and thus supports parents to raise healthy children.

Dynamic Skill Theory: A Translational Model for Normative Development in Context

Dynamic skill theory provides a model for understanding the intersection of social and language development embedded in the varied contexts of family risks, parental stress, and parent–child relationships. Within the dynamic skill framework, development involves an individual's construction of progressively more complex skills. Skills are the

The authors thank John Willett, Dick Murnane, Kristen Bub, Kurt Fischer, and the members of the Early Head Start Consortium. Research was supported by a grant from the Administration for Children and Families (ACF), Grant 90YR0008, and by a grant from NICHD, Grant 1 F32 HD050040-01. The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services, or the National Institutes of Health.

The findings reported here are based on research conducted as part of the national Early Head Start Research and Evaluation Project funded by the ACF, U.S. Department of Health and Human Services under Contract 105-95-1936 to Mathematica Policy Research, Princeton, NJ, and Columbia University's Center for Children and Families, Teachers College, in conjunction with the Early Head Start Research Consortium. The Consortium consists of representatives from 17 programs participating in the evaluation, 15 local research teams, the evaluation contractors, and ACF. Research institutions in the Consortium (and principal researchers) include ACF (Rachel Chazan Cohen, Judith Jerald, Esther Kresh, Helen Raikes, and Louisa Tarullo); Catholic University of America (Michaela Farber, Harriet Liebow, Nancy Taylor, Elizabeth Timberlake, and Shavaun Wall); The Center for Children and Families at Columbia University (Lisa Berlin, Christy Brady-Smith, Jeanne Brooks-Gunn, and Allison Sidle Fuligni); Harvard University (Catherine Ayoub, Barbara Alexander Pan, and Catherine Snow); Iowa State University (Dee Draper, Gayle Luze, Susan McBride, Carla Peterson); Mathematica Policy Research (Kimberly Boller, Jill Constantine, Ellen Eliason Kisker, John M. Love, Diane Paulsell, Christine Ross, Peter Schochet, Cheri Vogel, and Welmoet van Kammen); Medical University of South Carolina (Richard Faldowski, Gui-Young Hong, and Susan Pickrel); Michigan State University (Hiram Fitzgerald, Tom Reischl, and Rachel Schiffman); New York University (Mark Spellmann and Catherine Tamis-LeMonda); University of Arkansas (Robert Bradley, Richard Clubb, Andrea Hart, Mark Swanson, and Leanne Whiteside-Mansell); UCLA (Carollee Howes and Claire Hamilton); University of Colorado Health Sciences Center (Robert Emde, Jon Korfmacher, JoAnn Robinson, Paul Spicer, and Norman Watt); University of Kansas (Jane Atwater, Judith Carta, and Jean Ann Summers); University of Missouri-Columbia (Mark Fine, Jean Ispa, and Kathy Thornburg); University of Pittsburgh (Beth Green, Carol McAllister, and Robert McCall); University of Washington School of Education (Eduardo Armijo and Joseph Stowitschek); University of Washington School of Nursing (Kathryn Barnard and Susan Spieker), and Utah State University (Lisa Boyce, Gina Cook, Catherine Callow-Heusser, and Lori Roggman)

Correspondence concerning this article should be addressed to Catherine Ayoub, Massachusetts General Hospital, 388 Commonwealth Ave, Boston, MA 02215. Electronic mail may be sent to cayoub@partners.org.

 0009-3920/2011/8202-0010
DOI: 10.1111/j.1467-8624.2010.01549.x

activities or actions a person can control in a given context or situation, and are organized into varying strands that build a developmental web (Fischer & Bidell, 2006). In contrast to historically favored linear models of development (e.g., Kohlberg, 1969; Piaget, 1983), the developmental pathways approach of skill theory proposes that young children develop along a web of multiple strands, the shapes of which vary between children and are influenced by each child's context. Individuals' webs can be similar to one another or may differ depending upon both internal and external influences, but together they form the child's developmental pathway. In this study, language and self-regulation are considered a set of dynamic and increasingly integrated skills within the first few years of life. Examination of the level and change in these systems in the context of family risks and early intervention offers a way to understand the variation in the developmental pathways of at-risk children (Fischer & Bidell, 2006).

An integrative pathways approach supports better understanding of the social behavior of young children facing social and economic risks because it portrays differences in performance as adaptive and complex rather than simply delayed or dysfunctional. Using this perspective, we suggest ways to help practitioners consider variation in development with a ''child-in-context'' framework over time, using the constructs of the developmental web and the central role of adaptation to the environment in the service of survival and healthy growth. Second, we offer practitioners suggestions about effective intervention design and propose additional targeted interventions to further support families and children in given contexts of risk.

Self-Regulation as a Dynamic Set of Skills

One critical way to map the young child's move from dependence to competence is through the study of self-regulation (Shonkoff & Phillips, 2000). Toddlerhood may be a particularly important phase for learning self-regulation skills because children are expected to begin regulating their physical and emotional states with less assistance from parents while coping with greater environmental demands. For instance, children who cope more effectively with stressful situations at age 3 show more successful preschool adjustment and better self-control at age 6 (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Shields et al., 2001).

Boys tend to have more trouble with self-regulation than girls beginning in infancy (Weinberg, Tronick, Cohn, & Olson, 1999). They are less skilled than girls at self-regulation during the toddler years (NICHD Early Child Care Research Network, 2004) and in preschool (McCabe, Cunnington, & Brooks-Gunn, 2004). For example, Raikes, Robinson, Bradley, Raikes, and Ayoub (2007) found that boys at 36 months had lower levels of self-regulation than girls, but the trajectory of self-regulatory skills was not different by child sex. Whether boys show slower growth in self-regulation that leads to less developed abilities in the toddler and preschool years, or whether sex differences in self-regulation reflect similar growth rates but different starting points, has not yet been established.

Language as a Dynamic Set of Skills

For the young child, language serves primarily social goals such as negotiating social interactions, communicating needs, and representing one's own point of view (Tomasello, 1995). During the preschool years, language is increasingly used as the mechanism for gaining access to information about the physical and social world (Koenig, Clément, & Harris, 2004). Around age 2, substantial individual and social class differences in language skills emerge, such that there are striking differences in vocabulary before children enter kindergarten (Hart & Risley, 1995). Sex differences in early language development are characterized by a small average advantage for girls in both receptive and expressive language (Bates, 1999). As language skills grow they begin to reflect and influence children's social relationships and capacities. The relation between language and self-regulation develops in the context of adult–child relationships as caregivers guide children's behavior, moderate their arousal, and help them interpret affective experiences using language (Palombo, 1992). According to Vygotsky (1986), children internalize the regulating speech of their caregivers, which becomes part of the child's internal self-regulatory dialogue (Berk & Winsler, 1995). As children's vocabulary grows to include psychological states, they are increasingly able to be coached or directed (Parke & Kellam, 1994) and to increasingly rely on cognitive strategies for self-regulation. The transition from other- to self-controlled regulation is underpinned by children's growing representational abilities, most easily observed through the use and growth in their language skills. Thus, we expect young children's self-regulatory skills to grow along with their expansion of vocabulary.

Risk and Protective Factors: The Importance of Ontext in Skill Theory

For scientific knowledge in human development to productively contribute to the helping professions, we must understand the varied potential pathways that emerge through the dynamic relation of the individual within multiple embedded contexts (e.g., Horowitz, 2000). Dynamic skill theory offers a helpful set of constructs we can apply to the study of the interrelation of developmental domains and the varying contexts of family risks and parenting behaviors.

Demographic indicators. Socioeconomic status (SES) encompasses aspects of economic resources, and human and social capital. While there is no single definition of SES, there is wide agreement that income, parental education, and occupation are each associated with cognitive, language, and social skill performance and best represent SES. Even within a poverty cohort, there is considerable variation in these indicators; children living in poverty obtain lower scores on tests of cognitive and language skills when their parents have not graduated high school, are not employed, or receive government assistance (Bradley & Corwyn, 2002; Zill, Moore, Smith, Stief, & Coiro, 1995). Families with the most demographic risks are less likely to benefit from Early Head Start services designed to support their child's development (Raikes & Emde, 2006).

Parenting stress. Parenting stress is a complex construct that represents a combination of parent, child, and family characteristics as they relate to a person's appraisal of his or her role as a parent (Everly & Lating, 2002). Stress related to parenting taxes the psychological resources of parents and may directly or indirectly disrupt the formation and maintenance of healthy parent–child relationships (Hillson & Kuiper, 1994). Accordingly, children whose parents have high levels of general and specific parenting-related stress are at increased risk for problems in language, cognition, attachments, emotional regulation, and social competence (Fischer et al., 1998; Shields, Cicchetti, & Ryan, 1994). General distress experienced by parents is largely a result of social and emotional difficulties external to the child. Parents' depression, anxiety, and isolation dominate this form of stress and have significant negative consequences for a child's development. Specific components of the parenting role and the parent–child relationship are a second contributor to overall parenting stress. These contributors include stresses from within the parent–child dyad, as well as difficulties with the tasks of being a parent (Coyl, Roggman, & Newland, 2002).

Parent–child interactions. The assumption that the development and expression of optimal skills is dependent upon contextual support—such as a sensitive and stimulating parent or teacher—is central to the skill theory approach. Thus the nature of the interaction between the primary caregiver and child plays a significant role in defining the ''context'' in which the child's pathway develops. Learning to self-regulate has been described as moving from other-controlled process, in which children rely on caregivers to control regulatory interactions, to a self-controlled process (Schaffer, 1996). Thompson (1998) has hypothesized that mothers who sensitively respond to children help them deal effectively with negative emotional states by anticipating transitions, redirecting attention, and quickly responding to distress. These parental responses in turn support children's growing abilities to regulate their emotions independently.

However, the quality of mother–child interactions is predicted by family contexts such as poverty (Conger, Ge, Elder, & Lorenz, 1994) and by parenting-related stress (Coyl et al., 2002). Researchers have found that poorer mothers and mothers with psychological distress tend to have more hostile, more intrusive, and less sensitive interactions with their young children than do mothers with fewer demographic and psychological risks (Shaw & Vondra, 1995; Tronick & Weinberg, 1997). Thus, demographic risk factors may heighten parental stress, which in turn weakens parent–child interaction and may lead to negative developmental outcomes for the child.

The role of intervention as a developmental change agent. One of the largest early intervention models in the United States is Early Head Start (EHS), a two-generational program that focuses on enhancing child development and supporting the family during the critical first 3 years of the child's life. Program involvement addresses children's self-regulatory and language development directly through specific child-focused activities during home visits and through the provision of high-quality, center-based child care, and indirectly through parenting education and support services (Administration for Children and Families [ACF], 2002). The initial evaluation of EHS suggests modest effects across a wide range of child development domains, including both socioemotional and language skills (ACF, 2002; Raikes et al., 2007). Specifically, the EHS impact study findings found that children's receptive language ability at 3 years of age emerged in

part because of earlier impacts on the parent's sensitivity, cognitive stimulation, and support for language development across a range of parenting situations. A second mediated finding suggested that children's negativity toward their parents at 3 years of age was inversely related to parents' sensitivity and positively related to a combination of parenting and general stresses in the previous year.

The effects of EHS on children's self-regulatory and language skills prior to 3 years of age have not been examined together longitudinally, nor have the mechanisms through which EHS influences development in these domains. Our study extends the findings of the EHS impact study by using a longitudinal approach to track both level and trajectory of change over time. Second, we attend to the nature of development in these two domains as they relate to the meditational mechanisms alluded to in the impact study, which explain the differences in child developmental outcomes in the presence or absence of intervention.

The Current Study

We address a set of questions related to the interplay of developmental domains in the face of family risks and parenting stresses in the presence and absence of the comprehensive EHS intervention. We use the data collected for the National Early Head Start Evaluation Study, which includes 3,001 families who were followed over time when children were 14, 24, and 36 months of age. We then divide the sample into those who were and were not randomly assigned to receive the intervention in order to determine whether the self-regulatory and language processes are different in the context of an early, multigenerational intervention. Our assumption, based in dynamic skill theory, is that there is interplay between these domains of development and that the relations between domains as well as their developmental progression will be affected by the family and intervention contexts. That is, we expect family risks, parenting stresses, and parent–child interaction to affect the developmental strands of language and self-regulatory skills, partially through their effects on each other. In addition, these risks may have different effects in the context of early intervention. Therefore, we test the hypotheses that both demographic risks and parents' stress disrupt the development of both language and self-regulation, and examine mechanisms by which parenting risks affect these domains. Specifically, we test whether the effects of risks and stresses on development are mediated through parent–child interaction characteristics. Testing the intersection of domains, we examine whether the effects of parenting risks on self-regulation are mediated through child language development and whether this varies by child sex. Further, we test possible differences in EHS impacts by sex.

Method

Sample

The EHS Research and Evaluation project is a prospective study of children and their families from birth through preschool. Seventeen EHS programs were selected to participate in a rigorous, large-scale evaluation with a sample of 3,001 families near or below the federal poverty level who had a child < 1 year of age. Half the families were randomly assigned to participate in EHS upon entry to the study; control group participants could enroll in other child care and support services but received no EHS services. The sample was ethnically diverse; 34% of children were African American, 23% were Hispanic, and 43% were European American. Approximately half (49%) were female. There was some expectable attrition between the first and third waves of data collection; however, there were no significant differences in sociodemographic characteristics between the remaining families at Wave 3 and the full sample of 3,001 families (see Love et al., 2005, for details on sampling, eligibility, and attrition).

Measures and Variables

Data were collected at program entry and when the focus child was 14, 24, and 36 months of age. Each measure is described in more detail next. Descriptive statistics for each variable at each wave in the two groups are provided in Table 1. A table of bivariate correlations between variables at each wave is available from the authors.

EHS intervention assignment. The variable EHS is a dummy variable denoting whether the family was or was not assigned to receive the EHS intervention.

Family demographic risks. Previous research on the impact of EHS identified a set of five demographic characteristics that together predicted variation in the effects of the intervention (ACF, 2002). These include teen parenting (TEEN MOM), receipt of Temporary Aid to Needy Families (TANF, which may be a proxy for poverty in this already low-income sample), mother with no high school diploma or equivalent (NO HS), parent unemployment, and

Table 1
Descriptive Statistics for Outcome and Predictor Variables for the Control (n = *1,488 children) and Intervention* (n = *1,513) Groups in the National Sample of the Early Head Start (EHS) Evaluation Study at Each Wave of Data Collection*

Categorical variables	Control group			EHS intervention group		
Girls	49.73%			48.32%		
Teen mom	39.57%			38.92%		
No high school	47.60%			47.66%		
TANF recipient	34.73%			35.62%		
Continuous variables	14 months *M* (*SD*) Min/max	24 months *M* (*SD*) Min/max	36 months *M* (*SD*) Min/max	14 months *M* (*SD*) Min/max	24 months *M* (*SD*) Min/max	36 months *M* (*SD*) Min/max
Child age	14.88 (1.23)	25.11 (1.50)	37.15 (1.60)	14.82 (1.22)	25.19 (1.55)	37.17 (1.47)
	12.58/22.24	22.37/32.65	33.27/46.88	12.05/20.50	22.17/32.42	33.38/42.18
General stress[a]	26.82 (6.09)	27.29 (5.98)	27.52 (5.92)	27.09 (5.95)	27.93 (5.67)	27.83 (6.05)
	7/35	7/35	9/35	7/35	9/35	7/35
Parenting stress[a]	17.70 (4.65)	18.80 (4.58)	18.93 (4.66)	17.90 (4.63)	19.17 (4.49)	19.15 (4.68)
	5/25	5/25	5/25	5/25	5/25	5/25
Sensitivity	4.36 (1.33)	4.48 (1.14)	4.46 (1.04)	4.48 (1.32)	4.56 (1.14)	4.55 (1.06)
	1/7	1/7	1/7	1/7	1/7	1/7
Stimulation	3.56 (1.22)	3.73 (1.13)	3.70 (1.12)	3.69 (1.79)	3.97 (1.13)	3.82 (1.13)
	1/7	1/6	1/7	1/7	1/7	1/7
Self-regulation	3.71 (0.69)	3.64 (0.81)	3.91 (0.75)	3.68 (0.69)	3.63 (0.78)	3.94 (0.77)
	1.29/5.00	1.00/5.00	1.14/5.00	1.14/5.00	1.00/5.00	1.00/5.00
CDI vocabulary		53.52 (22.58)			55.93 (23.24)	
		0/100			0/100	

Note. TANF = Temporary Aid to Needy Families; CDI = Communicative Development Inventory.
[a]The stress scores here are scored such that a lower score means more stress; this is the way the scales were calculated for the original article by Whiteside-Mansell et al. (2007). However, in our analyses, we standardize and reverse the valence of the scores such that each scale has a mean of zero, a standard deviation of one, and a higher score means more stress, rather than less.

single parent. In light of the research literature and prior EHS findings, we include these baseline demographic characteristics to delineate a set of family risks. However, unemployment and single parenting were not significant in any of the models and were eliminated for parsimony.

Parents' stress. Parental stress was measured using two subscales of the Parenting Stress Index Short Form (PSI–SF; Abidin, 1995), the Parenting Distress scale and Parent–Child Dysfunctional Interaction scale. Recent work by Whiteside-Mansell et al. (2007) on the psychometric properties of these scales has shown these items to form four rather than two distinct subscales. The four new scales assess general stress, parenting-related stress, parent–child dysfunctional interaction, and parents' perception of the child. We use two of these subscales, general stress (GENERAL STRESS) and parenting-related stress (PARENTING STRESS), to measure two types of stress that may have differential effects on children. We do not use the parent–child dysfunctional interaction or the parents' perception of the child subscales because they are closely related to other concepts for which we have other, more independent measures.

Parent–child interaction. At each wave, mothers and children were videotaped during a 10-min, semistructured interaction in which dyads were given three bags of age-appropriate toys and progressed through them at their own pace. Six different parent interaction qualities were rated from the videotapes. We use two of the positively valenced interaction characteristics indicating two distinct aspects of interaction: (a) cognitive stimulation (STIMULATION) or effortful teaching appropriate to the child's developmental level, such as providing explanations, offering activities with toys, and asking questions, and (b) sensitivity to children's cues (SENSITIVITY), including accurately observing and responding to children's needs, moods, interests, and abilities (for more information see Love et al., 2005). Ratings ranged from 1 (*very low*) to 7 (*very high*) based on both the quantity and quality of observed behaviors. Raters were trained to a criterion of 85% agreement (within 1 point) on all scales; intermittent reliability checks on 15% of

videotapes revealed that interrater agreement was above 90% on average.

Child age. Child age (AGE) was measured as the difference in months, to the second decimal, between the child's birth date and the date of data collection at each wave; there was some variance around the target ages at each wave. For longitudinal analyses, we center age at 14 months; for analysis of static measures at the 24 month wave, we center child age at 24 months.

Child sex. Child sex is coded as a dummy variable for which *GIRL* = 1.

Child language skills. We used the MacArthur Communicative Development Inventory (CDI) vocabulary scale score at 24 months (VOCABULARY) as our measure of language skills because we were interested in how the breadth of children's vocabulary supports their self-regulation skills. This score, normed for child age, ranges from 0 to 100 (Fenson et al., 1994). At 24 months there is wide variation in vocabulary; it is the earliest age at which we expect to see meaningful differences in spoken language. Pan, Rowe, Singer, and Snow (2005) found that parental report on the CDI was closely related to observed vocabulary, suggesting that parents accurately report child vocabulary.

Child self-regulation skills. In this study, self-regulation (*REGULATE*) is measured as the child's ability to successfully cope with the demands of completing the Bayley Scales of Infant Development (BSID; Bayley, 1993). The testing situation presents an opportunity to examine the child's ability to focus attention on successive tasks and modulate their negative effect resulting from the frustration of failures and from having to relinquish test materials to the researcher. After completion of the cognitive assessment, the examiner rated the child's self-regulation using a seven-item subscale of the Bayley Behavior Rating Scale (BBRS). These items include maintaining attention on tasks, degree of negativity, and adaptation to changes in testing materials. Each item was scored on a 5-point scale where better self-regulatory skills were indicated by higher scores. Ratings were averaged across the items to obtain a single score between 1 (*poor regulation*) and 5 (*good regulation*). Examiners were trained to a minimum of 85% exact agreement before rating independently (see Raikes et al., 2007, for information on training and reliability).

Analysis Plan

To test our hypotheses about the mechanisms by which parenting risks—including demographic risks and parents' stresses—affect children's social development, and whether these relationships vary in the context of an intervention, we tested a series of possible mediations. For example, we tested whether the effect of parent stress on child development was mediated by parent–child interaction; we also tested whether the effect of parent stress on self-regulation was partially mediated by its effect on child language. We used methods and criteria described in Frazier, Tix, and Barron (2004) to conservatively establish mediation. First, we tested for a main effect of the predictor on the outcome. Second, we tested for an effect of the predictor on the mediator. Third, we determined whether the mediator affects the outcome in the presence of the predictor, and fourth, whether the effect of the predictor is diminished when the mediator is in the model. We also tested the possibility of moderation by child sex; the criterion for moderation was a significant interaction when the main effects of each predictor were controlled. We completed each set of analyses in the two samples simultaneously to determine whether the developmental processes differed in the context of the EHS intervention. This is conceptually equivalent to adding an interaction between the group variable (*EHS* = 1) and every other term in the model. When substantial differences were found between the two groups, we followed up to confirm the effects of the EHS program by fitting the equivalent models using the entire combined sample, adding the main effect of EHS, and interacting the relevant variables by EHS.

Because the data were collected longitudinally and at multiple sites, we used multilevel models, fitting each suite of models in SAS PROC MIXED. When the outcome is time invariant we nested observations within sites (Singer & Willett, 2003). When our outcome was time varying, collected at all three waves, we used three level growth models, nesting observations within children over time, within sites. To ease interpretation, we standardized the scores of all predictors so that each has a mean of 0 and a standard deviation of 1; we left the outcome variables in their original units of measurement. Throughout these analyses, we used two criteria to determine whether any given variable or set of variables made a significant contribution to the model: the t statistic provided for the individual variable, and the overall model fit as indicated by significant reduction in the negative two log likelihood (−2LL) statistic. If the fit was substantially improved by the addition of a set of variables (as judged by the χ^2 statistic) we considered it

significant and retained it even if the *t* statistics on individual variables were not significant.

Results

In this section we present the results of our tests of the mechanisms by which family demographic risks and parenting stresses affect children's development, and the points at which the EHS intervention appears to break the connections between risks and negative outcomes. We describe results for the control and EHS groups together, beginning with the effects of the demographic risks on parents' stresses and parent–child interaction. Then we examine the effects of these risks on children's language and self-regulation. We present the fitted models for these tests in Tables 2–4, and elucidate the results in Figures 1–3. We summarize all of the tested relations for both groups in Figure 4.

Effects of Demographic Risks on Parents' Stresses and Parent–Child Interactions

For families in the control group, the risks of teen parenting, low education, and receiving TANF raised parents' stress levels for both their general (−1.6361, $p < .001$) and parenting (−0.586, $p < .10$) stresses. The combined impact of all three demographic risks on parents' general stress was 0.25 *SD* ($p < .05$). For families randomized to receive EHS intervention, risks increased general stress (−1.4511, $p < .05$) but did not affect parenting stress (−0.4005, *ns*).

Both demographic risks and parents' stresses acted independently to affect parent–child interaction. In the control group, the combined family demographic risks, general stress, and parenting stress each reduced parents' sensitivity to children's cues (−0.6294, $p < .001$) and their intentional teaching during interactions (−0.8854, $p < .01$); their combined effect on intentional teaching was 0.77 *SD*. For these families, both general and parenting stresses reduced parents' abilities to respond sensitively to their children and to provide cognitive stimulation.

The story is different for those families in the EHS intervention group. Demographic risks and both types of stress affected parents' sensitivity in intervention and control groups similarly; none of the demographic risks or stresses affected parents' intentional teaching. The EHS intervention appears to protect this aspect of parent–child interaction against both contextual and internal assaults. Please see the Appendix for a table summarizing all results.

Effects of Risks, Stresses, and Parent–Child Interaction on Child Language Development

In both the EHS and control groups, girls had higher language skills at 24 months; this can be seen by looking at the main effect of GIRL in Models A through H of Table 2. There were differences in the magnitude of this effect that can be seen by contrasting the values of GIRL in models for the control group (A, B, E, and F) with those for the EHS group (C, D, G, and H). Overall, for children in the control group, girls had language skills 0.19 *SD* greater than boys, whereas for children in EHS, girls had language skills 0.32 *SD* higher than boys. This hints at possible sex differences in the impact of EHS intervention on children's language development.

Both general and parenting stress had small but significant negative effects on children's vocabularies at 24 months in the control group (0.13 *SD* and 0.10 *SD*, respectively) and the EHS group (0.10 *SD* for both general and parenting stress). Yet, there were differences between the groups in the mediation of the impact of parents' stresses through parent–child interaction. As seen in Table 2, in the control group, the effects of both general stress and parenting stress on language were partially mediated by parent–child interaction qualities (contrast the effects of GENERAL STRESS in Models A and B, and the effects of PARENTING STRESS in E and F). In the EHS group, the effects of stresses on child language were not mediated by interaction, as seen by examining the stable effects of general stress in Models C and D and effects of parenting stress in G and H. Thus, for those EHS families who still had high stress levels, the effects of those stresses on language development were not mediated through parent–child interaction.

In the control group, both parents' sensitivity and cognitive stimulation had simultaneous positive effects on children's vocabularies, even when controlling for both stresses. For these children, parental sensitivity during interaction had a small but significant effect on children's vocabularies at 24 months (2.68 words, $p < .01$) equal to 0.12 *SD*. However, parents' sensitivity during parent–child interaction did not affect the vocabulary skills of 2-year-olds in EHS. We confirmed this finding in an analysis of the total sample. Table 3 shows the results of a suite of models testing the protective effects of EHS for children's language development

Table 2
Suite of Fitted Multi-level Models Testing Whether General and Parents' Stresses and Negative Parent–Child Interactions Affect Children's Language Skills at 24 Months in the Control Group (n = *992) and in the Early Head Start (EHS) Intervention Group* (n = *1,078)*

	General stress				Parenting stress			
	Control group		EHS group		Control group		EHS group	
Fixed effects	Model A: General stress	Model B: General stress + interaction	Model C: General stress	Model D: General stress + interaction	Model E: Parenting stress	Model F: Parenting stress + interaction	Model G: Parenting stress	Model H: Parenting stress + interaction
Intercept	48.7233*** (1.5480)	49.5904*** (1.4656)	49.4926*** (1.7043)	49.8044*** (1.7500)	48.8090*** (1.5477)	49.6273*** (1.4691)	49.3012*** (1.6887)	49.5533*** (1.7435)
Girl	4.2859* (1.3866)	3.3537* (1.4689)	6.8368*** (1.3464)	6.4243*** (1.4442)	4.0898** (1.3825)	3.3518* (1.4649)	7.3013*** (1.3383)	6.9783*** (1.4347)
Age	2.6482*** (0.4532)	2.7535*** (0.5305)	2.9572*** (0.4370)	2.8462*** (0.5169)	2.6523*** (0.4501)	2.7684*** (0.5264)	2.8553*** (0.4367)	2.6716*** (0.5173)
General stress	−2.9574*** (0.6840)	−1.9921** (0.7358)	−2.3008*** (0.6929)	−2.3138** (0.7456)				
Parenting stress					−2.2367** (0.6987)	−1.4422† (0.7469)	−2.3294*** (0.6780)	−2.3863** (0.7288)
Sensitivity		2.6229** (1.0079)		0.1778 (1.0224)		2.7103** (1.0075)		0.0901 (1.0114)
Stimulation		3.4794*** (0.9991)		3.7900*** (1.0026)		3.4981*** (0.9955)		4.2165*** (0.9898)
Variance components								
L1: Within site	456.73***	419.69***	468.52***	450.47***	461.42***	421.60***	470.21***	450.94***
L2: Between site	20.05*	13.47*	30.21**	30.45*	19.90*	13.68*	29.59*	30.24*
Fit statistics								
Deviance	8,606.6	6,975.1	9,472.9	7,935.5	8,759.9	7,049.9	9,593.4	8,017.0

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 3
Fitted Multi-level Models for the Protective Effects of the Early Head Start (EHS) Intervention on Child Vocabulary Skills at 24 Months (CDI Standardized Vocabulary Scale), Using Children in Both the EHS and Control Groups (n = *2,072)*

Fixed effects	Model A: EHS protects from risks	Model B: EHS protects from general stress	Model C: EHS protects from parenting stress	Model D: EHS protects from insensitivity
Intercept	49.7770*** (1.9169)	48.6375*** (1.5966)	48.7983*** (1.5844)	49.8967*** (1.6260)
Girl	4.6478** (1.5917)	4.3132** (1.3941)	4.1090** (0.3140)	3.1198* (1.4925)
Age	2.7390*** (0.3624)	2.8324*** (0.3150)	2.7860*** (0.3140)	2.7358*** (0.3721)
Teen mom	1.1027 (1.8504)			
No HS	−2.1865 (1.7819)			
TANF	−2.3167 (1.7554)			
General stress		−3.0711*** (0.6862)		
Parenting stress			−2.4202*** (0.6957)	
Sensitivity				5.3027*** (0.7662)
EHS	−1.9291 (1.9923)	0.9480 (1.3555)	0.5212 (1.3513)	0.1939 (1.4486)
EHS*Girl	4.7303* (2.2169)	2.6008 (1.9306)	3.2551† (1.9232)	3.8112† (2.0578)
EHS*Teen mom	4.9537† (2.5278)			
EHS*No HS	−3.8409 (2.4002)			
EHS*TANF	5.6687* (2.3624)			
EHS*General stress		0.8092 (0.9700)		
EHS*Parenting stress			0.1410 (0.9618)	
EHS*Sensitivity				−2.4470* (1.0326)
Variance components				
L1: Within site	480.78***	436.19***	466.54***	448.38***
L2: Between site	23.69**	24.72**	24.04**	23.62**
Fit statistics				
Deviance	1,4242.9	1,8066.4	1,8341.1	1,5351.2

Note. CDI = Communicative Development Inventory; HS = high school; TANF = Temporary Aid to Needy Families.
†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

against each of the demographic risks, parents' stresses, and parental insensitivity. The protective effects of EHS against the demographic risks and parental insensitivity are shown in Panels A and B of Figure 1. Finally, the EHS intervention had a positive effect on girl's language development at 24 months, as indicated by the significant interaction between EHS and child sex in an analysis of the combined sample (see Models A, C, and D in Table 4).

Intertwined Domains of Development: Effects of Child Sex and Language on Regulation

On average, children's self-regulation skills decreased between 14 and 24 months, then increased through their 3rd year of life. However, the basic trajectories of self-regulation were different for boys and girls, as seen by examining the fitted values of GIRL and the interaction between GIRL and AGE in Table 4, Models A through H. Girls started with higher levels of regulation at 14 months, their skills did not dip quite as far at 24 months, and they rose higher by 36 months.

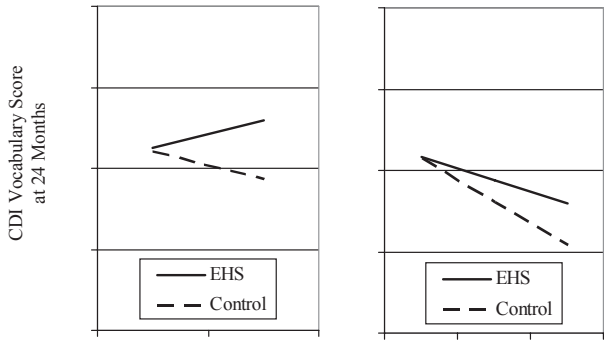
Children's vocabulary at 24 months predicted not only the level but also the linear and quadratic growth of self-regulation (Table 4, Models B, D, F, and H). Figure 2 shows the effects of language skills at 24 months on the trajectories of self-regulation for boys and girls in the control group from 14 to 36 months. At 24 months, children who have 1 *SD* higher vocabularies have self-regulation skills 0.19 *SD* higher than those with average language skills; at 36 months there is still an effect of 0.14 *SD* difference of 24-month vocabulary on self-regulation.

In the control group, the effects of child sex on the development of self-regulation was slightly but consistently stronger when child language was controlled (contrast the fitted value of GIRL*AGE in Table 4, Models A and B and Models E and F), indicating that for this group there was a conflation between the effects of language and child sex. Once language is controlled, girls had higher self-regulation skills beyond those attributable to language. On the other hand, there was an opposite pattern in the EHS group; controlling for child language slightly but consistently *reduced* the effect of sex on

Table 4
*Suite of Fitted Multilevel Growth Models Testing Whether General and Parenting Stresses Affect Child Self-Regulation Through Their Effects on Children's Language at 24 Months in the Control Group (*n *Children = 1,204;* n *Observations = 2,714), and the Early Head Start (EHS) Intervention Group (*n *Children = 1,269;* n *Observations = 2,942)*

	General stress				Parenting stress			
	Control group		EHS group		Control group		EHS group	
Fixed effects	Model A: General stress	Model B: General stress + language	Model C: General stress	Model D: General stress + language	Model E: Parenting stress	Model F: Parenting stress + language	Model G: Parenting stress	Model H: Parenting stress + language
Initial status at 14 months								
Intercept	3.62440***	3.68280***	3.62740***	3.62930***	3.62450***	3.68090***	3.62410***	3.62850***
	(0.04287)	(0.04495)	(0.06106)	(0.06134)	(0.04319)	(0.04477)	(0.05997)	(0.06021)
Girl	0.17700***	0.11070*	0.10080*	0.09191*	0.17550***	0.11050*	0.10090*	0.08984*
	(0.04266)	(0.04723)	(0.04177)	(0.04603)	(0.04239)	(0.04705)	(0.04155)	(0.04573)
Vocabulary		0.06968*		0.04835†		0.07375**		0.05398*
		(0.02872)		(0.02657)		(0.02764)		(0.02636)
Linear rate of change each month								
Age	−0.02149**	−0.02551**	−0.01785**	−0.01818**	−0.02044**	−0.02420**	−0.01841**	−0.01871**
	(0.00542)	(0.00570)	(0.00556)	(0.00568)	(0.00530)	(0.00560)	(0.00550)	(0.00560)
Girl*Age	0.00508	0.00761*	0.00688*	0.00517†	0.00438	0.00660*	0.00706*	0.00540†
	(0.00284)	(0.00316)	(0.00282)	(0.00308)	(0.00282)	(0.00317)	(0.00279)	(0.00305)
Vocabulary*Age		0.02088***		0.01631**		0.01924***		0.01622**
		(0.00548)		(0.00495)		(0.00537)		(0.00490)
Quadratic rate of change each month								
$(Age)^2$	0.00121***	0.00126***	0.00108***	0.00111***	0.00117***	0.00122***	0.00113***	−0.00116***
	(0.00020)	(0.00021)	(0.00019)	(0.00020)	(0.00020)	(0.00021)	(0.00019)	(0.00020)
Vocabulary*$(Age)^2$		−0.00085***		−0.00062**		−0.00076***		−0.00062**
		(0.00022)		(0.00020)		(0.00022)		(0.00019)
Parents' stress								
General stress	−0.02993*	−0.00820	−0.03100*	−0.02952†				
	(0.01506)	(0.01646)	(0.01436)	(0.01533)				
Parenting stress					−0.03148*	−0.02120	−0.01643	−0.00636
					(0.01502)	(0.01638)	(0.01406)	(0.01489)
Fit statistics: −2LL	5,597.3	4,796.2	6,118.8	5,428.6	5,731.8	4,903.8	6,223.7	5,523.8

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.



Panel A. Effect of Demographic Risks on Child Language for EHS and Control Group Children

Panel B. Effect of Parental Insensitivity on Child Language for EHS and Control Group Children

Figure 1. Effects of demographic risks and parental sensitivity on the vocabulary skills of children at 24 months old for children who were assigned to the Early Head Start (EHS) intervention and those in the control group.
Note. Each panel contrasts the self-regulation trajectory for prototypical children who have average vocabulary to those who have vocabulary scores 1 *SD* above and below the mean. CDI = Communicative Development Inventory.

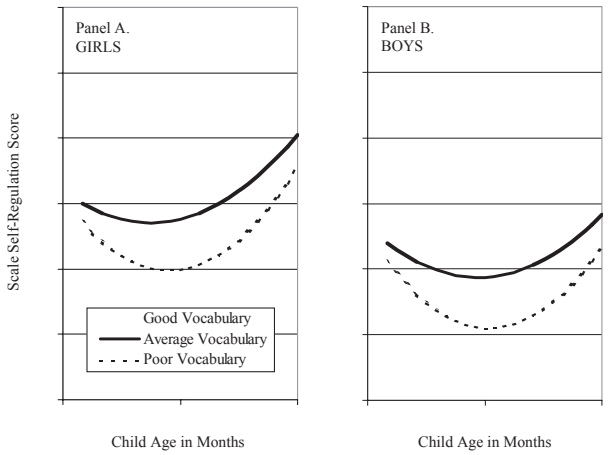


Figure 2. Effects of children's vocabulary score at 24 months on the development of self-regulation for boys and girls controlling the effects of parent sensitivity and cognitive stimulation during parent–child interaction.

self-regulation, showing that part of the effect of sex on self-regulation for this group was because girls have higher language skills. This is consistent with the findings that EHS increased the language skills of girls in the intervention.

Effects of Risks, Stresses, and Parent–Child Interaction on Children's Self-Regulation Development

Demographic risks had negative effects on the trajectory of self-regulation for the control group. In particular, teen parenting negatively affected the level of self-regulation, and TANF negatively affected change in self-regulation over time. These effects were partially mediated by their effects on parent–child interaction; the negative impacts of TANF on change in self-regulation were reduced by almost half when parent sensitivity and stimulation were added to the model. However, the EHS intervention protected children's self-regulation from the negative effects of these risks. The effects of the demographic risks on self-regulation for children in EHS were less than half of their impact on children in the control group. For controls, the risks had a combined effect of −0.20179 on the intercept of self-regulation ($p < .01$), and poverty (TANF) slowed the growth in self-regulation, affecting both the linear (−0.02150, $p < .10$) and quadratic (0.00105, $p < .05$) rates of change. In the EHS group, the effects of the risks on the intercept were less than half that in the control group (−0.09381, *ns*), and poverty (TANF) did not have a significant effect on change in self-regulation. Figure 3 contrasts the combined effects of the risks for children in the control and EHS groups. As shown in Panel A, the self-regulation of EHS children was moderately affected by demographic risks, such that by 24 months, a child with all three risks had self-regulation 0.20 *SD* lower than a child with no risks, but by 3 years the difference was only 0.07 *SD*. Whereas, in Panel B, the self-regulation of a child with all three risks not assigned to EHS was 0.39 *SD* lower at 24 months and still 0.23 *SD* lower at age 3.

General and parenting stresses each had small but significant effects on children's self-regulation skills (0.04 *SD*) in the control group—effects that were not mediated by parent–child interaction. Parents' general stress affected EHS children's self-regulation to the same degree that it did in the control group. However, the parenting-related stress of EHS families did not affect self-regulation as it had the control group. This was observed by contrasting the fitted value of PARENTING STRESS in Model E (control) to that in Model G (EHS) of Table 4.

Effect of Parenting Risks on Self-Regulation: Mediation Through Child Language

The effects of demographic risks on children's self-regulation were not mediated by children's language; that is, the negative effects of teen parenting and TANF were not reduced when language was added to the model. However, vocabulary skills at 24 months did mediate the impacts of parents' stresses on child self-regulation for the control

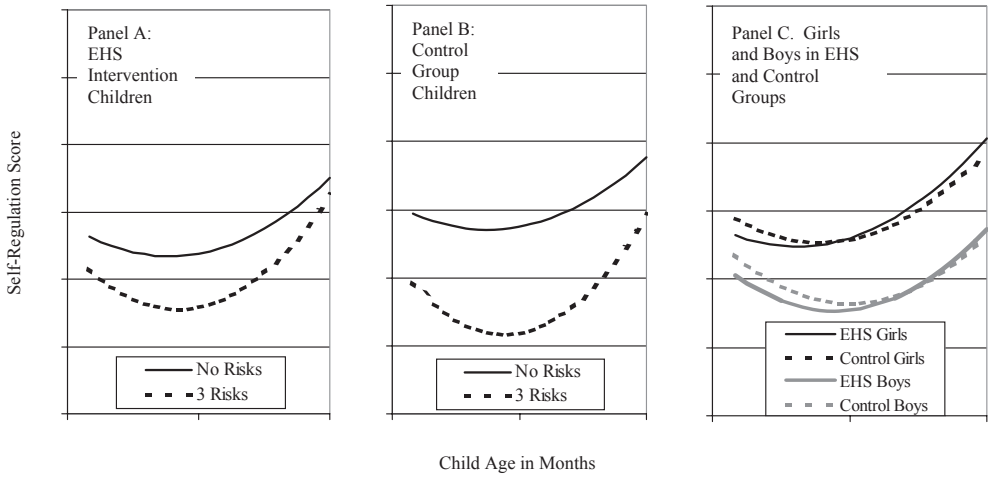


Figure 3. Effects of risks (teen parenting, low maternal education, and poverty) and Early Head Start (EHS) on the development of children's self-regulation, and effects of the EHS intervention on self-regulation for girls and boys, accounting for average differences in language skills for each group of children.

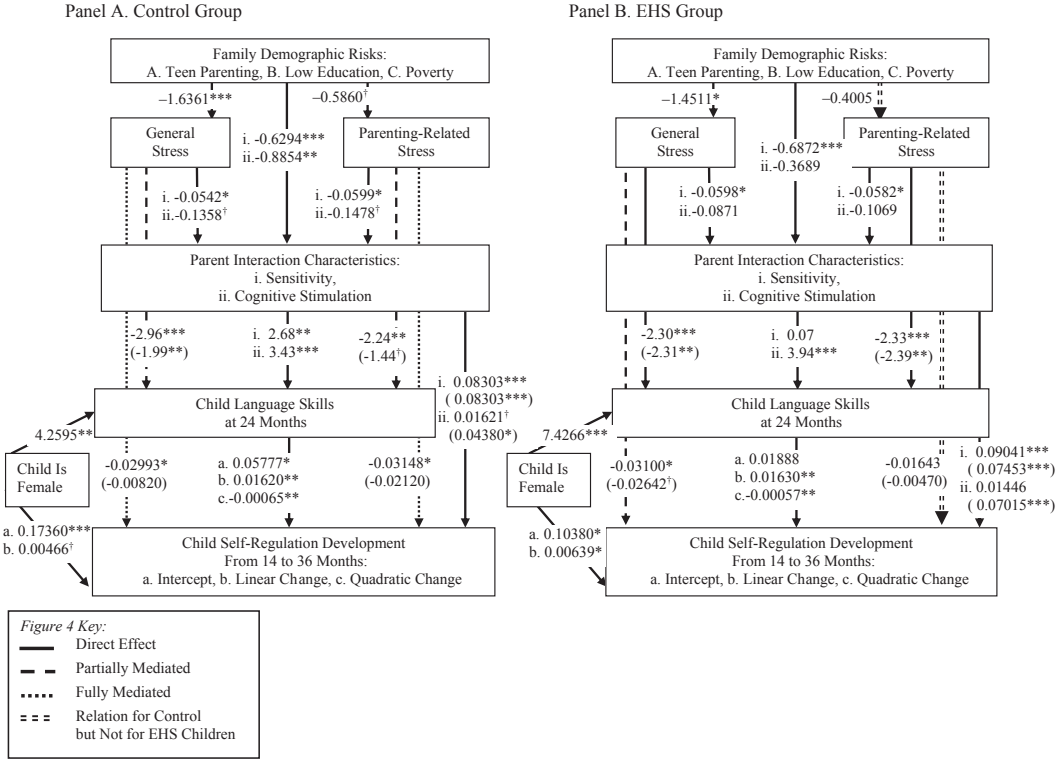


Figure 4. Summary of the direct, partially mediated, and fully mediated relations for the control and Early Head Start (EHS) groups.
Note. Each effect represented is the effect of 1 *SD* of predictor on the non-standardized outcome. In cases of mediation, first number is effect of predictor on outcome not controlling mediator; number in parentheses is effect when mediator is controlled. Effects of demographic risks are cumulative; their combined significance assessed by change in −2LL. When there is more than one indicator of a construct, they are numbered and effects presented separately. In all cases, effects of child age and gender are controlled.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

group. Table 4 shows the fitted models testing whether children's language skills at 24 months mediated the effects of parents' general and parenting stresses on the development of children's self-regulation. Models A through D of Table 4 show the results for general stress, and E through H show the results for parenting stress. The first two models of each set depict the results of the test of

mediation for the control group, and the third and fourth models in each set provide the results for those in EHS. In the control group, child's language mediated the relation between parent's general stress and child's self-regulation. This mediation can be observed by contrasting the values of GENERAL STRESS for the control group in Models A and B, and the effects of PARENTING STRESS in Models E and F. In contrast, in the EHS group the effect of parents' general stress was not substantially reduced by the inclusion of child language (see Models C and D), and because there was no effect of parenting-related stress on self-regulation, there was no effect to mediate.

Moderation of Effects of Parenting Risks by Child Sex

Girls were more advanced in both domains, and there were small average differences in parenting of boys and girls. The effects of parenting risks and characteristics on child development were the same for boys and girls, as was the effect of language on self-regulation.

Effects of EHS on Self-Regulation

In a model with the full sample, EHS had a small positive effect on the development of children's self-regulation as shown by a positive effect of the interaction between EHS and child age on self-regulation ($b = 0.00384$, $p < .10$), even accounting for the effects of children's language skills. Panel C of Figure 3 depicts this effect for boys and girls; each line shows the average trajectory of self-regulation for a prototypical child who is either male or female and either assigned or not assigned to EHS. These trajectories account for the average differences in language development of children in the four groups. As seen in Panel C, control group children had higher self-regulation scores than EHS children at 14 months, a difference that was reversed by the time they were 3 years old. The point at which the average EHS child's score was higher than the average control group child's scores was different for boys and girls, with EHS girls showing a greater increase in self-regulation than control group girls just before age 2, and EHS boys showing that greater increase after 24 months.

Summary of Results

Figure 4 provides an overview of the effects of parenting risks on children's social development in the control (Panel A) and EHS (Panel B) samples, including those relations in which predictors had direct (solid line), partially mediated (dashed line), and fully mediated (dotted line) effects on outcomes. For example, Panel A of Figure 4 shows that the effect of general stress on self-regulation is mediated through language development for the control group. The fitted value for the effect of general stress on self-regulation (-0.02993, $p < .05$) in Table 4, Model A is shown next to the dashed line running through language to self-regulation, while the diminished effect of general stress from Table 4, Model B is shown below it in parentheses (-0.00820, $p = ns$). This can be contrasted to the relations presented in Panel B in which the effect of general stress is only partially mediated by child language for the EHS group, as shown by the dashed line. Further, in Panel B of Figure 4, the double dashed line represents relations that did not exist for the EHS group but did exist for the control group.

Bringing these findings together, there were three main ways that EHS protected children's development: (a) EHS protected parents from the stresses particularly involved in parenting, reducing the impact of demographic risks on parenting-related stress; (b) EHS protected parents' abilities to provide cognitive stimulation to their children despite contextual risks and high stress levels; and (c) EHS promoted children's language development directly, particularly for girls, which bolstered child language against the harmful effects of parents' stress and poor interactions, and promoted self-regulation skills.

Discussion

Dynamic Self-Regulatory and Language Skills in Context

We apply a dynamic skill theory framework to explain the multiple mechanisms and mediating processes that influence the development of social skills in early childhood. We found that risks, stressors, and interactions each contribute to the child's self-regulatory skills in the face of concurrent language development. By carefully mapping the interface of these predictors on the child's self-regulatory skills, we were able to diagram the influences on the developmental pathways for this group of low-income children. Having plotted the complex influences of risks, parenting stresses, and parent–child interaction on language and self-regulation in the comparison group, we then compared variation in the sequence of developmental mechanisms in light of an intervention

context—EHS services. The purpose of this exercise was to identify the mechanisms by which EHS protects development in a family and parenting risk context, then to use them to inform focused interventions based on the developmental pathways of these low-income children across the first 3 years of life.

Applying Skill Theory to Exploring the Interaction Between Domains

Looking across developmental domains, language skills at 24 months are significantly associated with the trajectories of children's self-regulation skills from infancy through toddlerhood, such that language at 24 months predicts the trajectory of later self-regulation skills. This finding supports a skill theory perspective that language production is a social, as well as a cognitive, skill and that the language strand of development supports the development of self-regulatory processes. While we find evidence of strong relations between these domains, we also identify ways in which language development in part encompasses a separate skill set that interacts with environmental factors independently and differently from the self-regulatory domain. This is illustrated in our control group finding that the negative influence of teen parenting and TANF on self-regulation was not diminished when language skills at 24 months are considered; that is, these risks do not have universal negative effects across all domains but seem to have more targeted effects. Our mapping of the interface of these developmental strands in context allows us to consider the complex ways in which several strands of the pathway for each child weave together to create the whole child's developmental identity at any given moment.

The timing of skill development varies for boys and girls. Child sex is a moderator of both language and self-regulatory skill building. Although girls are more advanced across both domains, none of the effects of the other predictors vary by sex. This finding gives weight to the theory that both boys and girls move along the same developmental trajectory, but at a different pace. For the practitioner, this knowledge helps avoid unrealistic expectations and comparisons across children of the same age. In addition, it provides support for teachers to identify and scaffold boys during those periods of developmental vulnerability.

Dynamic skill theory demands that we explore changes over time. Examination of our control group demonstrates how trajectories of self-regulation change in the contexts of different risks and stressors, which may have implications for intervention. For example, from an intervention perspective it is useful to know that the child of a teen may be more dysregulated on average, but that economic hardship can slow the growth in that child's self-regulatory skills. Further, the influence of these risks on the rate of change in self-regulation is partially mediated by parent–child interaction. When parents are more cognitively stimulating and sensitive with their children, growth in self-regulation is promoted. Informatively, while the demographic risks have negative effects on self-regulation, none of these same risks influence the child's language at 24 months. Armed with this information, interventionists might consider the benefit of focusing on building positive parent–child interactions. This message may be important for targeted intervention programs as well as considering how much effort to expend on the components of these programs that support positive parenting.

The Significance of General and Parenting Stress in the Context of EHS Intervention

Without intervention, higher general and parenting-related stresses both reduce children's language and self-regulation skills, but there are some important differences between them. The effects of general stress on child development are largely entwined with families' demographic risks. These tend to be preexisting vulnerabilities or risks such as depression, anxiety, and isolation that the parents bring with them to the parenting role. In addition, parents' stress and parent–child interaction both simultaneously influence children's language skills at 24 months, indicating that though stress influences parent–child interaction, they are two separate dimensions of parenting. This is consistent with others' findings that parental depression and anxiety are more prominent in low-income families and are often present before or shortly after the birth of the child (Barry, Dunlap, Cotton, Lochman, & Wells, 2005). Our work contributes support to the construct of maternal psychological functioning as a distinct contributor to the stresses present during the parenting years (Williford, Calkins, & Keene, 2007). In contrast to the relation between general stress and demographic risks, the effects of parenting-related stress remained significant with demographic risks in the models. This suggests that parenting-related stress is a distinct stressor from general stress. If this is so, then each is likely to require its own set of intervention strategies that

should be differentiated in order to mediate presenting risk factors.

One reason that parenting stress may be more directly related to child development than general stress (which is mediated through parent–child interaction) is that the relation between parenting stress and children's language and social skills may be reversed or bidirectional. That is, children with lower language and self-regulation skills may provide to be more stressful for their parents. Future studies should test whether children's earlier language and social skills predict later parenting-related stress. For instance, it would be useful to contrast this to general stress, which often includes preexisting parent-centered conditions such as depression or isolation. An alternative hypothesis is that children of parents who are anxious, distracted, and less attentive may engage in behaviors that are more difficult for parents to ignore, and are thus seen as less well regulated.

In our study, EHS participation plays a role in ameliorating the effects of parenting stress. In both its home-based and center-based models, EHS interventions focus on promoting positive interactions for children and modeling these interactions for parents. EHS appears to protect parenting by reducing the negative effect of risks on parenting-related stress. In contrast, the EHS intervention does not change general, adult-based stress, which likely reflects long-term difficulties. Conditions that are likely to cause general stress in adult caregivers may require more extensive and targeted interventions that are not part of the EHS program plan. However, targeted families may benefit from the addition of special programs within EHS designed to augment typical EHS services. For example, programs focusing on maternal depression have met with success by using an EHS program as a springboard from which to offer more intensive adult mental health services (see Beeber, Holditch-Davis, Delyea, Funk, & Canuso, 2004).

EHS Promotes Positive Parent–Child Interaction Despite Risks and Stressors

Another difference between the EHS and control group was the effect of both demographic characteristics and parenting stress on cognitive stimulation. Intentional teaching resulting in cognitive stimulation for children, another goal of EHS programming, is emphasized through ongoing modeling and educational offerings on child development and parenting practices. Our findings show that the EHS intervention had a positive effect on parents' cognitive stimulation of children and that, unlike in the control group, parents' stress did not diminish this positive interaction style. Since the EHS intervention occurs early, it may have the ability to build systems that support cognitively stimulating parent–child interactions, even in the face of parents' stress, resulting in EHS children's language development being bolstered even though their parents had risks that, in the control sample, predicted lower language skills.

Parents' intentional teaching had significant effects on children's language skills for both groups, but this positive interaction style is diminished by risks and stresses for the control group. This impact of EHS is consistent with the results reported by Love et al. (2005), who described the impact of EHS on parents' overall supportiveness during parent–child interactions, a measure that included cognitive stimulation during parent–child interaction. Whereas Love et al. reported the main effects of EHS on parenting when children were 36 months, the current study finds the same effects at each wave from 14 to 36 months of age. More specifically, we find that EHS protects this aspect of parenting from the negative effects of demographic risks and parental stress. Overall, it appears that one way the EHS program protects children's development is by bolstering parents' intentional teaching of their children during everyday interactions in the face of family risks and stress. Practitioners may want to capitalize on and promote this cognitive buffer in their work with high-risk children.

Another mechanism by which EHS programs appear to support healthy development is by protecting child language from the negative effects of parental insensitivity. Parents' insensitivity has a much more negative effect on the language skills of control children than those of EHS children. Parental sensitivity still has small but significant effects on children's self-regulation in both the EHS and control groups; thus, it is children's language development in particular that EHS programs are most consistently protecting. Importantly, in both groups of children, language skills support the development of self-regulation.

EHS and the Intersection of Domains of Language and Self-Regulation

The EHS program appears to have a more positive effect on girls' language skills than boys'. The positive impact of EHS on language development is consistent with the positive effects on children's language at 36 months presented by Love et al.

(2005). However, Love et al. did not report any sex differences. It could be that the authors may have found a sex difference in the impact of EHS at the 36-month wave if they had looked for one. Another possibility is that there is no sex difference in EHS effects on language at 36 months, and those sex differences we see at 24 months may be because girls' average language advantage at this age means we can see the positive effects for girls earlier than we can for boys. Another possibility is that for some reason, girls simply benefit more from the intervention, at least with respect to language. This sex difference warrants further investigation. That is, it would be useful to see the sex differences in EHS's impact on language over time from 14 to 36 months.

In the EHS group, both general and parenting-related stresses decreased children's vocabularies directly. Further, the EHS intervention had a direct positive effect on language development of girls at 24 months. EHS had a small, positive effect on the development of children's self-regulation, even accounting for the effects of children's language skills. If we assume that these two domains of development share some skill-building functions, then we can see how they interface in light of the EHS intervention context.

Limitations of the Current Study

One of the limitations of the EHS evaluation study is that it was undertaken at the beginning of the implementation of EHS programming, and sites varied in their levels of implementation, creating 17 different interventions. Inconsistent effects are evident across sites and thus this study presents very conservative results on overall program impact. However, this is the only experimental study of a broad two-generational early intervention that has gone to scale. Another limitation is that this study does not map the developmental pathways across contexts after the program ends. Additional waves of data from this study at entry into kindergarten and at fifth grade will be available for extended analysis in the near future.

Implications for Policy and Practice

We began by delineating the variations in the complex developmental paths of low-income children and applied our developmental findings with attention to interacting domains and the importance of context described in dynamic skill theory. We then examined EHS service intervention to see where it changed the developmental mapping for language and self-regulation. Our findings demonstrate how language skill acquisition provides support to self-regulatory skill building. Therefore, designing activities that support one domain can benefit another domain in important ways. For example, curricula that support self-regulation through language, such as Tools of the Mind (Leong, Bodrova, & Hensen, 2007), are currently in use in preschool and kindergarten classrooms. We suggest developing similar programs for toddlers as a way to extend this work within early care settings.

Parent–child interaction is an important mediator of risks that affect both language and emotional expressiveness and regulation. This finding suggests that classroom interventions that support the interface of self-regulation and language would be better supported if partnered with educational skill sessions for parents. Such workshops and skill-building sessions could occur either in the classroom with parents or after hours in parent workshops.

Through a description of developmental mechanisms we determined the need for targeted versus more general intervention strategies that support positive change in self-regulatory functioning. Our findings reinforce the buffering effects of the EHS program on parenting stress but point out the need for more intense and targeted interventions to address general stressors like depression, anxiety, and related adversity.

Finally, we identified two constructs of significant value to practitioners. First, attention to the larger context of demographic and family indicators can help teachers better understand the child's varying skill performance. Second, child sex differences cross domains in early childhood. That is, understanding that the timing of skill development in boys and girls *differs* is important for teachers and other practitioners assessing children's progress, as well as the effects of their own efforts to promote positive developmental outcomes.

References

Abidin, R. R. (1995). *Parenting Stress Index* (3rd ed.). Odessa, FL: Psychological Assessment Resources.

Administration for Children and Families. (2002). *Making a difference in the lives of infants and their families: The impacts of Early Head Start*. Washington, DC: U.S. Department of Health and Human Services.

Barry, T., Dunlap, S., Cotton, S., Lochman, J., & Wells, K. (2005). The influence of maternal stress and distress on disruptive behaviors problems in boys. *Journal of the American Academy of Child and Adolescent Psychiatry*, *44*, 265–273.

Bates, E. (1999). Plasticity, localization, and language development. In S. H. Broman & J. M. Fletcher (Eds.), *The changing nervous system: Neurobehavioral consequences of early brain disorders* (pp. 214–254). New York: Oxford University Press.

Bayley, N. (1993). *Bayley Scales of Infant Development* (2nd ed.). San Antonio, TX.: Psychological Corporation.

Beeber, L., Holditch-Davis, D., Delyea, M., Funk, S., & Canuso, R. (2004). In-home intervention for depressive symptoms with low-income mothers of infants and toddlers in the United States. *Health Care for Women International*, *25*, 561–580.

Berk, L., & Winsler, A. (1995). *Scaffolding children's learning: Vygotsky and early childhood education*. Washington, DC: National Association for the Education of Young Children.

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology*, *53*, 371–399.

Conger, R. D., Ge, X., Elder, G. H., & Lorenz, F. O. (1994). Economic stress, coercive family process, and developmental problems of adolescents. *Child Development*, *65*, 541–561.

Coyl, D., Roggman, L., & Newland, L. (2002). Stress, maternal depression, and negative mother-infant interactions in relation to infant attachment. *Infant Mental Health Journal*, *23*, 145–163.

Everly, G. S. Jr., & Lating, J. (2002). *A personality-guided approach to the treatment of posttraumatic stress disorder*. Washington, DC: American Psychological Association.

Fenson, L., Dale, P., Reznick, J. S., Bates, E., Thal, D., & Pethick, S. (1994). Variability in early communicative development. *Monographs for the Society for Research in Child Development*, *59*(5, Serial No. 242).

Fischer, K., Ayoub, C., Singh, I., Noam, G., Maraganore, A., & Raya, P. (1998). Psychopathology as adaptive development along distinctive pathways. *Development and Psychopathology*, *9*, 749–779.

Fischer, K. W., & Bidell, T. R. (2006). Dynamic development in action and thought. In W. Damon & R. M. Lerner (Eds.). *Handbook of child psychology: Theoretical models of human development 1* (6th ed., pp. 313–399). New York: Wiley.

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology*, *51*, 115–134.

Gilliom, M., Shaw, D., Beck, J., Schonberg, M., & Lukon, J. (2002). Anger regulation in disadvantaged preschool boys: Strategies, antecedents, and the development of self-control. *Developmental Psychology*, *38*, 222–235.

Hart, B., & Risley, T. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes.

Hillson, J. M. C., & Kuiper, N. A. (1994). A stress and coping model of child maltreatment. *Clinical Psychology Review*, *14*, 261–285.

Horowitz, F. (2000). Child development and the PITS: Simple questions, complex answers and developmental theory. *Child Development*, *71*, 1–10.

Koenig, M. A., Clément, F., & Harris, P. L. (2004). Trust in testimony: Children's use of true and false statements. *Psychological Science*, *15*, 694–698.

Kohlberg, L. (1969). Stage and sequence: The cognitive developmental approach to socialization. In D. A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 347–480). Chicago: Rand McNally.

Leong, D. J., Bodrova, E., & Hensen, R. (2007). *Tools of the Mind Curriculum Project preschool manual* (4th ed.). Denver, CO: Center for Improving Early Learning, Metropolitan State College of Denver.

Love, J. M., Kisker, E. E., Ross, C., Constantine, J., Boller, K., Chazan-Cohen, R., et al. (2005). The effectiveness of Early Head Start for 3-year-old children and their parents: Lessons for policy and programs. *Developmental Psychology*, *41*, 883–901.

McCabe, L., Cunnington, M., & Brooks-Gunn, J. (2004). The development of self-regulation in young children. In R. Baumeister & K. Vohs (Eds.), *Handbook of self-regulation: Research, theory and application* (pp. 340–356). New York: Guilford.

NICHD Early Child Care Research Network. (2004). Affect dysregulation in the mother-child relationship in the toddler years: Antecedents and consequences. *Development and Psychopathology*, *16*, 43–68.

Palombo, J. (1992). Narratives, self-cohesion, and the patient's search for meaning. *Clinical Social Work Journal*, *20*, 249–270.

Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of toddler vocabulary production in low-income families. *Child Development*, *76*, 763–782.

Parke, R. D., & Kellam, S. G. (Eds.). (1994). *Exploring family relationships with other social contexts*. Hillsdale, NJ: Erlbaum.

Piaget, J. (1983). Piaget's theory. In W. Kessen (Ed.) & P. H. Mussen (Series Ed.), *Handbook of child psychology: Vol. 1. History, theory and methods* (pp. 103–126). New York: Wiley.

Raikes, H., & Emde, R. (2006). Early Head Start: A bold new program for infants and toddlers. In N. F. Watt, C. Ayoub, R. H. Bradley, & J. Puma (Eds.). *Reforming the village that raises our children: Early intervention programs and policies* (pp. 181–206). Westport, CT: Greenwood.

Raikes, H. A., Robinson, J. L., Bradley, R. H., Raikes, H. H., & Ayoub, C. C. (2007). Developmental trends in self-regulation among low-income toddlers. *Social Development*, *16*, 128–149.

Schaffer, H. R. (1996). *Social development*. Cambridge, UK: Cambridge University Press.

Shaw, D., & Vondra, J. (1995). Infant attachment security and material predictors of early behavior problems: A longitudinal study of low income families. *Journal of Abnormal Child Psychology*, *23*, 335–357.

Shields, A., Cicchetti, D., & Ryan, R. (1994). The development of emotional and behavioral self-regulation and social competence among maltreated school-age children. *Development and Psychopathology*, *6*, 57–75.

Shields, A., Dickstein, S., Seifer, R., Giusti, L., Magee, K., & Spritz, B. (2001). Emotional competence and early school adjustment: A study of preschoolers at risk. *Early Education and Development*, *12*, 73–96.

Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis*. New York: Oxford University Press.

Thompson, R. A. (1998). Early sociopersonality development. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social and personality development* (pp. 25–104). New York: Wiley.

Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103–130). Hillsdale, NJ: Erlbaum.

Tronick, E. Z., & Weinberg, K. (1997). Depressed mothers and infants: Failure to form dyadic states of consciousness. In L. Murray & P. Cooper (Eds.), *Postpartum depression and child development* (pp. 54–81). New York: Guilford.

Vygotsky, L. S. (1986). *Thought and language*. (Rev. ed.). Cambridge, MA: MIT Press.

Weinberg, M. K., Tronick, E. Z., Cohn, J. F., & Olsen, K. L. (1999). Gender differences in emotional expressivity and self-regulation during early infancy. *Developmental Psychology*, *35*, 175–188.

Whiteside-Mansell, L., Ayoub, C., McKelvey, L., Faldowski, R. A., Hart, A., & Shears, J. (2007). Parenting stress of low-income parents of toddlers and preschoolers: Psychometric properties of a short form of the Parenting Stress Index. *Parenting: Science and Practice*, *7*, 27–56.

Williford, A., Calkins, S., & Keene, S. (2007). Predicting change in parenting stress across early childhood: Child and maternal factors. *Journal of Abnormal Child Psychology*, *35*, 251–263.

Zill, N., Moore, K., Smith, E., Stief, T., & Coiro, M. (1995). The life circumstances and development of children in welfare families: A profile based on national survey data. In P. L. Chase-Lansdale & J. Brooks-Gunn (Eds.), *Escape from Poverty: What makes a difference for children?* (pp. 38–59). New York: Cambridge University Press.

Appendix

*Summary of Results: Effects of Each Predictor on Each Outcome for Families in the Control and Intervention Groups of the National Early Head Start (EHS) Study (*N = *3,001)*

Predictor	Outcome	Effect for control		Effect for EHS	
Demographic risks	General stress	−1.6361***		−1.4511*	
Demographic risks	Parenting stress	−0.5860†		−0.4005	
Demographic risks	Sensitivity	−0.6294***		−0.6872***	
Demographic risks	Stimulation	−0.8854**		−0.3689	
Demographic risks	Level of self-regulation	−0.2018**		−0.0938	
TANF	Change in self-regulation (linear)	−0.2150†		−0.0136	
TANF	Change in self-regulation (quadratic)	0.0011*		0.0007	
General stress	Sensitivity	−0.0542*		−0.0598*	
General stress	Stimulation	−0.1358†		−0.0871	
General stress	Vocabulary (mediated by interaction)	−2.9600***	(−1.9900**)	−2.3000***	(−2.3100**)
General stress	Level of self-regulation (mediated by vocabulary)	−0.0299*	(−0.0082)	−0.0310*	(−0.0264†)
Parenting stress	Sensitivity	−0.0599*		−0.0582*	
Parenting stress	Stimulation	−0.1478†		−0.1069	
Parenting stress	Vocabulary (mediated by interaction)	−2.2400**	(−1.4400†)	−2.3300***	(−2.3900**)
Parenting stress	Level of self-regulation (mediated by vocabulary)	−0.0315*	(−0.0212)	0.0164	(0.0047)
Sensitivity	Vocabulary	2.6800**		0.0700	
Sensitivity	Level of self-regulation (mediated by vocabulary)	0.0830***	(0.0830***)	0.0904***	(0.0745***)
Stimulation	Vocabulary	3.4300***		3.9400***	
Stimulation	Level of self-regulation (mediated by vocabulary)	0.0162†	(0.0438*)	0.0145	(0.0702***)
Vocabulary	Level of self-regulation	0.0578*		0.0189	
Vocabulary	Change in self-regulation (linear)	0.0162**		0.0163**	
Vocabulary	Change in self-regulation (quadratic)	−0.0007**		−0.0006**	
Gender	Vocabulary	4.2595**		7.4266***	
Gender	Level of self-regulation	0.1736***		0.1038*	
Gender	Change in self-regulation (linear)	0.0047†		0.0064*	

Note. TANF = Temporary Aid to Needy Families.
$^{\dagger}p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.