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HOUSEHOLD CHAOS MEDIATES THE LINK BETWEEN FAMILY RESOURCES AND CHILD SLEEP

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ABSTRACT

This study examined the mediational role of household chaos in the link between family resources and child sleep outcomes during the transition to kindergarten. Participants included 230 families of children entering kindergarten (50% female) who participated in an eight-day measurement burst at pre-kindergarten (July-August), early kindergarten (September/October), and mid-kindergarten (November-December). At pre-kindergarten, mothers completed the Family Resources Scale-Revised (FRS-R; Van Horn et al., 2001), while trained observers assessed household chaos using the Descriptive In-Home Survey of Chaos-Observer ReporteD (DISCORD; Whitesell et al., 2015) at pre- and early-kindergarten. In order to better understand perturbations in child sleep during this transition, actiwatches (AW Spectrum Plus, Philips/Respironics, Inc.) were used to measure both child sleep duration and proportion of optimal sleep duration (9+ hours per 24-hour period; Paruthi et al., 2016) at early- and mid-kindergarten. Results found that family resources were more clearly predictive of child sleep outcomes than household income. Controlling for quality of coparenting and maternal depressive symptoms, household chaos fully mediated the link between family resources and child sleep duration at both early and mid-kindergarten and the link between family resources and the proportion of optimal sleep duration in mid-kindergarten.

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Chapter 1

Introduction

Sleep matters, especially for young children. Not surprisingly, sleep plays a vital role in human development. Higher sleep duration has been found to promote learning and memory consolidation (Al-Sharman & Siengsukon, 2014; Jha & Jha, 2019;), mental and physical health (Al-Sharman & Siengsukon, 2014; El-Sheikh et al., 2010; Hornby & Holleran, 2014; Kronholm et al., 2011; Krueger & Friedman, 2009; O'Brien & Gozal, 2004), and positive academic outcomes (El-Sheikh et al., 2007; Hafner et al., 2017). Further, emerging research has indicated that insufficient, young child sleep (less than 9 hours of sleep per 24-hour period; Paruthi et al., 2016) is linked to Body Mass Indexes (BMIs) outside of the normal range (Deacon-Crouch et al., 2018; Li et al., 2010), increased unhealthy eating habits (Córdova et al., 2018), worse consistent family bedtime routines (Li et al., 2010) and decreased cognitive-functioning at school-entry (Touchette et al., 2007).

Sleep is complexly determined. Sadeh et al.'s transactional-ecological model (2007) suggests that sleep is imbedded in a broader ecological context and can be examined from multiple levels of analyses. The present study is concerned with one particular "macro" influence on child sleep, socioeconomic risk (SER), which has been found to be a reliable predictor of child sleep. A variety of studies have reported that SER, typically defined by marker variables such as reduced parental income and education, is associated with reduced quantity and quality of child sleep (El-Sheikh et al., 2010; Gellis, 2011; Silver et al., 2005).

Less clear from this work, however, is how socioeconomic risk "operates" to impact child sleep. The present study addresses this dearth by (1) moving beyond broad socio-demographic markers of socioeconomic risk and conceptualizing it in terms of tangible family resources, and (2) examining household chaos as a specific mechanism that accounts for the link between family resources and child

sleep. The present study's conceptualization of socioeconomic risk in terms of family resources (e.g., liquid income, food access, and social supports from family and friends) is based on the premise that such an approach reflects a more wholistic, ecologically valid, process-oriented view of a family's lived-experience (Dunst & Leet, 1987) that is not captured by general marker measures of SER. Many prior studies that have looked at single SER marker variables have focused on household income (Hauser, 1994). And while there are logical connections between low income and inadequacies in food, social supports, and other material and social necessities (Carlson & Corcoran, 2001; Duncan, & Magnuson, 2005), direct assessment of these resources from the vantage point of the parents better captures the manner in which socioeconomic risk uniquely impacts particular families. Parental perception of family resources, in turn, may be a more salient predictor of children's outcomes than marker variables alone.

Household Chaos, Family Resources, and Child Sleep

The present study's focus on household chaos as an explanatory mediator linking family resources and child sleep derives from growing evidence that links socioeconomic risk with household chaos (Ackerman & Brown, 2010; Coldwell et al., 2006; Deater-Deckard et al., 2009, 2012; Philbrook et al., 2020) and higher household chaos with poor child sleep (Berger et al., 2019; Uebergang et al., 2017; Whitesell et al., 2015). Low family resources are associated with more disorganized and less predictable households. Under-resourced families typically find themselves living in higher-risk, unpredictable environments (Ackerman & Brown, 2010; Deater-Deckard et al., 2012; Fuller-Rowell et al., 2015), which can impact parents' ability to maintain order and routine in the home (Seaton & Taylor, 2003). In turn, high household chaos is expected to exert a unique and debilitating impact on family processes and child development even when controlling for markers of socioeconomic status (SES) (Wachs & Evans, 2010).

Household chaos is characterized by noise, clutter, disarray, lack of routines, and unpredictability. Families living with higher household chaos may have children who are less able to

regulate themselves (Bridgett et al., 2013; Evans et al., 2005) and may encounter difficulties falling asleep and staying asleep amidst the increased disorganization and unpredictability in their environments. Such results were evidenced by Whitesell and colleagues (2015) who linked higher household chaos with lower infant and parent sleep. Within more chaotic households, family members may be more likely to engage in sleep-disturbing behaviors (e.g. watching television/listing to music at night), which has been found to negatively impact early-adolescents' ability to fall asleep (Spilsbury et al., 2017) and increase child bedtime resistance, sleep anxiety, and total sleep problems (Boles et al., 2016).

In contrast, low chaos homes appear to provide better supports for children. Parents in lower chaos households, characterized by increased order and routine and decreased noise and clutter, can better monitor children's behavior and set more effective limits (Sadeh & Anders, 1993; Sadeh et al., 2010) and thus parent more effectively (Whitesell et al., 2015). Routines and household consistency appear to help facilitate better sleep in young children, perhaps because children in lower chaos homes benefit from a more predictable environment (Prokasky et al., 2019; Teti et al., 2010).

In sum, researchers are finding that well-established routines and household organization represent an ordered environment that appears to be promotive of good child sleep, as opposed to a chaotic environment which is predictive of poor child sleep.

The Present Study: Family Resources, Household Chaos, and Child Sleep during the Transition to Kindergarten

The present study examined family resources, household chaos, and sleep among children making the transition to kindergarten. In the United States, kindergarten is often a child's first introduction to a formal education setting and requires children to sit patiently, with directed attention on an instructor. But when school-aged children experience insufficient amounts of sleep, their academic performance suffers, and this may be especially true for children from low SES families (El-Sheikh et al., 2007). To date, there are no published studies that explore the interlinkages between family resources, household chaos, and

sleep among children making their first foray into formal schooling. In doing so, the present study made use of two separate objective assessments of child sleep duration, one using an overall weekly mean sleep duration, and a cumulative measure of child sleep that draws from recommendations from the American Academy of Sleep Medicine (AASM) that kindergarten-age children should have at least 9 hours of sleep per night to optimize daily functioning and development (Paruthi et al., 2016).

The following hypotheses were addressed:

H1: Family resources will be more clearly linked with child sleep during the transition to kindergarten than a more traditional index of socioeconomic risk (family income). Previous research has cautioned that income, a static marker indicator of socioeconomic risk, may provide inconsistent, unreliable prediction of developmental processes in children (Hauser, 1994). Perceived family resources, on the other hand, are more dynamic, process-oriented representations of how a parent sees her/his ability to meet financial obligations and obtain social support (Dunst & Leet, 1987; Van Horn et al., 2001). Thus, it was hypothesized that family resources will be superior to family income as a predictor of household chaos and child sleep.

H2: Household chaos is expected to significantly mediate the link between family resources and objective measures of child sleep in early kindergarten, whether measured as an overall mean duration across the week or in terms of National Sleep Foundation/American Academy of Sleep Medicine (NSF/AASM) recommendations (Paruthi et al., 2016) for adequate sleep for children at kindergarten-age. Consistent optimal sleep in the present study was determined from NSF/AASM recommendations that school-aged children should sleep at least 9 hours per 24 period. Examining sleep duration in terms of how well it meets these is, in effect, an assessment of how consistently one meets recommended guidelines, and consistency in meeting guidelines is likely to be affected by overall levels of chaos.

H3: To be explored is whether these relations are upheld later in the transition kindergarten (November) as evidence earlier (September) in the transition. Family systems

perspective emphasizes that as routines are established such as would be expected at the beginning of a transition, normal family function is “perturbed” (Minuchin, 1985). Linkages between socioeconomic risk, household chaos, and child sleep may be more difficult to observe early in the transition due to the expected increases in perturbations to the family system earlier versus later in the transition. Also of interest was to determine if household chaos continued to mediate the link between family resources and child sleep at a point following the initial transition to kindergarten (i.e. at a point when these initial perturbations may have resolved).

Chapter 2

Method

Participants

This study draws from families with children entering kindergarten. Subjects included whole families drawn from the participants in the larger, ongoing, longitudinal, Project SIESTA-K (R01HD087266; Study InvEstigating Sleep TrAjectories in Kindergarten) funded by the National Institute of Child Health and Human Development (NICHD). Two-hundred thirty families of children from one or two parent households were recruited prior to the start of kindergarten into a study on parenting, child sleep, and school functioning. The sample included 50.0% male children across 11 schools in three school districts. During the Summer pre-kindergarten (pre-k) home visit, the majority of sample children had their mother living with a partner (90.4%, n=208). About 75.7% (n=174) parents identified their children as "white", 7.4% (n=17) as Black or African American, 0.4% (n=1) as American Indian or Alaska Native, 0.9% (n=2) as Asian, 1.7% as some other race (n=4) and 11.7% (n=27) as two or more races. Additionally, 8.3% (n=19) of families self-identified their ethnicity as Latinx or not. Families reported a high range of resources (M = 71.14, SD = 10.54). Table 2-1 further details sample demographics.

Procedure

Families were approached at kindergarten registration across three school districts (March-June of the year prior to Fall kindergarten entry) where district records indicate that over 80% of children who enter Fall kindergarten register at the March-June registration period.

Trained project staff conducted four week-long (8 days or 7 nights) assessments across the kindergarten year for each family, with 30 to 76 families assessed per year. The first Wave (W1) took place in July or August (pre-kindergarten home visit), prior to the start of school. The second Wave (W2) occurred 2-6 weeks into the transition to kindergarten, in late September/early October (early transition). The third Wave (W3) took place in early-mid November or December (mid-transition), and the fourth Wave (W4) in March-May (late transition). Data collection is in its final year, with a final cohort of 49 families; whose complete data for the W4 observations has not yet been collected. Assessments were not conducted during any week encompassing daylight saving time.

The present study focused on data collected from Waves 1, 2, and 3, which all participants had completed. All analyses were completed for the sample with complete maternal FRS-R, chaos, maternal depression, maternal coparenting, and child sleep durations. Complete data were available for 187 families in Wave 2 and 185 families in Wave 3. One-way ANOVA attrition analyses revealed that children who left the study (n=45) were more likely to be non-white ($F(1,228)=12.85$, $p<.001$), have parents that don't live together ($F(1,223)=52.03$, $p<.001$), and have both parents (mother's $F(1,215)=6.24$, father's $F(1,161)=4.66$, $ps<.05$) with higher depressive symptoms than their peers that stayed in the study. Additionally, families that dropped the study had lower nightly sleep duration at Wave 2 ($F(1,214)=6.04$, $p<.05$) and Wave 3 ($F(1,212)=17.49$, $p<.001$), fewer family resources ($F(1,215)=9.53.04$, $p<.01$), and greater household chaos ($F(1,208)=15.19$, $p<.001$) than those who stayed in the study. There were no distinctive differences between the sample with all completed data at Wave 2 versus Wave 3.

Data were collected over eight consecutive days at each Wave. Project staff had contact with families at two home visits and daily phone contact with each parent during the 8-day period. Home visits lasted between 15-30 minutes; observations of household chaos where made throughout each visit and during daily parent phone interviews. On the first day of the visit (Saturday) mothers, fathers, and the focal child received a Respironics Actiwatch (model Spectrum Plus), which were collected on the 8th day

Table **2-1**: Demographics of Family Study Participants

	Child (n=230)
Child Gender, N (%)	
Male	115 (50.00)
Female	115 (50.00)
Age at Start of Study, Mean Age in Years (SD)	
Maternal Age	34.5 (0.3)
Paternal Age	36.9 (0.5)
Mother's Marital Status, N (%)	
Living with Partner	208 (90.4)
Not Living with Partner	17 (7.5)
Mother's Perceived Family Resources, N (%)	
41 – 50	1 (0.4)
51 – 60	1 (0.4)
61 – 70	13 (6.1)
71 – 80	36 (16.6)
81 – 90	69 (31.8)
91 – 100	97 (44.7)
Annual Household Income, N (%)	
$0-$29,999	19 (8.5)
$30,000-$59,999	33 (14.7)
$60,000-$89,999	63 (28.1)
$90,000-$129,999	67 (30.0)
$130,000-$159,999	26 (11.6)
$160,000-$189,999	10 (4.4)
$190,000 or more	5 (2.2)
Race, N (%)	
White	174 (75.7)
Black or African American	17 (7.4)
American Indian or Alaska Native	1 (0.4)
Asian	2 (0.9)
Some other race	4 (1.7)
Two or more races	27 (11.7)
Ethnicity, N (%)	
Latinx	19 (8.3)
District, N (%)	
District 1	89 (38.7)
District 2	61 (26.5)
District 3	80 (34.8)

Note. Families both self-identified race and ethnicity (whether or not they were Latinx) separately. Data collected the summer before kindergarten started. Mother's Perceived Family Resources assessed via the Family Resource Scale-Revised (FRS-R; Van Horn et al., 2001) in which scores can range from 20 to 100 and higher scores indicate higher perceived resources.

of data collection (Saturday). These actiwatches collected sleep/wake data (Tonetti et al., 2008) across the night, using a sampling window of 30 seconds.

Project staff identified whether or not each night of Actiware data was usable. Nights were not scored when there was technical failure, the individual was extremely sick with radically disturbed sleep, sleep periods that began after 6 am, when there was more than an hour of the sleep period influenced by extreme external motion (such as occurs when sleeping in a car), or the actigraph watch was not attached to the child for more than one hour of the sleep period.

Sleep data were scored using the Actiware Philips Respironics software (version 6.0.9) Night sleep was scored using the Sadeh algorithm, which identified sleep onset as the first of three minutes of consecutive sleep after the parent-reported sleep start time and identified sleep end as the last of five minutes of consecutive sleep after the parent-reported wake time.

Measures

Demographics. During the summer before pre-k visit, parents completed a brief demographics questionnaire comprised of questions on parent and child race, age, marital status, parent educational attainment, yearly family income, number of adults and children living in the home, public assistance status, marital/partner status, number of children, and prior preschool experience for their child. Only yearly household income was addressed in the present study under H1.

Family Resources. The present study indexes socioeconomic risk using a well-established 20-item measure of family resources (the Family Resource Scale-Revised; FRS-R; Van Horn et al., 2001) assessed at W1. The FRS-R taps into parents' perceptions of basic needs, time for self, time for family, and money. This measure includes 20 items, in which the respondent uses a 5-point Likert scale ranging from (5) almost always adequate to (1) not at all adequate. Higher FRS-R scores indicate more resources

and thus lower socioeconomic risk. Internal reliability of mothers' FRS-R composite score was high (alpha = 0.90).

Household Chaos. The Descriptive In-Home Survey of Chaos-Observer ReporteD (DISCORD; Whitesell et al., 2015) is a family-level measures that was assessed once by trained observers at each Wave (Summer, September/October, November/December, and April/May during kindergarten). DISCORD is a composite variable composed of three categories – physical organization of the home, management intrusions, and adherence to study protocol – with a total of 11 items, each rated on a scale of 1, 2, or 3 with a maximum score of 33. Each parent was rated separately on whether or not they completed study measures and were available for daily interviews across the Wave. Higher scores indicated higher levels of household chaos and disorganization and lower scores indicated lower levels of household chaos and disorganization. DISCORD in this sample was assessed by four reliable observers with high interrater reliability (interclass correlation, ICC, absolute agreement) greater than 0.80 between all raters across a total of 82 household observations. Internal reliability of household chaos was moderate to high at both W1 and W2 (alphas = 0.72, 0.67). Given that household chaos was highly stable across Waves (rs>0.69, ps<.0001), the mean DISCORD score between W1 and W2 was used for analyses.

Sleep Duration. Philips Respironics Actiware (Version 6.0.9) software was used to determine, for each of the seven nights, nighttime sleep duration (total minutes between sleep onset and sleep end). The mean sleep duration across the full week of data collection was further calculated amongst all usable nights for each child at W2 and W3. Children that had fewer than four nights of usable actigraph data were considered missing for that data collection Wave.

Proportional Recommended Sleep Duration. A proportion of nights the child slept at least 9 hours (540 minutes) was calculated by summing the total number of days that had a minimum of 540 minutes, divided by the total number of days of usable data in that Wave. Children that had fewer than four nights of usable actigraph data were considered missing for that data collection Wave. Proportions were calculated for both W2 and W3.

Covariates. As sleep is multiply determined, this study controlled for one individual and one family variable that have been found to be reliable predictors of child sleep. The first was maternal depressive symptoms, assessed with the Beck Depression Inventory (BDI; Beck et al., 1961) at W1, which previously has been linked to child sleep (Teti & Crosby, 2012; Warren et al., 2006). The second was mother-reported coparenting experiences at W1, using the Coparenting Relationship Scale (CRS; Feinberg et al., 2012), because of recent work linking coparenting quality with infant sleep (Voltaire et al., 2017).

Data Analytic Strategy

Data analyses were conducted using SPSS (Version 26.0; IBM Corp, 2019) with the PROCESS macro (Version 3.5; Hayes, 2013, 2018). PROCESS uses path analyses to create ordinary least squares regressions. All main study variables were treated as continuous variables.

First preliminary descriptive bivariate, Pearson correlations were conducted for primary study variables. Preliminary analyses also included one-way ANOVA tests between the three districts and primary study variables to account for possible clustering biases. Next, partial correlations, controlling for mothers' depressive symptoms and coparenting quality, were performed between the two sleep outcome variables (sleep duration and proportional recommended sleep duration) and SER variables including family resources and household income (hypothesis 1). Fisher's r-to-z transformation was used to determine significant differences in the correlations between family resources and household income and child sleep (Lee & Preacher, 2013; Steiger, 1980).

Second, PROCESS path analyses were conducted to include household chaos as a mediator between family resources and child sleep at W2 (hypothesis 2), and these analyses were conducted in predicting child sleep at W3 to determine if prediction differed at earlier versus later points in the transition to kindergarten (hypothesis 3). Figure 1 details the path models investigated in hypothesis 2 and

3 with Model A and B detailing earlier kindergarten transitions and model C and D showing mid-kindergarten sleep. Both the impact of family resources on

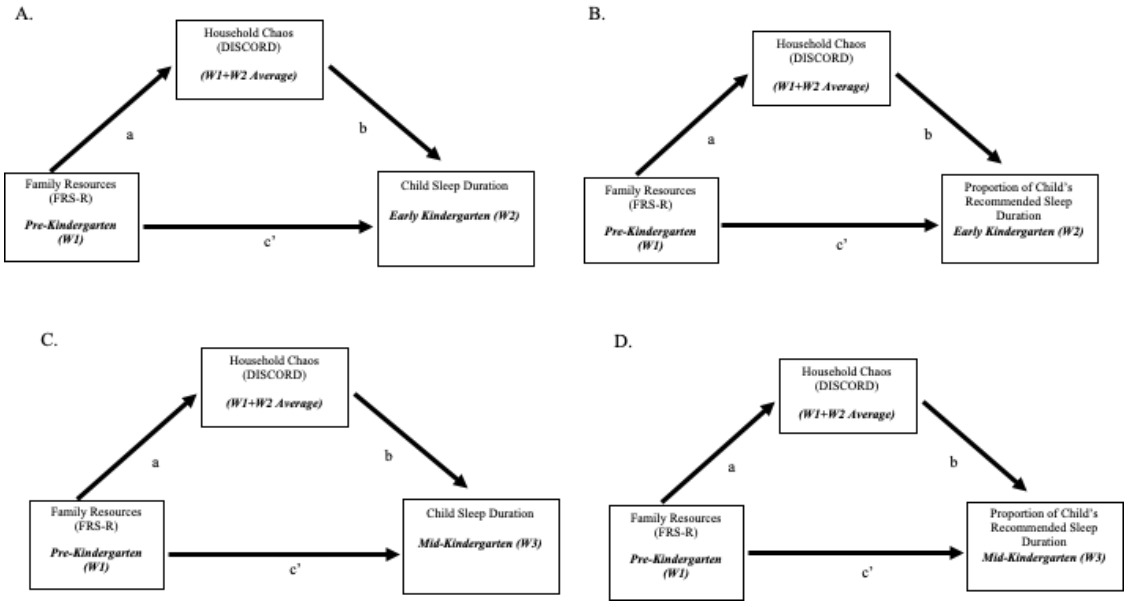


Figure **2-1**: Simple Mediation Model depicting FRS-R as a Predictor and DISCORD as a Mediator of Child Sleep During the Transition to Kindergarten

household chaos and the indirect effect of socioeconomic risk on child sleep via household chaos (ab, *see Figure 2-1*) were evaluated following Preacher and Hayes (2004) recommendations. The PROCESS program elaborates on this more rigorous indirect test by applying 10,000 bootstrap estimates and a 95% bias-corrected confidence intervals to the indirect effect significance estimation (Hayes, 2018), which helps to estimate if the indirect effects significantly differ from zero. PROCESS (Version 3.5; Hayes, 2018) used listwise deletion for all missing data. All PROCESS path analyses controlled for the two family variable covariates: mother-reported coparenting and mother-reported depressive symptoms.

Chapter 3

Results

Preliminary Analyses

Table 3-1 shows correlational analyses statistics between main study variables and covariates. Notably, all dependent sleep variables significantly correlated amongst each other (n=210 to 216, ps<.01) regardless of measurement Wave (early or mid-kindergarten) or whether sleep duration or proportion of optimal sleep was measured, indicating that if children experienced higher sleep durations in early kindergarten, they were likely to continue to experience higher sleep durations in mid-kindergarten.

Additionally, sleep variables correlated significantly with mother-perceived family resources (n=208 to 210, ps<.01) and household chaos (n=204 to 206, ps<.01). These correlations appear in the expected direction such that higher household chaos correlated with lower child sleep durations and higher resources were associated with higher sleep durations. Household chaos also significantly correlated with FRS-R (n=205, p<.01) such that higher family resources was associated with lower household chaos. These correlated pathways follow initial pathway (Hayes, 2018; Preacher & Hayes, 2004) justifications for mediation analyses. While FRS-R significantly correlated with each of the sleep outcome variables, household income only significantly correlated with proportions of optimal sleep at W2 (n=214, p<.05) and W3 (n=212, p<.01).

Mothers' coparenting experiences (n=199, p<.01) and depressive symptoms (n=214, p<.01) both significantly correlated with mother-perceived family resources such that higher depressive symptoms were associated with fewer perceived family resources and higher (more positive) coparenting experiences were linked to higher perceived family resources. Higher coparenting experiences significantly correlated with lower levels of household chaos (n=192,

Table **3-1**: Bivariate Pearson correlations of Main Study Variables

Variable	Sleep Duration (W2)	Sleep Duration (W3)	Proportion of Optimal Sleep (W2)	Proportion of Optimal Sleep (W3)	M Perceived Family Resources (W1)	Household Income (W1)	Household Chaos (W1 + W2 Average)	M Coparenting Experiences (W1)	M Depressive Symptoms (W1)
Sleep Duration (W2)	-								
Sleep Duration (W3)	0.56**	-							
Proportion of Optimal Sleep (W2)	0.77**	0.45**	-						
Proportion of Optimal Sleep (W3)	0.41**	0.79**	0.41**	-					
M Perceived Family Resources (W1)	0.24**	0.28**	0.30**	0.25**	-				
Household Income (W1)	0.11	0.12	0.15*	0.20**	0.43**	-			
Household Chaos (W1 + W2 Average)	-0.26**	-0.33**	-0.30**	-0.40**	-0.35**	-0.45**	-		
M Coparenting Experiences (W1)	0.04	0.08	0.20	0.09	0.29**	0.09	0.17*	-	
M Depressive Symptoms (W1)	-0.10	-0.12	-0.10	-0.14*	-0.34**	-0.17*	0.10	-018*	-

Note. W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (August/September); W3 = Mid-Kindergarten (November/December). M = Mother. *p <0.05 **p<0.01. Number of participants range from 192 to 217.

p<.05). Analyses confirmed that both mother depressive symptoms and coparenting experiences are justified as covariates.

Finally, one-way ANOVA analyses were conducted to ensure no differences amongst study variables existed for participants within the three school districts included in this study. None of the one-way ANOVA tests were significant. Further moderation probes revealed that district did not appear to impact results at a rate above chance levels. Therefore, district was no included as a covariate.

Hypothesis 1

Both socioeconomic risk variable zero-order correlations (*see Table 3-1*) and each sleep outcome variable were transformed with Fisher's r-to-z transformation (Lee & Preacher 2013). These scores, along with the zero-order correlation between pre-kindergarten household income and mother perceived FRS-R ($r(182)=0.43$, $p<.001$), were then used to calculate the asymptotic one-tail z-test (Steiger, 1980) as displayed in Table 3-2. Steiger's (1980) test revealed significant differences between all but one correlations among income and sleep outcomes and correlations among mother's perceived family

Table **3-2**: Asymptotic Z-Test scores of household income and family resources with study sleep variables following Fisher's r to z transformation

	Sleep Outcomes			
	Sleep Duration (W2	Sleep Duration (W3)	Proportion of Optimal Sleep (W2)	Proportion of Optimal Sleep (W3)
z-score	1.67*	2.08*	1.964*	0.65

Note. W2 = Early Kindergarten (August/September); W3 = Mid-Kindergarten (November/December). Z-scores calculated between the income and family resource correlations for each sleep outcome following Fisher's r-to-z transformation. z-score accounts for n of 184 and significant correlation between income and family resources (r(182)=.43, p<.01) with alpha=.05 and one-tail test. *p <.05

resources and sleep outcomes (*ps*<.05), supporting hypothesis 1 that associations between FRS-R scores and child sleep would be stronger than associations between household income and child sleep scores.

Next, partial correlations were calculated to further confirm whether mother perceived resources better connected to sleep outcome variables than income when accounting for family and individual variables. Table 3-3 details partial correlations between socioeconomic risk variables and sleep outcome variables, statistically controlling for mother's pre-kindergarten depressive symptoms and coparenting experiences were taken (*see Table 3-3*). While all correlations between mother's perceived family resources significantly correlated with each sleep variable (*see Table 3-3*), household income only significantly correlated with W3 mid-kindergarten proportion of optimal sleep. Significant correlations were in the expected direction such that increases in mother's perceived family resources corresponded with increased sleep durations and proportions of optimal sleep in both early and mid-kindergarten. Similarly, higher pre-kindergarten household income significantly correlated with higher proportions of child optimal sleep in mid-kindergarten. These results bolstered those found from Steiger's (1980) test, further supporting that household resources appeared to be better linked to child sleep outcomes than income.

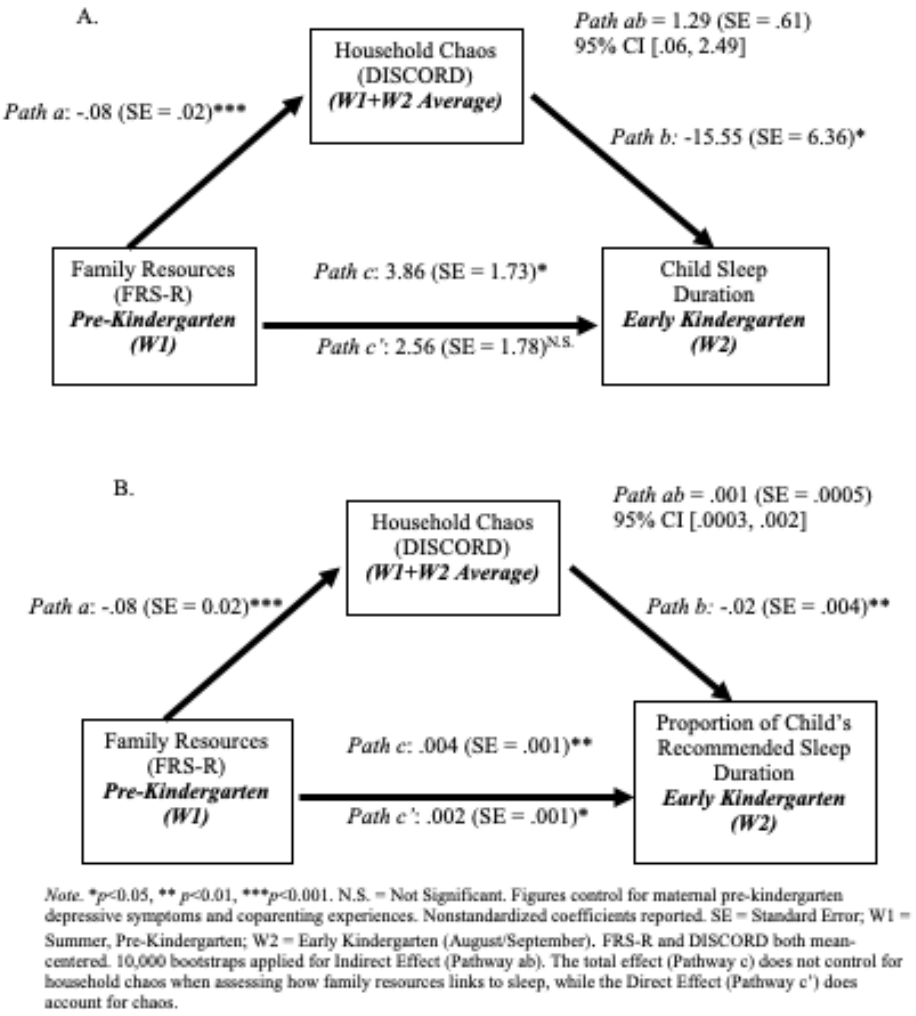
Table **3-3**: Partial Correlations between socioeconomic risk variables and sleep outcome variables controlling for pre-kindergarten maternal depressive symptoms and coparenting experiences

Socioeconomic Risk Variables	Sleep Outcomes			
	Sleep Duration (W2)	Sleep Duration (W3)	Proportion of Optimal Sleep (W2)	Proportion of Optimal Sleep (W3)
Mother's Perceived Family Resources (W1)	0.17*	0.22**	0.21**	0.18*
Household Income (W1)	0.06	0.07	0.10	0.18*
z-score	0.17	1.82	1.32	-0.10

Note. W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (August/September); W3 = Mid-Kindergarten (November/December). All correlations control for maternal pre-kindergarten depressive symptoms and coparenting experiences. Z-scores calculated between the two socioeconomic risk correlations for each sleep outcome following Fisher's r-to-z transformation. z-score accounts for n of 184 and significant correlation between income and family resources (r=0.35, p<0.001) with alpha=0.05 and two-tail test. *$p < .05$ **$p < .01$

Hypothesis 2

As detailed in Figure 3-1, a simple mediation tested if increased Family Resources leads to increased sleep duration (A) or increased proportion of child's recommendation sleep (B) through household chaos. As Figure 3-1A illustrates, the unstandardized regression coefficient between family resources and household chaos (path a) was significant ($t(186)=-4.18$, $p<.0001$), as was the unstandardized regression coefficient between household chaos and child sleep duration during early



Note. *$p<0.05$, ** $p<0.01$, ***$p<0.001$. N.S. = Not Significant. Figures control for maternal pre-kindergarten depressive symptoms and coparenting experiences. Nonstandardized coefficients reported. SE = Standard Error; W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (August/September). FRS-R and DISCORD both mean-centered. 10,000 bootstraps applied for Indirect Effect (Pathway ab). The total effect (Pathway c) does not control for household chaos when assessing how family resources links to sleep, while the Direct Effect (Pathway c') does account for chaos.

Figure **3-1**: Mediation Models depicting FRS-R as a Predictor and DISCORD as a Mediator of Child Sleep During Early Kindergarten

kindergarten in Wave 2 (path b; $t(186)=-2.44$, $p< .05$). Figure 3-1B shows the unstandardized regression coefficient between family resources and household chaos (path a) was significant ($t(186)=-4.18$, $p<.0001$), as was the unstandardized regression coefficient between household chaos and the proportion of child's recommended sleep proportion in Wave 2 (path b; $t(186)=-2.91$, $p<.01$).

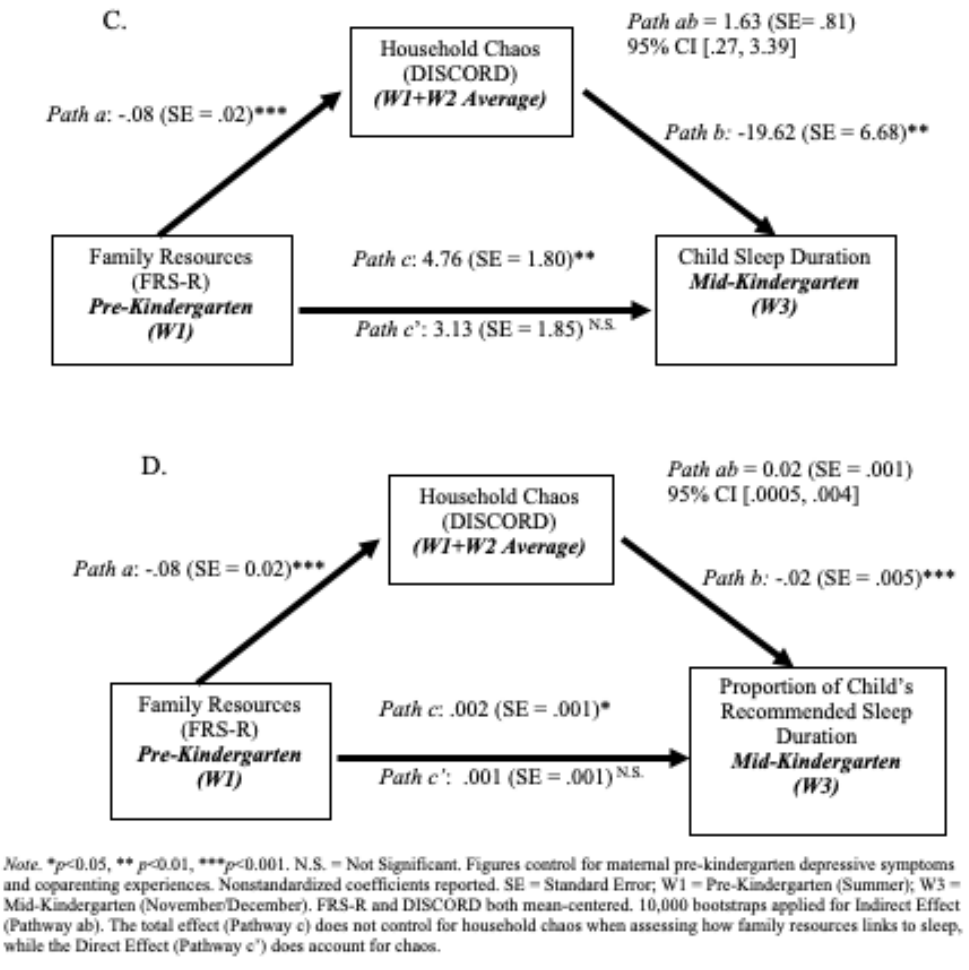
Unstandardized indirect pathways were computed for each of the 10,000 bootstrapped sample, with an alpha of 95%. The indirect pathway was significant for both early kindergarten sleep outcomes, supporting the hypothesis that household chaos would mediate the link between perceived family resources and early-kindergarten child sleep duration ($B = 1.29$, $SE = .61$, 95% CI [.06 , 2.49]) and proportion of children's recommended sleep duration ($B = .001$, $SE = .0005$, 95% CI [.0003 , .002]). All PROCESS path analyses controlled for the two family variable covariates: mother-reported coparenting and mother-reported depressive symptoms.

Both Figure 3-1A and 3-1B, detail the total pathway (path c), which does not control for household chaos. The direct pathway (path c') indicates the link between family resources and sleep, when household chaos is accounted for in the model. In Figure 3-1B, the c' pathway between family resources and the proportion of child's recommended sleep proportion in Wave 2 was also significant ($t(186)=2.09$, $p<.05$) suggesting partial mediation. In Figure 3-1A, the c' pathway is not significant indicating full mediation as household chaos has accounted for the initial link between family resources and early sleep duration.

Hypothesis 3

Results for simple mediation looking at mid-kindergarten sleep duration and proportion of recommend sleep did not differ greatly than results for early-kindergarten sleep. As Figure 3-2C illustrates, the unstandardized regression coefficient between family resources and household chaos (path a) was significant ($t(184)=-4.23$, $p<.0001$), as was the unstandardized regression coefficient between

household chaos and child sleep duration during mid-kindergarten in Wave 3 (path b; $t(184)=-2.94$, $p<.01$). Figure 3-2D shows the unstandardized regression coefficient between family resources and household chaos (path a) was significant ($t(184)=-4.23$, $p<.0001$), as was the unstandardized regression coefficient between household chaos and the proportion of child's recommended sleep in Wave 3 (path b; $t(184)=-4.52$, $p<.0001$).



Note. *$p<0.05$, ** $p<0.01$, ***$p<0.001$. N.S. = Not Significant. Figures control for maternal pre-kindergarten depressive symptoms and coparenting experiences. Nonstandardized coefficients reported. SE = Standard Error; W1 = Pre-Kindergarten (Summer); W3 = Mid-Kindergarten (November/December). FRS-R and DISCORD both mean-centered. 10,000 bootstraps applied for Indirect Effect (Pathway ab). The total effect (Pathway c) does not control for household chaos when assessing how family resources links to sleep, while the Direct Effect (Pathway c') does account for chaos.

Figure **3-2**: Mediation Models depicting FRS-R as a Predictor and DISCORD as a Mediator of Child Sleep During Mid-Kindergarten

Similar to results obtained in predicting child sleep in the early transition to kindergarten. unstandardized indirect pathways were computed for each of the 10,000 bootstrapped sample with a 95% confidence interval. The indirect pathway was significant for both mid-kindergarten sleep outcomes,

supporting household chaos as a mediator of the link between perceived family resources and mid-kindergarten child sleep duration (*B* = 1.63, *SE* = .81, *95% CI* [.27 , 3.39]) and proportion of children's recommended sleep duration (*B* = .002, *SE* = .0009, *95% CI* [.0005, .004]). Similar to above, all models controlled for mother-reported coparenting and mother-reported depressive symptoms.

Notably, neither the c' pathway in Figure 3-2D, between family resources and the proportion of child's recommended sleep proportion in Wave 3 nor in Figure 3-2C between family resources and child sleep duration in Wave 3 was significant. Both models demonstrated full-mediation, a slight departure from the findings in Figure 3-1B which showed only partial mediation for the path between family resources and child sleep duration.

Chapter 4

Discussion

While socioeconomic differences have long been touted as predictors of child health, understanding how underlying mechanisms, like household chaos, influence health outcomes are less understood. Child sleep duration and consistency has pervasive impacts on child development. The findings from the current study support household chaos as a mechanism through which family resources predict child sleep during the transition to kindergarten. Uniquely, this study also assessed two measures of child sleep duration – mean child sleep duration over a week and proportion of nights children received optimal sleep duration during a week (9+ hours/day). Results supported the hypothesis that family resources would be a stronger predictor of child sleep than a marker indicator of socioeconomic risk (income). Results also supported the hypothesis that household chaos would mediate the link between family resources and child sleep. It did not seem to matter whether this link was examined for child sleep in early versus mid-kindergarten.

This study first explored whether income, a marker variable of SER, or family resources was more clearly linked to child sleep. Previous research has cautioned against income as the sole predictor for household risk (Hauser, 1994) and that family resources more veridically captures their ability to meet financial and familial obligations and receive social supports (Dunst & Leet, 1987). This study hypothesized that family resources would be more clearly linked to child sleep outcomes compared to household income. Results supported this hypothesis such that family resources were more significantly associated with child sleep than household income in all but one instance. There were no distinctive difference between income and family resources and the proportion of child sleep in mid-kindergarten. However, findings did present significant differences between child family resources and income for proportion of child optimal sleep in early kindergarten and for sleep duration at both times. These

findings suggest that mother's overall perceived resources, which may better relate to the family's lived-experience, more clearly link to child sleep durations and proportions of sleep.

Second, the present study found evidence for the hypothesis that household chaos is an important intervening variable that accounts for the link between family resources and child sleep outcomes in early kindergarten. To our knowledge, this is the first study to demonstrate that household chaos is a viable intervening mechanism between perceived family resources and kindergarten-aged child sleep outcomes. Prior research suggested that environmental chaos may disrupts proximal processes in early childhood development (Bronfenbrenner & Morris, 1997; Evans et al., 2005). Such findings are in line with recent research (Philbrook et al., 2020) that have linked higher levels family chaos as an intervening variable between parent perceived economic wellbeing and adolescent sleep quality.

Finally, the present study demonstrated that household chaos continued to mediate linkages between family resources and child sleep in middle-kindergarten. Following family systems perspectives, normal household routines, a component of household chaos, may be more disrupted in the initial phase of a family transition (Minuchin, 1985) (in this case, the initial transition to kindergarten), and thus it was important to demonstrate that household chaos continued to be a viable mediator of links between family resource and child sleep following the initial transition. Ultimately, findings did not differ greatly between early and middle-kindergarten. One small deviation was that full mediation was found for proportion of child optimal sleep in middle kindergarten compared to partial mediation found in early kindergarten. All mediation results were in the expected direction, such that higher numbers of household resources led to decreased household chaos, and higher amounts of household chaos predicted less sleep in both early and middle kindergarten.

The transition to kindergarten is a unique shift in child development, where children have their first foray into an institutionalized organization: education. How children learn to react to and manage school demands and routines early on influence their later-school experience (Athanasiou, 2006). In order to set children up for success, it is important to understand how aspects of this transition may influence

child experience. Sleep is a necessary biological imperative, linked to student academic success (El-Sheikh et al., 2007; Hafner et al., 2017) as well as multiple health outcomes (Al-Sharman & Siengsukon, 2014; El-Sheikh et al., 2010; Hornby & Holleran, 2014; Kronholm et al., 2011; Krueger & Friedman, 2009; O'Brien & Gozal, 2004), and merits consideration during such a unique transition.

This study has drawn attention to household chaos as a link between family situations and sleep. Kindergarten demands, replete with consistent daily routines and ordered teacher-student interactions, may be more difficult for students to manage who hail from higher chaos environments. Importantly, household chaos is amenable to change through family routines (Evans et al, 2010), meaning that parents and professionals can intervene prior to kindergarten-entry to allow for a smoother transition.

These findings suggest that interventions addressing kindergarten transitions may focus on both parent and child bedtime routines and sleep hygiene, as a way to support child sleep. As child sleep is imbedded in a larger family ecological context, future research should address additional parent and family-level contexts when attempting to influence child sleep. Lally et al. (2010) suggested that it takes adults an average of 66 days to ingrain a new habit, providing some evidence that sleep hygiene and routine-formation interventions would need to begin at least two-months prior to the beginning of kindergarten, if not earlier.

The present study has several strengths. Two of the main study variables derived from observational assessment (household chaos) and objective actigraph assessments (child sleep outcomes) rather than self-report measures. Thus, the associations found between family resources, household chaos, and child sleep could not be attributed to shared method variance. Further, data were assessed through longitudinal design allowing for better opportunity to capture pathways of influence between resources, chaos, and sleep. Family resource assessments were made using the FRS-R, a process-oriented, ecologically valid measure of socioeconomic risk (Dunst & Leet, 1987, Van Horn et al., 2001), which analyses found to be a more robust predictor of child sleep than household income, a marker variable. Additionally, inclusion of family and individual mother control variables helped to rule out alternative

explanations and reinforce the robustness of the mediational models tested in the present study. Finally, this study assessed two types of sleep outcomes as a further test and ultimate demonstration of the robustness of the mediational models under study.

The present study has several limitations. First, non-completers were more likely to have higher household chaos, greater child sleep variability, and lower family resources. Thus, the present results were most applicable to better resourced and less chaotic, less volatile families. Second, the majority of this sample hailed from primarily white, middle-class families, although annual incomes varied widely across the sample. At the same time, Philbrook et al. (2020), whose sample consisted of primarily disadvantaged and low-resourced families, similarly found that household chaos mediated the link between perceived family economic well-being and adolescent sleep outcomes. This suggests that despite differences in level of family resources and child age, household chaos is emerging as a robust explanatory construct that links socioeconomic resources with child sleep. While more work needs to be done, chaos theory suggests that chaos generally has a negative impact on human functioning (Deater-Deckard, 2014; Wachs & Evans, 2010; Whitesell et al., 2015), such that it may generalize across different economic and ethnic groups.

Overall, this study provides support for household chaos as mechanism by which perceived family resources, a metric of socioeconomic risk, influences child sleep during the transition to kindergarten. These findings further highlight a need for family routine and organization as a potential method for improving kindergartener sleep and, ultimately, quality of adjustment to kindergarten.

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