HHS Public Access

Author manuscript

Early Child Res Q. Author manuscript; available in PMC 2017 January 01.

Published in final edited form as:

Early Child Res Q. 2016 ; 37: 16–25. doi:10.1016/j.ecresq.2016.02.004.

The role of household chaos in understanding relations between early poverty and children's academic achievement

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Abstract

The following prospective longitudinal study used an epidemiological sample (N = 1,236) to consider the potential mediating role of early cumulative household chaos (6–58 months) on associations between early family income poverty (6 months) and children's academic achievement in kindergarten. Two dimensions of household chaos, disorganization and instability, were examined as mediators. Results revealed that, in the presence of household disorganization (but not instability) and relevant covariates, income poverty was no longer directly related to academic achievement. Income poverty was, however, positively related to household disorganization, which was, in turn, associated with lower academic achievement. Study results are consistent with previous research indicating that household chaos conveys some of the adverse longitudinal effects of income poverty on children's outcomes and extend previous findings specifically to academic achievement in early childhood.

Keywords

Poverty; Chaos; Disorganization; Instability; Academic achievement; Early childhood

1. Introduction

Family income poverty is the strongest predictor of school failure and is a stronger predictor of poor school achievement than either family structure or child neglect (Children's Defense Fund, 2004; Lacour & Tissington, 2011; Nikulina, Widom, & Czaja, 2011). Although the links between family income poverty and poor school achievement are well documented, the processes that account for these associations have not been thoroughly explored. Processes

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that occur within the family context have been identified as critically important to understanding these associations (Engle & Black, 2008). Numerous studies have shown that less sensitive parenting is associated with income poverty suggesting that parenting may be one of the key processes that account for relations between income poverty and children's achievement (Bradley & Corwyn, 2002; Vernon-Feagans & Cox, 2013). Another less frequently studied aspect of the family context that has been identified as a possible process mechanism is household chaos (Brody & Flor, 1997; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005). Chaotic households are characterized by crowded noisy homes filled with distractions, limited structure and routines, and frequent changes in family structure or residential moves, all of which can undermine young children's developing regulatory and pre-academic skills and ability to focus on school-related activities (e.g., completing homework) (Evans & Wachs, 2010; Li Grining, 2007; Vernon-Feagans, Willoughby, Garrett-Peters, & The Family Life Project Key Investigators, 2016). Thus, in the present study, we examined whether household chaos serves as a viable mechanism that conveys some of the adverse effects of early family income poverty on children's academic achievement.

Household chaos has been defined as “systems of frenetic activity, lack of structure, unpredictability in everyday activities, and high levels of ambient stimulation” (Bronfrenbrenner & Evans, 2000, p. 121). Several studies have shown that individual indices of household chaos (e.g., noise, crowding, lack of family routines) can act as intervening or statistically mediating variables in associations between poverty and socioemotional and cognitive competencies among school-aged and adolescent children (Brody & Flor, 1997; Evans & English, 2002; Evans & Kim, 2007; Evans & Wachs, 2010). Only a single longitudinal study conducted by Evans et al. (2005) examined a composite index of general household chaos as a potential mediator in this pathway. These authors found that, among rural White 7th and 8th graders, a parent-report measure of chaos mediated the relations between income poverty and children's socioemotional adjustment, including learned helplessness, psychological distress, and self-regulation. To date, no studies have examined household chaos as a mediator of associations between family income poverty and children's early academic achievement. Further, the majority of previous studies have focused on the experience of household chaos during school-age and adolescent years rather than during early childhood.

Research suggests that the early childhood years may be a critical period during which environmental stressors, such as poverty and chaos, can be particularly harmful to children's early and later academic achievement. For example, by the time children enter kindergarten, the gap between poor and non-poor children is already substantial (Future of Children, 2005; Laird, Cataldi, Ramani, & Chapman, 2008). In addition, although poverty is remarkably stable, early poverty in the first five years of life has consequences for later academic achievement, as well as stress-related disorders and generally poorer life outcomes well into adulthood (Duncan, Magnuson, Kalil, & Ziol-Guest, 2012; Duncan, Ziol-Guest, & Kalil, 2010; Evans & Kim, 2013). The experience of poverty and its concomitant risks during early childhood may be more closely linked to the development of young children because the family context is so central to young children's experiences. Compared to their school-aged counterparts, younger children generally have fewer opportunities to interact with sources

beyond the family context (e.g., teachers, classroom/neighborhood peers) (Bradley, Corwyn, Burchinal, McAdoo, & Garcia Coll, 2001).

In this prospective longitudinal study, we contribute to the extant literature by examining whether household chaos experienced prior to school entry serves as one of a process mechanisms through which early family income poverty is linked to academic achievement in kindergarten. Because we focus specifically on income poverty in this study, references to poverty throughout the manuscript reflect family income exclusively as opposed to other limited resources (e.g., neighborhood poverty, social capital). To provide a rigorous test of our model, we controlled for a host of important covariates that tend to co-occur with income poverty and that have not been included as controls in many other studies, such as race, maternal education/employment, children's early cognitive functioning, and particularly important, the quality of observed parenting. In addition, as described in detail below, our assessment of household chaos provides several advantages over previous work as our measurement includes a cumulative index of two dimensions of household chaos (i.e., disorganization and instability) experienced across the first five years of life, as well as multi-informant and observed ratings of chaos.

1.1. Poverty and Chaos

Over the past 40 years, there have been significant changes to the ways in which families function owing in part to an increase in dual-earner and single-parent families. In addition, the rise of the “24 hour economy” (Presser, 2004) has created a family context with less predictability and less parent–child time because work schedules often require evening and weekend hours, especially for poorer families who are more likely hold service industry jobs. These factors and others have contributed to an increase in household chaos that can disrupt family life and impact children's development (Evans & Wachs, 2010). This is particularly true for poor children whose developmental ecologies are imbued with chaos at multiple contextual levels, including the macrosystem (i.e., the context of poverty) and the microsystem (i.e., the family context), each of which has independent and reciprocal influences on the developing child (Bronfenbrenner & Morris, 2006). Thus, poor children are likely to experience aspects of household chaos that are associated with conditions of poverty (e.g., crowded homes and noisy neighborhoods), as well as chaos that emerges from the changing structure of family life (e.g., parents working irregular work hours) (Presser, 2004; Vernon-Feagans, Burchinal, & Mokrova, 2015).

Poor children and families who live in rural areas may be especially vulnerable to experiencing chaos in their homes. The disadvantaged economies of life in rural contexts include fewer jobs with standard work hours, longer distances to work, childcare, and schools, limited public transportation, and less access to a variety of health and human resources that can promote a stable and predictable family life (Vernon-Feagans, Garrett-Peters, De Marco, & Bratsch, 2012). These unique features of rural life underscore the importance of examining the potential deleterious effects of living in chaotic households on the development of rural children.

1.2. Chaos and Academic Achievement

Chaotic home environments are hypothesized to interfere with children's abilities to extract the rules of discourse and social exchanges (Wachs, 1989), as well as the development of attentional and regulatory processes (Li Grining, 2007; Vernon-Feagans et al., 2016), that are important for school success. When experienced in early childhood prior to school entry, household chaos appears to undermine the development of cognitive and non-cognitive competencies that are vital to academic achievement. For example, preschoolers who live in chaotic homes are likely to demonstrate low expectations, lack of persistence, and withdrawal from academic challenge (Brown & Low, 2008). Excessive noise and crowding in chaotic homes may undermine children's developing regulatory systems that support their ability to focus and sustain attention. Children living in chaotic homes likely need to expend greater effort to concentrate and maintain focus and attention, which might hinder their ability and desire to engage in activities that require focused attention that can facilitate learning and achievement.

Chaotic homes also create stressful situations that can diminish opportunities for positive and sustained interactions between children and adults that support learning (Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 1998). Indeed, mothers living in more chaotic homes demonstrate less positive parenting during interactions with their children (Zvara et al., 2014). Chaotic home environments may cause fatigue and have been linked to elevated negative mood (Evans, Bullinger, & Hygge, 1998), which can deplete emotional and psychological resources that parents might otherwise invest in their children. Parents in chaotic homes may rely more often on authoritarian parenting (e.g., reprimands) and may be less likely to engage in positive sustained verbal exchanges and cognitively-stimulating interactions with their children. Indeed, children in chaotic homes demonstrate poorer language and cognitive development, which can impede the acquisition of basic reading skills that are essential for later school achievement (Petrill, Pike, Price, & Plomin, 2004; Vernon-Feagans, Garrett-Peters, Willoughby, Mills-Koonce, & The Family Life Project Key Investigators, 2012). Thus, the experience of chaotic home environments early in life may thwart the development of critical foundational cognitive and non-cognitive competencies (e.g., attention regulation, language development) that are essential to children's later academic success.

Children living in chaotic homes may adapt to the environment by blocking out and withdrawing from the overstimulation in the home (Matheny, Wachs, Ludwig, & Phillips, 1995). Researchers contend that children might extend this withdrawal to the school and classroom context (Hanscombe, Haworth, Davis, Jaffee, & Plomin, 2011), which can have detrimental effects on school performance. Indeed, chaotic home conditions have been found to directly and negatively impact academic competence in school-aged children. For example, elementary school children whose mothers reported low household order and routine demonstrated poorer reading skills, even after controlling for maternal reading ability and home literacy environment (Johnson, Martin, Brooks-Gunn, & Petrill, 2008). In addition, 12 year-old children who perceived higher chaos in their homes scored lower on tests of school achievement than their counterparts who perceived less home chaos (Hanscombe et al., 2011).

Household chaos has also been implicated as a process mechanism through which poverty is related to aspects of socioemotional and cognitive development that can be critical to school achievement (Evans et al., 2005; Evans & Wachs, 2010). For example, chaos has been found to mediate the links between poverty and psychological distress, self-regulating behavior, learned helplessness, internalizing problems, and academic achievement in early adolescence (Brody & Flor, 1997; Evans et al., 2005). These findings suggest that chaos may be an underlying proximal process that helps to explain some of the covariance between poverty and multiple developmental competencies that support children's success in school. However, these studies were conducted with children during middle childhood and adolescence. No studies to date have specifically examined these mediational pathways in early childhood and in relation to academic achievement.

1.3. Household Chaos as a Multidimensional and Cumulative Construct

Most previous studies have conceived of chaos as a single indicator (e.g., noise) and/or a parent report composite index, which is typically measured at a single point in time using all (or a subset) of the items from the Confusion, Hubbub, and Order Scale (CHAOS) (Matheny et al., 1995). However, parent ratings are subjective and influenced by factors such as cultural norms, parental coping strategies, values, and personality traits (Kaya & Weber, 2003; Wachs, 2013).

Additionally, recent empirical and conceptual work has moved beyond the consideration of individual indicators or a composite index and toward the conceptualization of chaos as consisting of multiple constructs or dimensions. Two key dimensions have been identified: disorder/disorganization and instability/turbulence (Brooks-Gunn, Johnson, & Leventhal, 2010; Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012). Disorder includes disorganization and “high levels of noise, excessive crowding, clutter, and lack of structure” in daily life (Sameroff, 2010, p. 258). Disorganization is a prevalent feature of chaotic households that reflects the daily experiences of families and their children. Recent studies have reported that household disorganization is negatively related to children's outcomes, including early language development, emotional development, and stress physiology (Berry et al., 2013; Evans et al., 1998; Evans et al., 2005; Maxwell & Evans, 2000; Raver, Blair, Garrett-Peters, & The Family Life Project Key Investigators, 2014; Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012).

Instability/turbulence, on the other hand, is described as changes in settings and relationships in the home, such as changes in household residences and changes in household members, including the mother or father figure. Unlike disorganization, instability is more often experienced intermittently rather than on a daily basis. Nonetheless repeated experiences of instability can be detrimental to children's development, and particularly the social-emotional adjustment of adolescents (Ackerman, Kogos, Youngstrom, Schoff, & Izard, 1999; Brooks-Gunn et al., 2010; Fiese & Winter, 2010). However, recent research examining instability has reported limited associations with children's outcomes in early childhood (Raver et al., 2014, Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012; Vernon-Feagans et al., 2016; Zvara et al., 2014). Together these findings suggest that the development of young children may be more affected by the experience of daily

disorganization in the home as compared to periodic instability and that instability may play a more prominent role in the development of older children.

1.4. The Present Study

The present study makes several important contributions to the extant literature. First, rather than use a single item or composite index of chaos as was done in most previous studies, we considered separately the roles of household disorganization and instability. Second, ours is the first study to examine the potential mediating roles of these chaos dimensions in the association between family income poverty in early childhood and children's academic achievement in kindergarten. In addition, our chaos dimensions were assessed using observational measures with multiple indicators from multiple informants rather than relying on potentially subjective parental reports. Further, we assess chaos at multiple time points across early childhood, thus reflecting the cumulative experience of chaotic households across the child's first five years of life. To minimize potential confounding effects between poverty, chaos, and other factors associated with children's academic achievement (e.g., child gender, race, maternal education, quality of parenting), we included multiple control variables in our model. Finally, ours is the first prospective longitudinal study to test whether exposure to cumulative household chaos (i.e., disorganization and instability) during the preschool years conveys some of the harmful effects of early poverty on children's academic achievement in kindergarten. Given our own previous work, as well as other development literature, we hypothesized that poverty will have direct effects on children's early academic achievement, and that elevated exposure to household chaos, and particularly disorganization, prior to school entry will act as a process mechanism through which poverty adversely affects children's achievement in school.

2. Method

2.1. Sample and Design

Data were drawn from the Family Life Project (FLP), a large multi-site longitudinal study (N = 1,292) of ethnically diverse families living in contexts of rural poverty in the United States. Participants resided in one of two geographical areas with high poverty rates, the Black South in Eastern North Carolina or Appalachia in Central Pennsylvania. The FLP adopted a developmental epidemiological design in which sampling procedures were used to recruit a representative sample. Low-income families in both states and African American families in North Carolina were oversampled to ensure adequate power for dynamic and longitudinal analyses of families at elevated psychosocial risk. African American families were not oversampled in Pennsylvania because the targeted communities were at least 95% non-African American. See Vernon-Feagans and Cox (2013) for a complete description of the FLP sample.

The sample for this study included families who participated in the 6 month home visit (N = 1,236), which is when the information related to families' income-to-needs ratios was obtained. There were no differences between included and excluded families in terms of basic demographic characteristics, such as child gender, race, maternal level of education and marital status. Of the participating families, 42% were African American (coded as 1)

and 51 % of the study children were male (coded as 1). Maternal level of education ranged from below high school to graduate degree; 16% of participating mothers did not have a high school diploma or equivalent, 15% had a bachelor's degree or higher, and 69% had some intermediate level of education (HS/GED, some college, or Associate's degree). At the 6 month home visit, approximately 49% of the mothers reported being married, and 52% were employed. The income-to-needs ratio for the household at the 6 month home visit was on average 1.8 (SD = 1.7) with a ratio of 1.0 corresponding to the federal poverty threshold for that household size.

2.2. Procedures

Families received their first home visit when study children were 2 months of age. At the 2-month home visit, a single research assistant visited the home and collected information from the mother about the demographics of all household members, childcare arrangements, and other key information. Two research assistants conducted home visits when target children were 6, 15, 24, 36, 48, and 58 months of age. Two home visits were conducted approximately 2 weeks apart when the children were 6, 24, and 36 months of age, and a single home visit was conducted when the children were 15, 48, and 58 months. Each home visit lasted approximately 1.5–3 hours depending on the protocol and generally consisted of interviews and questionnaires completed by the mother (and secondary caregiver, if available), child assessments, and videotaped interactions between children and adults (mother and secondary caregiver, if available). Families received gift cards for their participation in varying amounts depending on the visit and the participation of a secondary caregiver. Children's academic achievement data were collected at their schools when they were in kindergarten as part of a larger assessment protocol, which lasted approximately 1–1.5 hours. A single research assistant worked one-on-one with each child and made every effort to ensure that children were seated comfortably in a quiet room free from distractions. Children were given small prizes (e.g., pencils, stickers) for their participation.

2.3. Measures

2.3.1. Income Poverty—At the 6 month home visit, mothers reported on the number and ages of individuals living in the household, contributions of income from those individuals, and other sources of household income. We used income data from only the 6 month time point given that early income poverty in the Family Life Project was remarkably stable across the first three years of the child's life (Vernon-Feagans & Cox, 2013). Adopting the approach taken by Hanson, McLanahan, and Thomson (1997), the total annual household income for each family was determined based on income provided by anyone who resided in the household, rather than only those individuals related by blood, marriage, or adoption. Individuals were considered to be residing in the household if they spent three or more nights in the home each week. The total annual household income was divided by the federal poverty threshold for a family of that size and composition to determine the income-to-needs ratio (INR). The INR for this study was calculated using the 2004 poverty threshold values. The definition of “poor” in our study follows the eligibility criteria for assistance by many state and federal social agencies (i.e., the family income-to-needs ratio is below 200% of the federal poverty threshold for that family size) (Vernon-Feagans et al., 2015). In 2004, the annual dollar amount that corresponded to the 200% poverty line for a family of four was

$37,700, and the annual dollar amount that corresponded to the 100% poverty line for a family of four was $18,850.

2.3.2. Household Chaos: Instability and Disorganization—Ten indicators of household chaos were assessed at 6, 15, 24, 36, 48, and 58 months of child age and, based on our prior work on dimensions of household chaos (Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012), were aggregated into two composites representing *household instability* (indicators 1 through 5; Cronbach's $\alpha = .76$) and *household disorganization* (indicators 6 through 10; Cronbach's $\alpha = .67$): (1) the total number of times the child moved physically to another residence; (2) the total number of changes in the child's primary caregiver; (3) the total number of changes in the child's secondary caregiver; (4) the total number of different people residing in the household at that time point; (5) the total number of times individuals moved into or out of the household; (6) the average number of hours the TV was on each day as reported by the mother; (7) average household density, which was computed by dividing number of rooms in the home by the number of people residing in the home; (8) household preparation for the home visit rated by research assistants (0 = cannot rate, 1 = surprise/difficulty, 2 = aware, but unprepared, 3 = aware/ready, 4 = good hosts); (9) the cleanliness of the household rated by research assistants (0 = cannot rate, 1 = very dirty, 2 = slightly dirty, 3 = messy, 4 = clean); and (10) the level of neighborhood noise rated by research assistants (0 = cannot rate, 1 = very quiet, 2 = average, 3 = noisy, 4 = very noisy). The last three indicators were based on the post-visit inventory used in the Fast Track intervention study (Dodge, Pettit, & Bates, 1994). Household preparation and cleanliness were reversed coded with higher scores indicating higher level of disorganization in the home. Scores of “0” on these indicators were treated as missing in analyses. The 2-month data were used as a baseline from which changes in child's life circumstances were calculated from one time point to the next, where applicable. A principle components analysis indicated that two eigenvalues represented the covariance of these 10 indicators most optimally. Moreover, a follow-up exploratory factor analysis model extracted two correlated factors ($r = .38$. $p < .001$) that were labeled household instability and household disorganization. Factor loadings for the indicators comprising household instability ranged from .38 to .93, and factor loadings for the indicators comprising household disorganization ranged from .44 to .74. No indicator cross-loaded on both factors. Detailed information about the factor analysis procedures, factor structure, and correlations among indicators of household chaos can be found in Vernon-Feagans, Garrett-Peters, Willoughby et al. (2012) or obtained directly from the authors.

2.3.3. Academic Achievement at Kindergarten—Six indicators of academic achievement were collected during the Spring of the kindergarten school year using the following measures: the Woodcock–Johnson Psycho-Educational Battery III (WJ-III; Woodcock, McGrew, & Mather, 2001), the Test of Preschool Early Literacy (TOPEL; Lonigan, Wagner, Torgeson, & Rashotte, 2007), and the Early Childhood Longitudinal Study-K Math Battery (ECLS; http://nces.ed.gov/ecls/kinderassessments.asp; Rock & Pollack, 2002).

The WJ-III psycho-educational battery is a set of norm-referenced tests that assess students' cognitive abilities, aptitudes, and academic achievement and that were designed to be representative of the US population from ages 24 months to 90+ years. For this study, we used standard scores for three tests of academic achievement: Letter-Word Identification, which assesses basic reading skills; Applied Problems, which assesses basic math skills; and Picture Vocabulary, which assesses expressive language skills. All tests within the WJ-III battery have been shown high levels of reliability (αs of .80 or higher) and validity (Woodcock et al., 2001).

The TOPEL is a norm-referenced test that was designed to identify students in prekindergarten and kindergarten who may be at risk for literacy problems. For this study, we used the Phonological Awareness and Print Knowledge subtests. The Phonological Awareness subtest is a 27-item test that assesses children's ability to manipulate sounds, such as saying what is left after specific sounds are dropped from a word or combining separate sounds to form a word (Cronbach's α = .69). The Print Knowledge subtest is a 36-item test that assesses children's ability to identify specific letters and to associate letters and sounds (Cronbach's α = .62).

The ECLS-K Math Battery was designed to measure children's mathematical conceptual knowledge, procedural knowledge, and problem solving skills within specific content areas that include the number sense, operations, and properties. The ECLS-K Math Battery has a two-stage adaptive design that minimizes the potential for floor and ceiling effects. In addition, the ECLS-K Math battery was shown to have good validity and reliability characteristics (Cronbach's αs of .80 or higher; Rock & Pollack, 2002). All children were asked a common set of “routing” items, and their performance on these items determined the difficulty of the following set of items. In this study, we used item response theory (IRT) scale scores for the math battery as an indicator of children's level of academic achievement. As such, the latent construct of *children's academic achievement* at kindergarten was defined through the following six indices: three WJ-III standard scores, two TOPEL subscale scores, and the ECLS-K Math IRT score.

2.3.4. Covariates—To evaluate whether household instability and disorganization accounted for effects attributable to poverty, we included a range of variables that tend to co-occur with poverty at the child, parent, and dyadic level. These included demographic measures: race, maternal level of education, maternal marital status and employment status, all measured at 6 months. We also controlled for child level variables of sex, the child's Mental Developmental Index (MDI) assessed using the Bayley Scales of Infant Development (BSID-II; Bayley, 1993) at 6 and 15 months. The BSID-II is a widely used measure of cognitive developmental status for children in the first 2 years of life. The MDI scores were norm-referenced (M = 100, SD = 15) and averaged across the 6 and 15 month time points.

Finally, a stringent dyadic and more proximal control variable that measured the quality of parenting was collected via videotaped parent-child structured play interactions at the 6, 15, 24, 36, and 58 month home visits. These videos were later coded for the following five indicators of quality of parenting: (1) sensitivity; (2) detachment/disengagement (reversed-

coded); (3) stimulation of development; (4) positive regard; and (5) animation/support for autonomy (Mills-Koonce et al., 2011). Coders rated each of these subscales on 5-point scale from (1) not at all characteristic to (5) highly characteristic. About 30% of videos were double coded, and each pair of coders maintained an inter-rater reliability of .80 or higher for each of the subscales. The quality of parenting composite was created as an average of all five subscales at each assessment. The intra-class correlations ranged from .85 to .98 across the five assessment points.

2.4. Analytic Strategy

Analyses were conducted in three steps. First, descriptive data and zero-order bivariate correlations among study variables were examined. Next, a measurement model was fit to the data to establish the relations among income poverty, household instability, household disorganization, and children's kindergarten academic achievement before taking into account the control variables. Lastly, the central hypothesis of the study - the mediating roles of household instability and household disorganization in the relation between poverty and children's academic achievement - was tested through a structural path analysis model. The model included a number of control variables and estimated specific indirect effects from poverty to children's academic achievement through each of the mediators. Compared with other statistical methods of assessing mediation, latent path analysis modeling permits tests of indirect effects in a single analytic model (Burchinal, Nelson, & Poe, 2006; Kline, 2005). In examining indirect effects, confidence intervals (CI) at 95% ($p < .05$) were also estimated. An indirect effect is considered to be significant if the confidence interval does not include 0 (Kline, 2005). Several fit indices were used to evaluate the fit of all models to data: χ^2, comparative fit index (CFI), and root mean square error of approximation (RMSEA). A model is considered to have an adequate fit to the data when CFI values are .95 or higher and RMSEA values are .05 or smaller (Hu & Bentler, 1999). All analyses used robust full information maximum likelihood (MLR) estimation to accommodate missing data. In addition, all analyses accounted for the complex sampling design of stratification on income and race, and individual probability weights associated with over-sampling of low-income and African American families. All analyses were conducted using Mplus version 7 (Muthén & Muthén, 1998-2012).

3. Results

3.1. Preliminary Analysis

Descriptive data for the continuous study variables are presented in Table 1. The examination of missing data indicated that overall 8% of the data were missing and ranged from 0% to 15% on individual variables. Variables with the largest amount of missing data were academic achievement variables at kindergarten. The bivariate correlations among study variables are displayed in Table 2. The correlational analysis revealed that families with lower levels of income tend to have higher levels of household instability and disorganization. Children from families with lower levels of income and higher levels of household instability and disorganization were more likely to show lower levels of academic achievement (*rs* ranging from .15 to .33 for individual indices of academic achievement).

3.2. Measurement model

Next, we tested a model that examined the relations among income poverty, household instability and disorganization, and a latent variable of children's academic functioning in kindergarten prior to including control variables. The latent construct of children's academic functioning in kindergarten was defined through observed variables as detailed in the Methods section. Variables that were derived from the same measure were likely to have shared residual variance. Thus variables used to index children's academic achievement were allowed to covary during the model specification process. The final measurement model showed a good fit to the data (χ^2 = 48, df = 22, p < .001; CFI = .99; RMSEA = .03). The standardized coefficients and standard errors (SE) for each estimated path in the measurement model and for the loadings of the observed indicators (i.e., individual test scores) on the latent construct of academic achievement are presented in Fig. 1. The results of the model revealed that all observed indicators of academic achievement adequately represented the latent construct (λs ranging from .61 to .79, p = .000). The results also indicated that families with lower levels of income had higher levels of household instability (β = −.35, p = .000) and higher levels of disorganization (β = −.52, p = .000). Children with lower levels of academic achievement at kindergarten tended to come from families with lower levels of income (β = .33, p = .00) and from families with higher levels of household disorganization (β = −.22, p = .000). As such, the basic significant relations among the study variables were established.

3.3. Structural model

To test the study's central hypothesis, whether family income poverty was related to children's academic achievement through higher levels of household chaos, we tested a latent path analysis model. The model included the control variables and direct and indirect paths between family income poverty, household instability, household disorganization, and child academic achievement at kindergarten. The standard coefficients (β) and standard errors (SE) for each estimated path are shown in Table 3, and significant paths are illustrated in Fig. 2. The model had a good fit to the data (χ^2 = 241, df = 63, p < .001; CFI = .95; RMSEA = .04). The results of the model indicated that family income was not directly related to children' academic achievement at kindergarten (β = .03, p = 37) after accounting for variance attributable to control variables. Overall, the model explained 28% of the variation in children's academic achievement (R^2 = .28, SE = .04, p = .000), 28% of the variation in household instability (R^2 = .28, SE = .02, p = .000), and 43 % of the variation in household disorganization (R^2 = .43, SE = .02, p = .000).

Of the two mediators included in the model, only household disorganization was directly related to children's academic achievement (β = −.18, p = .000). Moreover, the estimation of standardized specific indirect effects from family poverty to children's academic achievement revealed the following significant mediating path: income poverty → household disorganization → child academic achievement (β = .05 [SE = .013], p = .000; 95% CI [.02, .07]). This specific indirect effect suggests that in the presence of covariates and mediator variables, family poverty at 6 months was no longer directly related to children's academic achievement at kindergarten; it was, however, related to household disorganization, which was, in turn, related to children's academic achievement. Thus,

household disorganization serves as a process mechanism through which family income poverty is associated with children's academic achievement (Fig. 3).

4. Discussion

The purpose of the current study was to examine whether the well-established association between family income poverty and children's early academic achievement was mediated by exposure to elevated levels of household chaos, even after controlling for a host of important covariates. We found that elevated levels of household chaos, and specifically disorganization, prior to school entry mediated the effects of early income poverty on children's academic achievement in kindergarten in a rural low-income ethnically diverse sample. These results are important given that our study controlled for a host of covariates, including children's early cognitive abilities, demographic factors that tend to co-occur with poverty (e.g., maternal education, marital status, employment, and race), and especially the quality of parenting, which has been identified in previous studies as an important process mechanism through which poverty conveys adverse effects on children's development (Bradley & Corwyn, 2002; Vernon-Feagans & Cox, 2013). Even after applying these rigorous controls, household disorganization continued to explain a significant portion of variance in children's academic achievement.

Our findings regarding household chaos as a meditating process between poverty and academic achievement are consistent with previous studies examining associations between poverty and socioemotional and cognitive outcomes in middle childhood and adolescence (Brody & Flor, 1997; Evans et al., 2005; Evans & English, 2002; Evans & Kim, 2007) and extend this mediation model to early childhood. These findings also highlight the early childhood years prior to school entry as a possible period of elevated vulnerability to the impact of environmental stressors, such as household chaos (see also Duncan et al., 2012; Duncan et al., 2010; Evans & Kim, 2013).

Our study lends support to growing conceptual and empirical work that distinguishes two underlying dimensions of household chaos: disorganization and instability (Brooks-Gunn et al., 2010; Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012). Consistent with previous work using this same sample (Berry et al., 2013; Raver et al., 2014; Vernon-Feagans, Garrett-Peters, Willoughbyet al., 2012), poverty was associated with increased household disorganization, which was, in turn, associated with compromised child competence. Household disorganization reflects home environments that are characterized by noise, crowding, clutter, and lack of structure, which permeates the home environment on a daily basis and may interfere with developing regulatory systems (Li Grining, 2007). Children may become overwhelmed by the excess stimulation (e.g., noise, crowding) in a disorganized home and adapt by withdrawing from the home environment (Matheny et al., 1995). Children may extend this withdrawal to other social contexts (e.g., classroom) (Hanscombe et al., 2011), and consequently fail to glean developmentally facilitative information from their surroundings. In addition, this excess stimulation may interfere with concentration and require children to expend more effort to maintain focus and attention (Zvara et al., 2014). Living in disorganized homes may thus diminish young children's

opportunities to develop skills (e.g., focused attention) that are important for school success and may ultimately undermine their ability to successfully engage in learning activities.

As expected, poverty was associated with greater household instability; however, household instability was not associated with children's early academic achievement. These findings are consistent with previous studies using this same sample showing no significant associations between household instability and children's outcomes in early childhood (Raver et al., 2014; Vernon-Feagans, Garrett-Peters, Willoughby et al., 2012; Vernon-Feaganset al., 2016; Zvara et al., 2014). Household instability is reflective of changes in settings and relationships (e.g., residential moves, changes in caregivers and household occupants), which is experienced intermittently and thus is not an aspect of everyday living. There is some evidence that instability may be more strongly associated with children's social/emotional adjustment rather than their cognitive/academic development, which was measured in this study (Ackerman et al., 1999; Brooks-Gunn et al., 2010; Fiese & Winter, 2010; Marcynszyn, Evans, & Eckenrode, 2008). For example, markers of instability (i.e., caregiver partner changes and residential/school changes) have been related to depression and externalizing problems in adolescence (Marcynszyn, et al., 2008). Instability, and especially changes in residences/schools, may be most disruptive for older children whose development is less exclusively dependent on the family context and is more dependent on peer/teacher relationships and school and neighborhood influences. As such, non-significant findings regarding instability in our study may be explained in part by the fact that our outcome was measured in early childhood (i.e., kindergarten) rather than later in development (e.g., adolescence) and was cognitive/academic rather than socioemotional in nature. Additionally, because our assessment of instability was truncated to the early childhood period, there was limited variability in our measure which might also have contributed to nonsignificant effects.

4.1. Conclusions, Limitations, and Future Directions

Conceiving of chaos as a multi- rather than unidimensional construct moves the field forward and helps to differentiate which dimensions of chaotic households may be most detrimental to children's competencies during specific periods of development. In the present study, we found that household disorganization, but not instability, served as a process mechanism in associations between early family income poverty and children's academic achievement in kindergarten. As noted above, our non-significant findings regarding instability could be attributed to the nature of our outcome (cognitive vs. socioemotional), as well as limited variability of our instability measure which was assessed only through 58 months of age. Future studies that examine instability for a longer period of development and outcomes assessed later in development (i.e., beyond early childhood) may reveal important links between instability and children's development that were not detected in this study.

Our study established household disorganization as a viable mediator in the relation between early income poverty and academic achievement in kindergarten. Our model did not include other potential process mechanisms through which early family income poverty may be associated with children's academic achievement. Although beyond the scope of the current

study, it is likely that other family- (e.g., parental values and beliefs, provision of learning opportunities) and child- level characteristics (e.g., temperament, self-regulatory skills) might also serve as mediators in associations between poverty and children's outcomes (Vernon-Feagans et al., 2016; Zvara et al., 2014.).

Another limitation of our study included the generalizability of the results. Given that our sample consisted of families living in low-wealth rural communities, it is not possible to say conclusively whether these results are generalizable to other poor communities, particularly those living in urban poverty. The broader context of families living in rural versus urban settings may play an important role in establishing processes through which income poverty leads to diminished academic achievement. For example, the development of children living in rural areas appears to be more closely intertwined with the family context than the development of children living in urban areas, as there are fewer opportunities for outside influences on child development in rural communities (O'Hare, 2009). Thus, children living in high poverty chaotic families in rural areas may be at a greater risk than children living in high poverty chaotic families in urban areas. On the other hand, families living in rural areas are more likely to be surrounded by kin, which often serves as a source of social support and as a buffer from negative influences for rural children. In addition, poor rural areas are less likely to be affected by neighborhood violence and crime compared to poor urban areas, which may further undermine children's academic achievement. In short, the results that are obtained based on a low-wealth rural sample may not hold for low-wealth urban families, and the conclusions presented in the current study should be empirically tested in urban contexts.

Additionally, ours was a prospective longitudinal study that utilized multi-method and multi-informant data collection and included a comprehensive list of control variables. Nonetheless, as with any observational study, this study is correlational in nature and no causal inferences can be made based on these results. In order to draw concrete implications for intervention and practice, ideally these results should be validated through efficacy-control trails demonstrating the utility of household disorganization as a mechanism through which a meaningful intervention can be delivered.

In conclusion, given the current larger sociocultural context, the field is now ripe for researchers who strive to understand the links between poverty, household chaos, and child development. The economic downturn in the U.S., accompanied by unemployment trends in recent years, has resulted in increases in residential mobility as families move to find employment and affordable housing, more crowded and noisy homes as families take in other household members to reduce living costs, and more relationship instability as these stresses take their toll on family life. In addition, the global thrust into the high-tech information age has created conditions in which the overwhelming majority of homes in the U.S. are replete with excess environmental stimulation, distractions, and interruptions from multiple televisions, cell phones, and computers. As these movements continue to unfold, researchers have an opportunity to advance the field by remaining cognizant of the ways in which these sociocultural trends might contribute to increased chaos in households across the SES spectrum and the potential implications of these increasing chaotic conditions for both family and child functioning.

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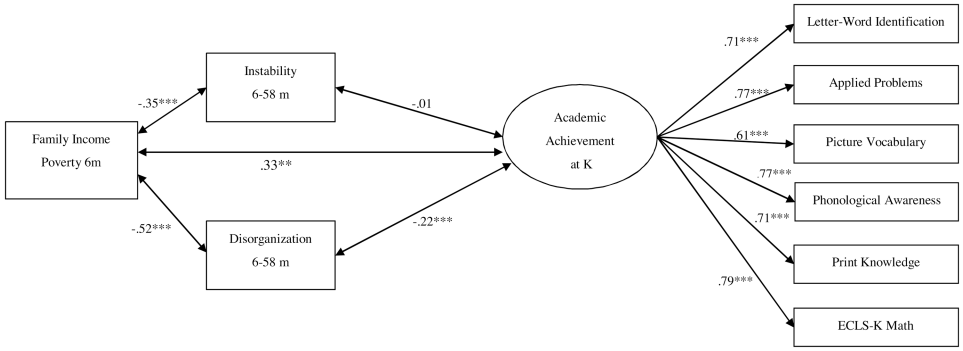

Figure 1.
Measurement model, standardized estimates.

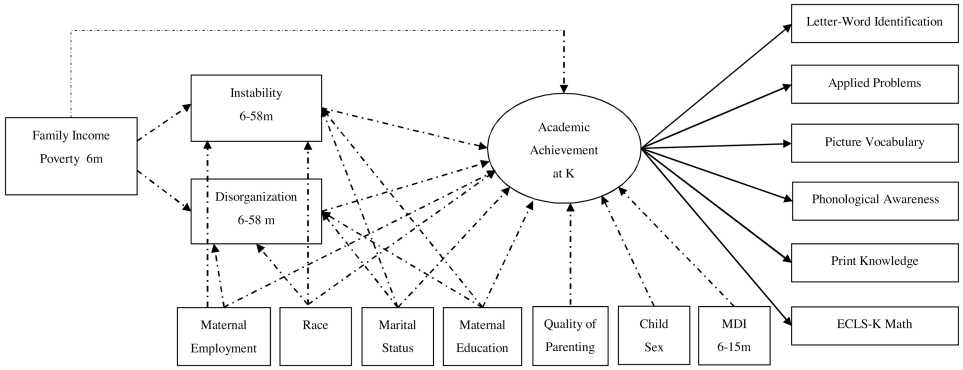

Figure 2.
Tested structural model with control variables.

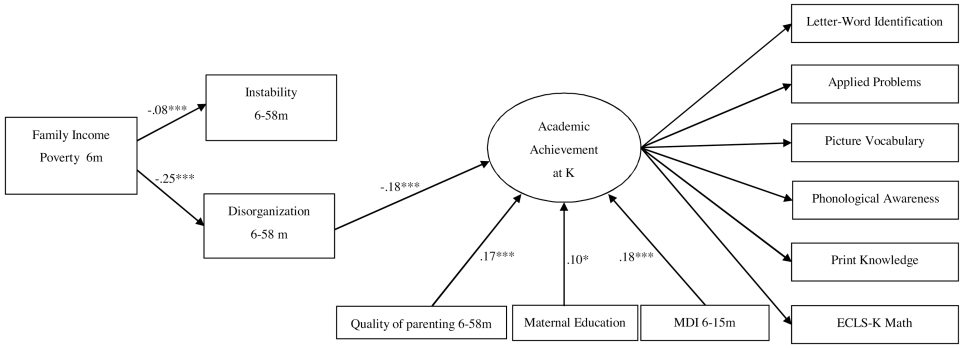

Figure 3.
Results of the structural model with control variables.

Table 1

Descriptive Statistics for Continuous Study Variables

Construct/Variable	*N*	%	*M*	*SD*	Min–Max
Child Characteristics					
Sex, male	1236	51	–	–	–
Race, African–American	1236	42	–	–	–
Child MDI (6 &15 months)	1207	–	97.9	7.6	59–122.5
Family Characteristics					
Maternal Marital Status, married	1236	49	–	–	–
Maternal Employment, employed	1196	52	–	–	–
Maternal Education, years	1236	–	12.9	1.9	7–20
Income Poverty (6 months)	1204	–	1.8	1.7	0–16.5
Quality of Parenting (6–58 months)	1223	–	2.8	.65	1–4.6
Household Chaos					
Household Instability (6–58 months)	1099	–	0	.75	−1.2–4.9
Household Disorganization (6–58 months)	1099	–	0	.67	−1.5–2.4
Academic Achievement at K					
WJ-III Letter-Word Identification	1058	–	107.5	12.0	59–150
WJ-III Applied Problems	1058	–	100.7	13.7	26–140
WJ-III Picture Vocabulary	1058	–	99.1	10.0	57–140
TOPEL Phonological Awareness	1045	–	102.4	13.8	54–122
TOPEL Print Knowledge	1057	–	109.7	8.6	62–117
ECLS-K Math Battery	1056	–	−.93	.56	−3.2–.57

Table 2

Bivariate Correlations among Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Sex	–														
2 Race	.01	–													
3 Marital Status	.00	−.40	–												
4 Maternal Education	.01	−.22	.46	–											
5 Maternal Employment	.03	−.06	.13	.30	–										
6 MDI	−.06	−.17	.09	.17	.08	–									
7 Income Poverty	.05	−.38	.50	.52	.37	.15	–								
8 Quality of Parenting	−.02	−.43	.45	.52	.19	.21	.47	–							
9 Instability	−.04	.20	−.36	−.46	−.17	−.08	−.35	−.34	–						
10 Disorganization	.01	.29	−.40	−.56	−.28	−.21	−.52	−.51	.42	–					
11 WJ Letter-Word	−.07	−.01	.16	.28	.13	.16	.24	.25	−.15	−.31	–				
12 WJ Applied Problems	−.02	−.28	.23	.28	.12	.27	.27	.37	−.18	−.31	.55	–			
13 WJ Picture Vocabulary	.05	−.22	.23	.30	.12	.21	.30	.35	−.18	−.30	.44	.57	–		
14 Phonological Awareness	−.09	−.30	.24	.29	.05	.25	.27	.34	−.20	−.30	.51	.55	.44	–	
15 Print Knowledge	−.12	−.12	.16	.20	.08	.22	.15	.23	−.15	−.26	.53	.53	.39	.51	–
16 ECLS Math Battery	.00	−.29	.25	.30	.14	.22	.27	.34	−.19	−.33	.44	.60	.45	.58	.56

Note: All correlations equal or greater than .10 are significant at $p < .001$; equal or greater than .06 are significant at $p < .05$

Table 3
Standardized Path Estimates of the Structural Model

Outcome	Predictor	*β*	*SE*
Instability	Race	.02	.03
	Maternal Education	−.37***	.03
	Maternal marital status	−.17***	.04
	Maternal employment	.01	.03
	Income poverty	−.09***	.02
Disorganization	Race	.07**	.03
	Maternal Education	−.37***	.03
	Maternal marital status	−.10**	.03
	Maternal employment	−.06*	.03
	Income poverty	−.25***	.03
Academic Achievement	Sex	−.03	.03
	Race	−.05	.04
	Maternal Education	.10*	.05
	Maternal marital status	.09	.05
	Maternal employment	.01	.03
	MDI	.18***	.04
	Quality of Parenting	.17***	.05
	Income poverty	.03	.04
	Instability	.01	.04
	Disorganization	−.18***	.05

MDI = mental development index.

*$p < .05$,

**$p < .01$,

***$p < .001$.