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ORIGINAL PAPER

Parental Depressive Symptoms and Children's School-Readiness: The Indirect Effect of Household Chaos

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Abstract The relationship between parental depressive symptoms and children's school-readiness has been well-established. However, contextual factors that may transmit the negative influence of parents' depressive symptoms on children has less been studied. The current study examined household chaos, the level of crowdedness, disorganization, noise, and lack of routine at home as a mediating factor between parental depressive symptoms and children's school-readiness. The data came from 444 preschool-aged children (36–70 months old). Parents and teachers reported on children's socio-emotional development and children were directly assessed on literacy, math, and behavioral self-regulation. Structural equation modeling was used to test the indirect association, using the bootstrapping technique. Results revealed that parents' depressive symptoms were significantly associated with their report of household chaos, which in turn was significantly related with children's cognitive skills, mother-reported socio-emotional development, and behavioral self-regulation. Test of indirect effects showed that household chaos had significant indirect effect only between parental depressive symptoms and mother-reported social skills. The negative association between depressive symptoms and child outcomes were statistically significant regardless of the level of household chaos. The results of the study reveal that parents who have depressive symptoms may elicit more chaotic home environments, which affects their children's socio-emotional development.

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Introduction

Depression is a mental health disorder characterized by low mood, low self-esteem, and loss of interest or pleasure in enjoyable activities (American Psychiatric Association 2013). Depression is prevalent in parents with children: data from the National Epidemiologic Survey of Alcohol and Related Conditions in 2001–2002 shows that 10 % of mothers in the US are affected by depression (Ertel et al. 2011); and a recent meta-analysis on paternal depression has reported that 5–10 % of fathers are depressed (Paulson and Bazemore 2010). Sub-clinical levels of depressive symptoms are even more prevalent and also have negative consequences for children (Cummings et al. 2005; Farmer et al. 2002; Silver et al. 2006). Studies have documented that young children of depressed parents are at higher risk for deficits in various indicators of school-readiness. Children of depressed parents (i.e., who reported depression levels above the cut-off point) score lower in cognitive achievement and socio-emotional development (Beardslee et al. 1998; Downey and Coyne 1990; NICHD 1999; Petterson and Albers 2001). Children whose parents have depressive symptoms also suffer deficits in socio-emotional development (Cummings et al. 2005; Luoma et al. 2001) and behavioral self-regulation (Sektnan et al. 2010).

The link between parental depression and child outcomes has been explained by several mechanisms: genetic heritability, exposure to parental negative behaviors, affect, and cognitions, and exposure to stressful environments (Cummings and Davies 1994; Goodman and Gotlib 1999).

Although the mechanisms through genetic heritability and poor parental behaviors, affect, and cognitions have been supported by extensive research (see review in Goodman 2007), fewer studies have examined the mediating role of household environments that are created by parents. In other words, the extent to which depressed parents' emotional unavailability and uninvolved nature *may elicit* a home atmosphere that may be associated with child outcomes has not yet been explored. Moreover, the degree of the impact of parents' depressive symptoms, which better captures its association with child outcomes (Hammen et al. 1987), has less been studied compared to a clinical diagnosis of depression (Cummings et al. 2005). In response to the call to explore the *contextual mechanisms* on how parental depression may influence children (Goodman and Gotlib 1999), it is important to explore *household chaos* as a mediating factor.

Household chaos, which is measured by the degree of disorganization at home (Matheny et al. 1995), has been emphasized as a factor for children's school-readiness because it may "set the condition for learning" in children (Johnson et al. 2008, p. 446). Chaotic homes are typically described as having high levels of stimuli (crowdedness, people moving in and out of the home inconsistently, and noise) and high levels of unpredictability (lack of routine, rules and expected behavior patterns) (Vernon-Feagans et al. 2012). High levels of stimuli in chaotic homes may deprive children of opportunities to receive developmentally facilitative stimulations because they may try to filter out the unwanted chaotic influences (Evans et al. 1991). High levels of unpredictability on the other hand, may confuse children's understanding of connection between action and consequences, and eventually interfere with their ability to internalize rules and regulations (Grolnick and Farkas 2002). Studies have found that children living in more chaotic homes experience difficulties in cognitive development (Deater-Deckard et al. 2009; Hart et al. 2007), social development (Dumas et al. 2005), and increased problem behaviors (Coldwell et al. 2006; Deater-Deckard et al. 2009). Investigating household chaos as an indirect factor may inform education and intervention efforts for depressed parents and help them provide healthier and more facilitative home environments for children's school-readiness.

Parents who are experiencing depressive symptoms may be less capable of establishing organization in the home. We propose that depressed parents may create high levels of household chaos based on several areas of research. First, studies have found that depressed individuals may lack executive functioning skills that can be critical to maintaining an organized home environment. Studies have shown that depressed individuals show major deficits in executive functioning such as working memory (Kaneda 2009; Sweeney et al. 2000), set-shifting (Grant et al. 2001; Moritz et al. 2002), and attention (Nakano et al. 2008). Lack of executive functioning skills are associated with more chaotic households: Valiente et al. (2007) reported that parental effortful control, which requires executive functioning skills such as attention shifting, activation control, and inhibitory control, was significantly and negatively associated with household chaos; and Bridgett et al. (2013) also found that the level of mothers' self-regulation, which was measured by a set of questionnaires and tasks that measured core executive functioning skills, was significantly and negatively associated with household chaos.

Secondly, some studies show significant relationships between parental depression and other family environments that may co-occur with chaos. Studies have reported that depressed parents experience higher degrees of daily hassles, which may interfere with parents' ability to maintain organized environments and stable routines (Kliewer and Kung 1998). Cicchetti et al. (1998) investigated the degree of daily hassles and stress of depressed and nondepressed parents and found that depressed parents reported significantly higher perceived daily hassles and stress. Similarly, Field et al. (2006) reported that depressed mothers and fathers rated significantly higher in daily hassle scores than non-depressed counterparts. Daily hassle measures include items about unpredictable and uncontrollable family schedules and circumstances. Thus, if depressed parents report higher levels of daily hassles, they may also report more chaotic home environments. Another line of research offers evidence that depressed parents are less able to provide cognitively and emotionally supportive home environments. Goodman and Brumley (1990) used the Home Observation for Measurement of the Environment (HOME) to observe depressed mothers and reported that the mothers exhibited lower levels of responsiveness and provided lower quality physical environments and less provision of play stimulation at home. Also, Pachter et al. (2006) reported that maternal depression significantly predicted HOME scores in white and Latino families. If depressed parents are less capable of providing emotionally and cognitively facilitative home environments, they may also fail to maintain appropriate levels of organization at home.

Thus, if parents experience depressive symptoms, they may lack important executive functioning skills, experience more daily stress that may in turn deprive them of their ability to maintain a quiet atmosphere, exerting clear and consistent rules and predictable routines. To date, only one study has shown a moderate and significant correlation between mothers' depression and household chaos (Pike et al. 2006). Other studies have shown the opposite direction, chaotic environment influencing affected individuals'

depressive symptoms. Those studies, however, view environmental noise as uncontrollable, which leads to learned helplessness (Evans and Stecker 2004) and a decrease in parenting self-efficacy (Corapci and Wachs 2002), which may in turn relate to depressive symptoms. We suggest that household chaos be viewed as an environmental factor that *can* be controlled by the parents, but which can be compromised by the depressive mood.

Although household chaos may be an intervening factor between parental depressive symptoms and child outcomes, parental depressive symptoms may also *interact* with chaotic home environments to impact child outcomes. Cicchetti et al. (1998) argue that depression is "a disorder that interacts within a social context" (p. 283) and that the negative influence of parental depression on children is accompanied by other contextual risks such as dysfunctional family environments. They assumed that depressed individuals are more likely to live in disadvantaged environments which may precede, co-occur, or remain even after the depressive symptoms diminish. Thus, if children are living with parents with depressive symptoms *and* in a highly chaotic environment (although the chaotic environment is not necessarily brought about by the parents), they may experience further risk for cognitive, social, and behavioral development. Thus, this possibility can be examined by a test of interaction between parental depressive symptoms and household chaos.

The link between environmental organization at home and children's school-readiness has been well-established in the literature. We define children's school-readiness as having achieved appropriate academic skills in literacy and math as well as social and behavioral skills necessary for school adaptation. Duncan et al. (2007), using six large longitudinal datasets in the US, found that children's early math and literacy skills significantly predicted later school cognitive achievement in reading and math. Young children's social and communication skills such as the capability of engaging in appropriate interactions with teachers and communicating appropriately with others, also have been found to be important predictors of school readiness (Denham and Brown 2010; Durlak et al. 2011; Ladd 1999; Ladd et al. 1999; Mashburn and Pianta 2006; Pianta et al. 1995). Furthermore, children's difficulties in following directions or conducting independent work in early childhood contribute to struggles to adapt in later school life (Brock et al. 2009; McClelland et al. 2007a).

Household chaos has been negatively linked to children's general cognitive ability in school-age children (Hart et al. 2007), verbal and nonverbal skills in 3- and 4-year-old children (Petrill et al. 2004); expressive vocabulary, reading, and phonological awareness skills (Johnson et al. 2008) and math skills (use of numbers, algebra, shape, space and measures) in 9–12 year-olds children (Hanscombe et al. 2011). Also, household chaotic environments have been negatively associated with children's socio-emotional development. Children living in highly chaotic homes exhibit a lack of understanding social cues (Dumas et al. 2005) and difficulties in peer relationships and emotional problems (Coldwell et al. 2006). On the other hand, household organization and stable family routines have been linked to better social competence, such as prosocial skills, cooperation, and assertion in African American preschoolers (Koblinsky et al. 2006).

Furthermore, recent studies have begun to examine the role of household chaos in children's behavioral self-regulation or self-control competence, which has been recognized as an important component of school-readiness (Blair 2002; McClelland et al. 2007a, b). Behavioral self-regulation includes children's ability to maintain attention, utilize working memory, and inhibit inappropriate behaviors (McClelland et al. 2007a). There are a few studies that have examined the association between household chaos and children's behavioral self-regulation. Evans et al. (2005) reported that household chaos had a negative association on teacher-rated self-control competence in grade 7 and 8 children. Evans et al. (2005) suggested that unpredictable home environments that lack routines and structure may interfere with children's ability to regulate their own behavior and emotions.

Studies on younger children have also shown some relationship between household chaos and child outcome variables that are similar to behavioral self-regulation. Hughes and Ensor (2009) found significant and negative correlations between household chaos and toddlers' executive functioning (Hughes and Ensor 2009). Also, Koblinsky et al. (2006) reported that stable family routines could predict children's self-control in African American preschoolers and Hardaway et al. (2012) reported that household chaos negatively predicted 3- and 4 year old children's inhibitory control. However, both these studies measured children's regulatory competence by parent-report questionnaire, and caution that the results might have been inflated due to shared variance. Thus, it is critical to extend previous findings by examining the association between household chaos and behavioral self-regulation in preschool-age children using a direct assessment.

Thus, the purpose of this study is to examine direct and indirect effects of parental depressive symptoms on children's school readiness (cognitive skills, socio-emotional development, and behavioral self-regulation) via household chaos. We hypothesized that children whose parents have higher levels of depressive symptoms will score lower in cognitive assessments and will show more problems in social skills and self-regulatory development. Additionally, we expected an indirect effect of household chaos on the relationship between parental depressive symptoms and

children's school readiness. We hypothesized that parents with more depressive symptoms will provide more chaotic home environments, which, in turn, will be associated with poor school-readiness. Furthermore, to test the possibility that household chaos may interact with parental depressive symptoms, we hypothesized that children living with parents with more depressive symptoms and in highly chaotic home environments will have lower cognitive achievement, more problems in socio-emotional development, and lower levels of self-regulatory development.

Method

Participants

The current study included data from 444 parents and their preschool-aged children (36–60 months) enrolled in 48 early child-care and education programs in a Midwestern state. Children's mean age was 55.28 months with a 6.48 standard deviation (SD) and approximately half of children were girls (47.33 %, $n = 204$). More than half of the children were White, non-Hispanic (61.25 %), 21.11 % of children were Black, non-Hispanic, 6.96 % were Hispanic, and 10.67 % were other race including multi-racial, American Indian or Alaska Native, Asian, and Native Hawaiian or Pacific Islander. Respondents to the parent questionnaire were primarily mothers (88.89 %, $n = 384$), 8.8 % were fathers ($n = 38$), 2.08 % were grandparents ($n = 9$), and one respondent was a legal guardian (0.23 %). The respondents confirmed that they were the primary caregivers of the participating child. Although, the median household income was from $50,001 to $75,000, 32.77 % of the parents had less than $30,000 in annual household income. Additionally, 37.96 % of respondents were single, separated, divorced, or widowed. The rest of parents were married or cohabiting.

Procedure

Data were collected in 2010–2011 from 48 randomly selected full-time center-based early child-care and education programs in a Midwestern state. On average, 43 % of children enrolled in the participating programs received child care subsidy (SD = 35 %). About 15 % (n = 66) of the programs were Head Start programs. In each program, two preschool classrooms were randomly selected, and from those classrooms, five children were randomly selected to participate in the study. The administrators, teachers and parents received hard copies of informed-consent forms and the questionnaires by mail. The participants sent the signed consent forms and completed questionnaires using the return envelope enclosed in the questionnaire packets. Additionally, trained research assistants conducted classroom observations and direct assessments of children's behavioral self-regulation, literacy and math skills. Among 480 children that were originally sampled, 36 children were not assessed due to absences or unwillingness to participate. Finally, 444 children from 96 classrooms completed assessments (81 % response rate). This study used data from child direct assessments, parents' questionnaires including demographics, depression, home environments and their children's socio-emotional development, and teachers' questionnaire on children's socio-emotional development. All study procedures were reviewed and approved by the Institutional Review Board (research ethics committee) of the author's university.

Measures

Cognitive Skills

Children's cognitive skills were assessed by trained research assistants. Literacy skills were measured using the Peabody Picture Vocabulary Test Third Edition (PPVT-III, Dunn and Dunn 1997) and the Phonological Awareness Literacy Screening Pre-Kindergarten (PALS-PreK, Invernizzi et al. 2004) and math skills were measured by two subtests from the Woodcock-Johnson Test of Achievement III (WJ-III, Woodcock et al. 2001). *PPVT–III* measures children's knowledge of receptive vocabulary which indicates early verbal ability (Dunn and Dunn 1997). Standardized scores were used, which was norm-referenced to the same age group of children. High internal consistency was shown by a median alpha coefficient of r = .95 and good temporal stability by a median test–retest coefficient of r = .92 (Campbell 1998). *PALS-PreK* measures children's early phonological awareness and literacy skills, which indicate their later reading abilities (Invernizzi et al. 2004). There were six subscales which were summed up as a single score including upper- and lower-case alphabet recognition, letter sounds recognition, beginning sound awareness, print and word awareness, and rhyme awareness. High internal consistency is reported (Invernizzi et al. 2004): Cronbach's alpha ranged from .75 to .93 and inter-rater reliability was .99. The internal consistency in the current study was .85. Two subscales in *WJ-III* (Woodcock et al. 2001) were used to measure children's math skills. Applied Problems measures children's ability to solve applied math problems (i.e., choosing math operations, conducting simple calculations) and Quantitative Concepts measures children's knowledge of mathematical concepts, formulas, symbols, shapes, and numbers. High reliability is reported including median reliability for Applied Problems

(.92) and Quantitative Concepts (.90) (Woodcock et al. 2001).

Socio-Emotional Development

Children's social competence was measured by parent-report of Ages and Stages: Social-Emotional (ASQ: SE, Squires et al. 2002) and teacher-report of Social Skills Improvement System (SSIS; Gresham and Elliott 2008). *ASQ: SE* is measured by parent-report of the frequency of childen's problem behaviors and 35 socio-emotional development items such as communication, affect, interaction, self-regulation, compliance, autonomy, and adaptive functioning on a 3-point scale (10 = *most of the times*, 5 = *sometimes*, and 0 = *rarely or never*). The sum of all 35 items were used as a single score with the higher score representing more frequent problem behaviors. High internal consistency has been reported in a previous study (Interrater reliability above .85 and test-retest reliability above .90) (Squires et al. 1997) and in the present sample (Cronbach's $\alpha = 79$). *SSIS* is measured by teacher-report of children's social skills including communication, cooperation, assertion, responsibility, empathy, engagement, and self-control. Teachers rated the frequency of given behavior on a 4-point scale (0 = *never*, 1 = *seldom*, 2 = *often*, and 3 = *almost always*) and how much they perceive given behavior as important for children's success in classroom on a 3-point scale (0 = *not important*, 1 = *important*, and 2 = *critical*). The frequency and the importance scores were summed to represent social skills, with the higher score representing better social competence. High internal consistency has been reported in the scale (Cronbach's $\alpha = 75$; Gresham and Elliott 2008) and in the current sample (Cronbach's $\alpha = 96$).

Behavioral Self-Regulation

Children's behavioral self-regulation was assessed by Head-Toe-Knee-Shoulder task (HTKS; Ponitz et al. 2009), which measures three components of behavioral self-regulation including working memory, attention, and inhibitory control. Children were assessed by trained staff who administered two sets of tasks. The first set required children to touch their toes when asked to touch their head (and vice versa) and the second set added instruction for children to touch their shoulders when asked to touch their knees (and vice versa). HTKS is a game-like measure of how much children can retain given rules (working memory), pay attention to each instruction (attention) and to inhibit prepotent or automatic response (inhibitory control). There were 20 sessions for each set, and correct responses were given 2 points, incorrect but self-corrected responses were given 1 point, and incorrect responses were given 0 scores. The score ranged from 0 to 40, with the higher scores representing higher levels of behavioral self-regulation.

Parental Depressive Symptoms

Parents' levels of depressive symptoms were measured by the short form of Center for Epidemiological Study of Depression Scale (CES-D, Radloff 1977). There were nine items that parents responded to regarding their feelings during the past week. Items were scored on a four-point scale [1 = *Rarely or none of the time (<1 day), 2 = Some or a little of the time (1–2 days), 3 = Occasionally or a moderate amount of time (3–4 days), 4 = Most or all of the time (5–7 days)*]. All nine items were summed to a single score, with the higher score representing more depressive symptoms (Cronbach's $\alpha = .76$ in the present sample).

Household Chaos

Household chaotic environment was measured by parents' report of the short version of the Confusion, Hubbub, and Order Scale (CHAOS, Petrill et al. 2004). There are six items in CHAOS asking about the environmental disorganization and hurried characteristics at home (sample item: "We are usually able to stay on top of things"). The items were rated on a 5-point likert scale (1 = *Definitely Untrue*, 5 = *Definitely True*) and the mean of all six items was calculated. The reliability was acceptable ($\alpha = .54$, which is similar to what was reported in a previous study that used the CHAOS scale; Petrill et al. 2004).

Control Variables

Several child and household characteristics that have been reported as having a relationship with home environments or child outcomes (e.g., Dumas et al. 2005; Griffin and Morrison 1997; Payne et al. 1994) were used as covariates in our hypothesized model. We controlled for child age, gender (dummy coded as 0 = boys and 1 = girls), race/ethnicity (dummy coded as White, non-Hispanic (reference category); Black, non-Hispanic; Hispanic; and other race), and number of children in the household. We also controlled for parent's marital status (dummy coded as 1 = *married or cohabitating* and 0 = *single, separated, divorced or widowed*) and family's income (dummy coded as 1 = *less than $30,000 annual income* and 0 = *more than $ 30,001*). We used $30,000 as the income cutoff level because it is near to the eligibility cutoff for free/reduced lunch for a three- to four-person family in the state where the study was conducted.

Data Analytic Strategy

Structural equation modeling (SEM) was conducted in STATA 12.0 using *sem* to simultaneously test our research questions as it allowed us to examine the direct and indirect relationships among observed (parental depression, household chaos, and behavioral self-regulation) and latent child outcome variables. We examined the following parameters in SEM: (1) the *direct effects* of parental depressive symptoms on child outcomes; (2) the effects of parental depressive symptoms on household chaos; (3) the effects of household chaos on child outcomes; (4) the *indirect effects* of parental depressive symptoms on child outcomes via household chaos. To quantify the indirect effects, we followed recent work on mediation analysis (Hayes 2009; MacKinnon 2008), rather than following Baron and Kenny's causal steps (1986) and comparing three nested models (i.e., a direct effects model, a full-mediation model, and a partial-mediation model). A Sobel test (Sobel 1982) was conducted to generate the significance and magnitude of indirect effects. To test the moderating effects of household chaos on the association between parental depressive symptoms and child outcomes, we added the interaction term between parental depressive symptoms and household chaos to the model. We interpreted standardized regression coefficients as effect sizes and multiple criteria of model fit indices were utilized: (1) the p value of Chi square statistics (χ^2) is desirable to be larger than .05; however, a significant χ^2 is still acceptable until we consider other fit indices since the χ^2 is sensitive for the sample size. Additionally, a Chi square to degrees of freedom (*df*) ratio of <5 is considered adequate (Bollen 1989); (2) a comparative fit index (CFI) of .90 or higher indicates an acceptable model fit; and (3) the root mean square error of approximation (RMSEA) less than .06 indicates an adequate model fit (Browne and Cudeck 1993).

Missing data were handled in the model using Full Information Maximum Likelihood (FIML) estimation in STATA. This method is preferred because it offers less biased estimators over other traditional approaches (Acock 2005) and it allows us to preserve all available data, rather than estimating missing data (Arbuckle 1996). Of 444 participants, eight children (1.8 %) did not complete at least one of direct cognitive skills assessments; 17 parents (3.8 %) did not report the measure of children's social development; 4.7 % ($n = 21$) were missing on at least one of items on independent variables; 6.3 % ($n = 28$) were missing on at least one of control variables. There was no difference in demographic characteristics between missing and non-missing responses.

Results

Descriptive statistics for study measures are presented in Table 1. On average, parents reported a 3.38 score in depressive symptoms, indicating that the participating parents did not experience depressive symptoms frequently. However, about 10 % of the parents reported above the cut-off score (9) for depression (Harder et al. 2006) which was consistent with general statistics for parental depression. The mean score for household chaos was also low (2.08) and the mode was 2, indicating that most of the participating families had low levels of chaos at home.

We conducted factor analyses on the measures of children's cognitive skills to confirm whether the variables could be reduced to a single factor and used as a latent variable. As shown in Table 1, all factor loadings were over .40 and significant at the .001 level. The measurement model fit was excellent, χ^2 (1, $N = 436$) = .02, $p > .88$, RMSEA = .00, CFI = 1.00. Bivariate correlations between study variables in confirmatory factor analysis are reported in Table 2. Children's cognitive skills and parent-reported socio-emotional development (i.e., higher score represents more problems in socio-emotional development) were negatively correlated, and cognitive skills and teacher-reported socio-emotional development were positive correlated, indicating children with better cognitive skills have less problems in socio-emotional development. Parent-reported socio-emotional development and teacher-reported social skills were negatively correlated to a moderate degree. Parental depressive symptom was significantly correlated with household chaos and child outcomes except children's self-regulation. To ensure there was no multicollinearity among independent variables, we checked tolerance and the variation inflation factor (VIF) parameters. All tolerance parameters were over .90 and all VIF were under 2.0 in regression analyses, indicating there is no multicollinearity problem (O'brien 2007).

Test of structural models revealed that the hypothesized indirect model explaining child outcome variables had an adequate model fit, χ^2 (59, $N = 444$) = 206.60, $p < .001$, Chi-ratio = 3.502, RMSEA = .08, CFI = .91. Even though the p-value of χ^2 was significant, chi-ratio, RMSEA and CFI were in the range of adequate model fit. Overall, the model explained 51 % of the variance in cognitive skills, 17 % of the variance in parent-reported socio-emotional development, 7 % of the variance in teacher-reported social skills, and 25 % of the variance in behavioral self-regulation. Additionally, 5 % of the variance in household chaos was explained by the model.

Standardized coefficients for the direct effects are described in Fig. 1. The results reveal that children with more

Table 1 Variable descriptive statistics and factor loadings in confirmatory factor analysis

Variable	M (SD)/%	Range	Total *N*	Factor loadings	α
Parental depressive symptoms	3.38 (3.94)	0-21	424	–	.76
Household chaos	2.08 (0.58)	1–4.50	433	–	.54
Behavioral self-regulation	13.20 (14.38)	0–40	441	–	–
Cognitive skills					.61
PPVT standardized score	102.10 (14.28)	40–140	442	.66***	–
PALS sum	59.56 (32.16)	1–108	441	.74***	.85
WJ: applied problems	13.44 (4.56)	0–24	443	.92***	–
WJ: quantitative concepts	11.15 (4.84)	0–25	442	.76***	–
AS socio-emotional development	36.24 (28.90)	0–190	428	–	.79
SSIS social skills	96.09 (13.56)	52–127	425	–	.96
Measurement model fit	χ^2 (1, N = 436) = .02, p = .88, RMSEA = .00, CFI = 1.00				

PPVT Peabody Picture vocabulary test III, *PALS* phonological awareness literacy screening, *WJ* Woodcock Johnson test of achievement III, *AS* ages and stages, *SSIS* social skills improvement system

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

Table 2 Bivariate correlations between variables in confirmatory factor analysis

	1	2	3	4	5	6
1. Parental depressive symptoms	1					
2. Household chaos	.20***	1				
3. Behavioral self-regulation	−.00	−.07	1			
4. Cognitive skills	−.14***	−.07†	.65***	1		
5. AS socio-emotional development	.22***	.26***	−.18***	−.27***	1	
6. SSIS social skills	−.12*	−.01	.19***	.26***	−.21***	1

AS ages and stages, *SSIS* social skills improvement system

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

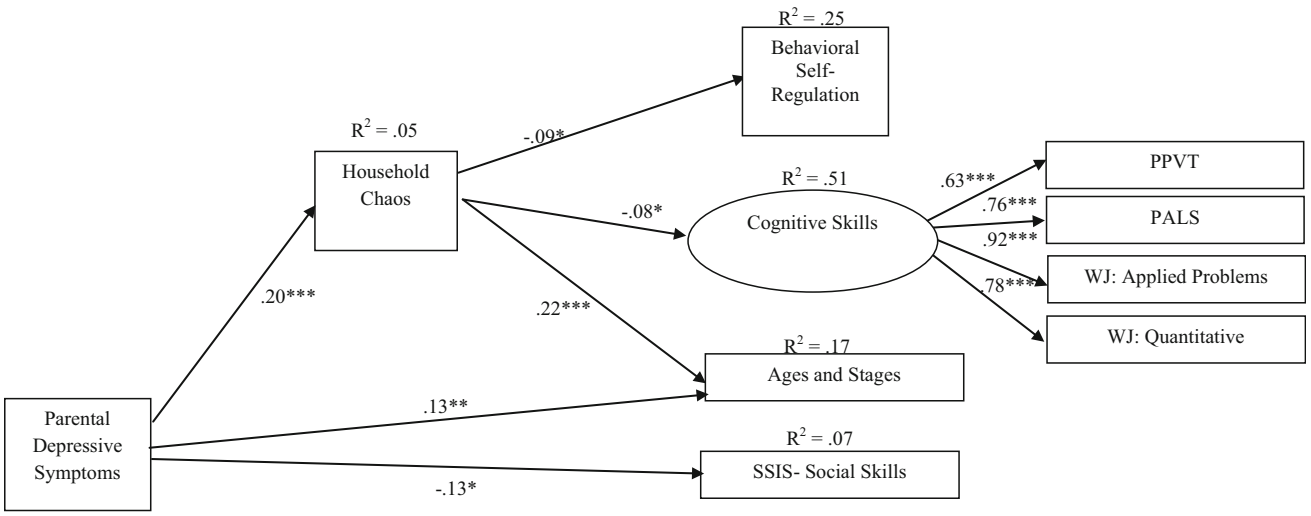

Fig. 1 Mediation model for children's school readiness. Model fit: χ^2 (59, N = 444) = 206.60, $p < .01$, Chi-ratio = 3.50, RMSEA = .08 (90 % CI [.06, .09]), CFI = .91. Standardized coefficients are shown. Control variables include child age, gender, race (white as reference category), parental marital status, and household income. The control variables and correlations between error terms for endogenous variables are not shown. *Notes PPVT* Peabody picture vocabulary test III, *PALS* phonological awareness literacy screening, *WJ* Woodcock Johnson test of achievement III, SSIS social skills improvement system. †$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

depressed parents demonstrated significantly more problems in parent-reported socio-emotional functioning and teacher-reported social skills after controlling for child age, gender, race/ethnicity, parental marital status, and household income. Each 1-point standard deviation (SD) increase in parental depressive symptoms corresponded to a

.13 SD increase in parent-reported socio-emotional problems, a .13 SD decrease in teacher-reported socio-emotional development, however, parental depressive symptoms did not directly predict children's cognitive skills nor behavioral self-regulation. Among covariates, children's age positively predicted children's cognitive skills ($\beta = .32$, $SE = .04$, $p < .001$). Girls more than boys ($\beta = .22$, $SE = .05$, $p < .001$) demonstrated better socio-emotional development as reported by teachers. Children from lower income ($\beta = -.23$, $SE = .05$, $p < .001$) and black, non-Hispanic children more than white, non-Hispanic children ($\beta = .12$, $SE = .05$, $p < .05$) demonstrated significantly more socio-emotional problems in the parent-reported measure. Older children ($\beta = .37$, $SE = .04$, $p < .001$) and children from higher income families ($\beta = .27$, $SE = .05$, $p < .001$) exhibited higher levels of behavioral self-regulation.

The results of a Sobel test with Bootstrapping (N = 5,000) indicated that household chaos had an indirect effect between parental depressive symptoms and child outcomes (24 cases were not converged in Stata and the results are based on 4,976 bootstraps). Specifically, indirect effects are produced by the products of two direct paths, (1) from the independent variable (parental depressive symptoms) to the mediating variable (household chaos), and (2) from the mediating variable to the dependent variables (children's cognitive skills, parent- and teacher-reported socio-emotional development, and behavioral self-regulation). First, parental depressive symptoms significantly predicted household chaos. Parents with more depressive symptoms reported more chaotic home environments ($\beta = .20$, $SE = .05$, $p < .001$) after controlling for covariates. Children in more chaotic home environments showed significantly more problems in mother-reported socio-emotional development ($\beta = .22$, $SE = .04$, $p < .001$), significantly lower cognitive skills ($\beta = -.08$, $SE = .04$, $p = .048$), and significantly lower levels of behavioral self-regulation ($\beta = -.09$, $SE = .04$, $p < .05$). The indirect effect of household chaos was only significant for the association between parental depressive symptoms and mother-reported socio-emotional development ($\beta = .32$, $SE = .11$, $p < .001$). Marginal indirect effects were found between parental depressive symptoms and behavioral self-regulation ($\beta = -.06$, $SE = .04$, $p < .10$) and between parental depressive symptoms and cognitive skills ($\beta = -.02$, $SE = .01$, $p < .10$).

The interaction term between parental depressive symptoms and household chaos was entered into the model. The model fit was not as good as the mediating model χ^2 (63, $N = 444$) = 395.42, $p = .000$, Chi-ratio = 6.277, RMSEA = .011, CFI = .82. In addition, none of the effects of the interaction term were significant on child outcomes, indicating that parental depressive symptoms predicted child outcomes regardless of the degree of household chaos.

Discussion

The current study explored the associations between parental depressive symptoms and children's school-readiness, and the indirect effect of household chaos. The results of the current study supported some of the associations that have been found in the literature. First, the results of this study confirmed the relationship between parental depressive symptoms and children's socio-emotional development (parent- and teacher-report). Consistent with the previous studies (Cummings et al. 2005; Luoma et al. 2001; Sektnan et al. 2010), the results of the current study support that children who have more depressed parents are less capable of developing important socio-emotional skills as early as in preschool. This might be because parents with depressive symptoms are less sensitive and responsive when they interact with their children (Downey and Coyne 1990) and children may fail to learn social skills from interacting with their parents. On the other hand, no direct associations were found between parental depressive symptoms and children's cognitive skills and behavioral self-regulation. Behavioral self-regulation is a construct that combines *cognitive functioning* (working memory and attention focusing) and *behavioral regulative ability* (inhibitory control) (Blair 2002; McClelland et al. 2007a). Strong correlation between behavioral self-regulation and cognitive skills in the current data ($r = .65$) shows potential overlap between those two variables. Thus, the results might suggest that although parental depressive symptoms are directly associated with children's social skills, they are not directly associated with cognitive-related abilities such as academic achievement and behavioral regulatory competence.

The test of household chaos as a mediating variable revealed some interesting findings. First, parental depressive symptoms were significantly and positively associated with household chaos, indicating that more depressed parents reported that their home environment is less organized and predictable than less depressed parents. This significant path corroborates the significant correlation between maternal depression and household chaos found in Pike et al. (2006). Depressed parents have been found to report higher levels of daily hassles and to provide lower levels of cognitive and emotionally supportive environments at home (Cicchetti et al. 1998; Field et al. 2006; Goodman and Brumley 1990; Pachter et al. 2006), and this study adds that depressed parents may also be less capable of maintaining stable and organized home environments.

Secondly, household chaos was also significantly associated with children's school-readiness: behavioral self-regulation, cognitive skills, and parent-reported socio-emotional development after controlling for various covariates (parental depression, household income, parents' marital relationship, children's age, gender, and race/ethnicity). Children living in more chaotic homes exhibited significantly lower levels of behavioral self-regulation and cognitive skills, as well as more problems in socio-emotional development. This is consistent with many studies that have reported a negative impact of household chaos on children's development (Coldwell et al. 2006; Deater-Deckard et al. 2009; Dumas et al. 2005; Matheny et al. 1995; Petrill et al. 2004; Wachs 2005). This study, however, adds to the literature by exploring the link between household chaos and preschool-age children's behavioral self-regulation, which has recently became a focus of research exploring the impact of houshold environments. As Evans et al. (2005) suggested, unpredictable home environments and a lack of routine and structure in the home environment may impede children's self-regulatory development, which requires consistent structure and clear rules in the home (i.e., Hughes and Ensor 2009; Lengua et al. 2007; Neitzel and Stright 2003).

Finally, the test of indirect effects revealed only one significant indirect effect between parental depressive symptoms and parent-report socio-emotional development. Thus, although parental depressive symptoms may have elicited more chaotic home environments, it did not have a consistent effect on child outcomes. The significant mediation effect on parent-report socio-emotional development should be interpreted with caution because it might have been due to shared method variance (parents have reported their depressive symptoms, household chaos, and their children's socio-emotional development). Also, it has been shown that depressed parents may perceive their children more negatively (McGrath et al. 2008; Schaughency and Lahey 1985), and the current significant mediation could also be due to negative perceptions of more depressed parents. Although this might be true, examination of correlation statistics in the current data indicate that parental perception of their children can be a valid judgment of their children's development. The correlations between parent- and teacher- reported socio-emotional development and parent-reported socio-emotional development and directly assessed behavioral self-regulation were small but significant, indicating that even though depressed parents may have more negative perceptions of their children, their perceptions are still in the range of others' judgment. With caution, we conclude that household chaos has indirect effect between parental depressive symptoms and their report of their children's socio-emotional development. Future studies need to examine whether this is only due to shared variance or negative perception of the parents with more depressive symptoms, or that children actually exhibit problematic socio-emotional development.

The contribution of this study is that we found a significant path from parental depressive symptoms to household chaos. The test of interaction between parental depressive symptoms and household chaos, on the other hand, revealed that parental depressive symptoms are associated with child outcomes regardless of the level of household chaos. Thus, we may conclude that parents with depressive symptoms may provide more confusing, disorganized and unpredictable household atmospheres and that there is no interaction effect between parental depressive symptoms and household chaos in relation to child outcomes. In such environments, children may receive too much stimuli that can overwhelm their ability to process them. Unpredictable environments may also confuse children and deprive them of opportunities to learn self-regulation. Although we found only one significant indirect effect, we still found significant associations between household chaos and behavioral self-regulation, cognitive skills, and parent-report of social-emotional development. Young children who make the transition to more structured kindergarten school settings need to have both the cognitive skills necessary to learn and the ability to understand and follow rules and guidelines and behave appropriately in social situations in the classroom (Blair 2002). Children who are not accustomed to following rules and behaving according to clear and consistent expectations at home may be at further risk for poor school-readiness. Thus, teaching and helping parents with depressive symptoms to enhance their home organization and to lower the levels of chaos might be beneficial in terms of children's developmental skills that are important for school-readiness. Parents may be unaware of the impact of their depressive symptoms on the organizational environments at home and the fact that a chaotic home environment may have a negative impact on their children. Thus, the level of organization at home can be an additional important target of home-based psychosocial interventions. Couple and family therapists dealing with parental depressive symptoms can be also encouraged to help parents understand the potential impact that household chaos might have on children's early development, and to provide parents with strategies that will improve their ability to organize their home environments. For example, therapists can suggest that parents establish a regular routine with children (e.g., watching television, cleaning, bedtime, mealtime, etc.), set consistent rules at home, organize family events, and prioritize time with family members.

The current study is not without limitations. First, the data was correlational and thus, the results of the study

need to be interpreted cautiously. Future study needs to examine longitudinal data in order to establish the effect of parental depressive symptoms and household environment on child outcomes. Second, the sample was predominately white and middle class families. Thus, the generalizability of the results of the current study is limited. Third, we did not have variables related to parenting behaviors that might have been useful to understand how parental depressive symptoms may lead to household chaos and child outcomes. Future studies will need to include parenting quality variables that can corroborate the results of this study. Furthermore, internal reliability of household chaos measure was lower than what has been reported in the literature. Although some studies have also reported acceptable reliability (Hart et al. 2007; Petrill et al. 2004), other studies have reported higher reliability (Dumas et al. 2005; Hart et al. 2007; Matheny et al. 1995). Low reliability indicates that the items in a scale are not coherent and may have contributed to the non-significant findings in the current study. Low reliability may be due to the small number of items or the homogeneous nature of the sample (Streiner 2003). Future studies may need to examine household chaos with the original scale with more items and be cautious in interpreting the results if there is little diversity in the sample.

Despite the acknowledged weaknesses, the current study was the first to examine the indirect effect of household environment on the association between parental depressive symptoms and children's school-readiness, measured by multiple informants (parents, teachers, and direct assessments). Also, the significant path between parental depressive symptoms and household chaos calls for targeting household environments or atmosphere when treating parents with depressive symptoms. Furthermore, the significant link between household chaos and child outcomes replicates the previous study but also extends it by revealing an important link to behavioral self-regulation.

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