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HOUSEHOLD CHAOS MEDIATES THE LINK BETWEEN FAMILY RESOURCES AND CHILD SLEEP

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Abstract

Purpose.—This study examined the mediational role of household chaos in the link between family resources and child sleep outcomes during the transition to kindergarten.

Procedures.—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 prekindergarten, mothers completed the Family Resources Scale-Revised (FRS-R; Van Horn et al., 2001), while at pre- and early-kindergarten, trained observers assessed household chaos using the Descriptive In-Home Survey of Chaos-Observer ReporteD (DISCORD; Whitesell et al., 2015). To better understand perturbations in child sleep during this transition, actiwatches (AW Spectrum Plus, Philips/Respironics, Murrysville, PA) were used to measure both child sleep duration and proportion of recommended sleep duration (9+ hours per night; Paruthi et al., 2016) at early- and mid-kindergarten.

Main Findings.—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 mediated the link between family resources and child sleep duration at both early and mid-kindergarten, the link between family resources and the proportion of recommended sleep duration in mid-kindergarten, and the change in proportion of recommended sleep from pre-kindergarten to early-kindergarten.

Conclusions.—Findings highlight household chaos as a mechanism by which family resources, a metric of socioeconomic risk, influences child sleep during the transition to kindergarten.

Keywords

Family resources; household chaos; sleep; kindergarten; transition; socioeconomic risk

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Declaration of Competing Interest

The authors have no known conflicts to declare.

Introduction

Sleep matters, especially for young children. Higher sleep duration has been found to promote learning and memory consolidation (Al-Sharman & Siengsukon, 2014), mental and physical health (El-Sheikh et al., 2010; Krueger & Friedman, 2009), and positive academic outcomes (El-Sheikh et al., 2007; Hafner et al., 2017). Emerging research reviewed by the American Academy of Sleep Medicine (Paruthi et al., 2016) suggests that nighttime sleep that is less than 9 hours for children of kindergarten age is linked to Body Mass Indexes (BMIs) outside of the normal range (Li et al., 2010), increased unhealthy eating habits (Córdova et al., 2018), and decreased cognitive-functioning at school-entry (Touchette et al., 2007).

Sleep is complexly determined. Sadeh and Anders' transactional/ecological model (1993) suggests that sleep is imbedded in a broader ecological context and can be examined from "distal" and "proximal" levels of influence. The present study is concerned with one particular "distal" 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). 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.

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; Philbrook et al., 2020) and higher household chaos with poor child sleep (Berger et al., 2019; Whitesell et al., 2015). Household chaos is conceptualized in terms of poor physical and temporal organization of the home and has been operationally defined in terms of excess noise, clutter, disarray, and lack of routines. Under-resourced families typically find themselves living in more disorganized, unpredictable environments (Ackerman & Brown, Fuller-Rowell et al., 2015), which can impact parents' ability to maintain order and routine in the home (Seaton & Taylor, 2003), with negative consequences for individual and family processes and child development (Wachs & Evans, 2010). Evidence is growing that well-established family 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 (Whitesell et al., 2018).

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

The transition to kindergarten sets the foundation for later academic achievement. Kindergarteners' social skills and task orientation (Caemmerer & Keith, 2015; Fitzpatrick & Pagani, 2013) and foundational learnings in basic academic domains in kindergarten are predictive of later educational gains (Kurdek & Sinclair, 2001; Saçkes et al., 2011). This transition can be negatively impacted, however, when children aren't receiving enough sleep as sleep disturbances in young children have consequential impacts on academic domains (Ravid et al., 2009; Quach et al., 2009).

To date, no published studies exist that explore the inter-linkages between family resources, household chaos, and sleep among children making their first foray into formal schooling. In addressing this, we made use of two separate objective assessments of child sleep duration, one using an overall weekly mean sleep duration, and another 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 present study also is unique in its focus on prediction of child sleep across short-term (July/August to September/October) and longer-term transitions (July/August to November/December) into the kindergarten year.

The following hypotheses were addressed:

H1: Family resources would be more clearly linked with child sleep during the transition to kindergarten than a more traditional index of socioeconomic risk (family income). Family resources are 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 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 American Academy of Sleep Medicine (AASM) recommendations (Paruthi et al., 2016) for adequate sleep (9 hours/night) for children at kindergarten-age.

H3: We wished to examine whether the mediated linkages between socioeconomic risk and child sleep by household chaos were as evident later in the transition to kindergarten (July/August to November/December) as earlier in the transition (July/August to **September/October).** We regarded this hypothesis as exploratory. On the one hand, such linkages may be more evident during the immediate transition to kindergarten than later, because of expectations that the impact of the transition would be more acutely felt earlier than later. On the other hand, because greater perturbations (and possible random "noise") in the family system were expected earlier in the transition (Minuchin, 1985), such linkages may be less readily detected earlier than later, when any earlier perturbations have resolved.

H4: Change in sleep from pre-Kindergarten (July) to early kindergarten (September/October) was also expected to be predicted by family resources and household chaos. Hypotheses 1 through 3 focused on overall sleep levels but not actual changes in sleep during the transition to kindergarten. Given expectations that perturbations in the family system, and children's responses to such perturbations are more likely to be observed earlier than the transition than later, this question was examined during that initial kindergarten transition (July/August to September/October).

Method

Participants

This study was approved by the Internal Review Board of the Pennsylvania State University Office for the Protection of Human Subjects, and was done with informed consent. Subjects were 230 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). Families were recruited during the springtime prior to the fall start of kindergarten and had their first home visit (Wave 1) in July/August prior to the fall kindergarten start. Mother-reported demographic data obtained at this visit identified the study sample primarily identified as "white", reasonably well-resourced, and composed of roughly equal male and female children across 11 schools in three school districts. Table 1 further details sample demographics.

Measures

Family Resources.—The present study indexed socioeconomic risk using a well-established 20-item measure of family resources (the Family Resource Scale-Revised; FRS-R; Van Horn et al., 2001), completed by mothers and assessed at W1. The FRS-R taps into parents' perceptions of basic needs, time for self, time for family, and money. Each item employs a 5-point Likert scale ranging from (5) almost always adequate to (1) not at all adequate, with higher scores indicating more resources and thus lower socioeconomic risk. Internal reliability of mothers' FRS-R composite score in the present study 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 assessed by trained observers at each Wave (Summer, September/October, November/December, and April/May during kindergarten). The DISCORD includes 11 items, rated on a 1-to-3-point scale) that tapped the physical organization of the home, parents' ability to manage intrusions, and each parent's adherence to study protocol – with a total of 11 items, each rated by one of four observers on a scale of 1, 2, or 3 with a maximum score of 33. Inter-rater reliability (interclass correlation, ICC, absolute agreement) was greater than 0.80 between all raters across a total of 82 household observations. In addition, internal reliability of the DISCORD was adequate at both W1 and W2 (alphas = 0.72, 0.67) and also highly stable across waves 1 and 2 (rs>0.69, ps<.0001). Given this high stability, a mean DISCORD score for each family was computed and used for analyses.

Sleep-Wake Activity

Child sleep/wake activity was gauged every day over the course of seven consecutive days at each timepoint using actigraphy (using a 30-second sampling window with medium activity sensitivity). Mothers also completed a daily sleep diary (adapted from Burnham et al., 2002) across every morning of data collection, noting when the child was put down to sleep, any night awakenings, and when the child woke up the next morning. This diary provided a cross-check with actigraph records to confirm child sleep onset and offset at both times. Sleep data were scored using the Actiware Philips Respironics software (version 6.0.9). Night sleep was scored using the Sadeh algorithm (Sadeh et al., 1991), which identified sleep onset as the first of three minutes of consecutive sleep after the parent-reported sleep start time and sleep end as the last of five minutes of consecutive sleep after the parent-reported wake time.

Sleep Duration.—A mean nighttime sleep duration, averaged across the week of data collection at each wave, was then calculated for each child. Children that had fewer than four nights of usable actigraph data were considered missing for that data collection Wave. At W1 and W2, only three children were excluded for having less than 4-days' worth of data. At W3, two children were excluded from analysis.

Proportion of Recommended Sleep Duration.—A proportion of nights the child slept at least 9 hours (540 minutes) at each Wave was calculated by summing the total number of days that had a minimum of 540 minutes and dividing that sum 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.

General Procedure

Families were approached at kindergarten registration across three suburban public-school districts (March-June of the year prior to Fall kindergarten entry) based in Southeastern Pennsylvania with data collection taking place across four years (four cohorts). A stratified recruitment method was applied such that families were recruited proportionate to school district population.

Trained project staff conducted week-long (8 days or 7 nights) assessments across the kindergarten year for each family, at each data collection wave, with 30 to 76 families assessed per wave at each of four consecutive cohorts. The first wave (W1) took place in July or August (prekindergarten home visit). 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 mid-November or early-December (mid-transition), and the fourth wave (W4) in March-May (late transition). Assessments were not conducted during any week encompassing daylight saving time or Thanksgiving break. Of the total 230 families recruited, 225 families participated at W1, 221 at W2, and 220 at W3. One-way analysis of variance (ANOVA) comparing study dropouts with those who remained did not reveal significant differences between children who left the study (n=10) and those who remained in through Wave 3 (n=220), with the exception that children who left the study

were more likely to have mothers with higher depressive symptoms at pre-kindergarten ($F(1,215)=10.46$, $p<.01$).

During each wave, project staff conducted two 15-to-30-minute home visits and had daily phone contact with each parent during the 8-day period. On the first day of each wave (Saturday) the focal child received a Respironics Actiwatch (model Spectrum Plus) and was asked to wear the watch continuously during the full week. The actiwatch was retrieved on the 8th day of data collection (Saturday).

Project staff identified whether 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.

Covariates.—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 well-established 21-item Beck Depression Inventory (BDI; Beck et al., 1961) at W1, which previously has been linked to child sleep (Teti & Crosby, 2012). Each item is scored on a 0-to-3 point Likert-type scale, with scores potentially ranging from 0 to 63. Scores from 0 to 9 are considered to have minimal depressive symptoms; scores from 10 to 18 indicate mild to moderate depression; scores from 19 to 29 indicate moderate to severe depression; and scores from 30 to 63 indicate severe depression (Beck et al., 1988). As expected, the present sample was largely nondepressed, with 76.5% of mothers scored between 0 and 9; 13.8% between 10 and 18; 7.9% between 19 and 29; and 1.8% between 30 and 63. The second covariate was mother-reported coparenting experiences at W1, using the 35-item Coparenting Relationship Scale (CRS; Feinberg et al., 2012), because of recent work linking coparenting quality with infant sleep (Voltaire et al., 2017). The CRS assesses parent perceptions of the quality of their coparenting relationship and comprises 35 items rated across a 7-point Likert scale. Feinberg et al. (2012) reported strong internal and test-retest reliability and construct validity of the CRS. In the present study, internal reliability of mothers' FRS-R composite score was high (alpha = 0.85).

Results

Preliminary Analyses

Means and standard deviations for the main study variables are presented in Table 2. Table 3 shows correlational analyses statistics between main study variables and covariates. Notably, all dependent sleep variables were significantly intercorrelated, regardless of measurement wave or whether sleep duration or proportion of recommended sleep was measured, indicating some stability in children's sleep duration across waves. Child sleep variables, family resources, and household chaos intercorrelated significantly in expected directions, and collectively, these correlated pathways met initial pathway (Hayes, 2018) justifications for mediation analyses.

In addition, mothers' coparenting experiences and depressive symptoms showed sufficient covariance with family resources and household chaos to justify their use as covariates in analyses. Finally, one-way ANOVA analyses indicates no differences in study measure between the three school districts, and moderation probes revealed that district did not appear to impact results at a rate above chance levels. Therefore, district was not included as a covariate.

Hypothesis 1: Comparison between Family Resources and Income

Lee and Preacher's (2013) calculation for the test of difference between two dependent correlations with one variable in common was utilized to compare correlation matrix results presented in Table 3 and determine whether household resources or income better linked to child sleep outcomes. This calculation employs Fisher's r-to-z transformation to transform the Pearson *r*s, presented in Table 3, to a standardized "z-score" and utilizes Steiger's (1980) equations to compute asymptotic covariances amongst the correlations of household resources and sleep and household income and sleep. Resulting Z-scores, which consider the shared variance between household income and household chaos, provides a test of equality between two correlation coefficients from the same sample with one variable in common. Z-scores greater than 1.65 are considered significant for a one-tailed test and indicate that there is a significant difference between the magnitude of correlations between family resources and sleep variables and household income and sleep variables. Indeed, family resources correlated significantly more strongly with three out of four child sleep outcomes than household income: W2 sleep duration (Z=1.74, p=.04), W3 sleep duration (Z=2.02, p=.02), W2 proportion of recommended sleep (Z=2.01, p=.02), and W3 proportion of recommended sleep (Z=.54, p=.30).

Hypothesis 2: Simple Mediation of Family Resources by Household Chaos on Early-Kindergarten Sleep

As detailed in Figure 1, simple mediational analyses, using the PROCESS macro (Version 3.5; Hayes, 2018), was performed to test if higher family resources predicted longer sleep durations (A) or higher proportions of child recommendation sleep (B) through household chaos. As Figure 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 kindergarten in Wave 2 (path b; t(186)=−2.44, p< .05). Figure 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 proportion of child's recommended sleep in Wave 2 (path b; t(186)= − 2.91, p<.01).

Both Figure 1A and 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 between family resources and the proportion of child's recommended sleep in Wave 2 was significant (t(186)=2.09, p<.05) and reduced in estimate size (from .004 to .002), suggesting partial mediation. In Figure 1A, the c' pathway was not significant indicating full

mediation as household chaos has accounted for the initial link between family resources and early sleep duration.

Unstandardized indirect pathways were then computed for each of 10,000 bootstrapped samples, with confidence interval of 95%. The indirect pathway was significant for both early kindergarten sleep outcomes, supporting the hypothesis that household chaos would mediate the link between 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 path analyses controlled for the two family variable covariates: mother-reported coparenting and mother-reported depressive symptoms.

Hypothesis 3: Simple Mediation of Family Resources by Household Chaos on Mid-Kindergarten Sleep

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 2A 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 2B 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; $t(184)=-4.52$, $p<.0001$).

Subsequent unstandardized indirect pathways, computed for each of 10,000 bootstrapped samples (95% confidence interval) indicated the indirect pathway to be significant for both mid-kindergarten sleep outcomes, again supporting household chaos as a mediator between family resources and child sleep duration (*B* = 1.63, *SE* = .81, *95% CI* [.27 , 3.39]) and between family resources and proportion of children's recommended sleep duration (*B* = .002, *SE* = .0009, *95% CI* [.0005, .004]).

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

Hypothesis 4: Simple Mediation of Family Resources by Household Chaos on Early Kindergarten Sleep Change

To test this hypothesis, one-way repeated-measures ANOVAs were first conducted between Pre-Kindergarten (Wave 1) and early-kindergarten sleep outcomes (Wave 2) to determine if overall change occurred in child sleep between W1 and W2. Analyses revealed no significant change for child sleep duration ($F(11,201) = 2.11$, $p>.05$) but did find that the proportion of child's recommended sleep (9 or more hours/night) from W1 to W2 changed significantly, ($F(13,199) = 4.26$, $p<.001$). Examination of means indicated that the

proportion of nights children were sleeping 9 or more hours increased from W1 (*M*=.79, *SD*=.23) to W2 (*M*=.86, *SD*=.20).

Simple mediational analyses were then conducted to test whether household chaos levels mediated this change. Residualized change in this analysis was examined by statistically controlling for W1 proportions of recommended sleep. As Figure 3 illustrates, the unstandardized regression coefficient between family resources and household chaos (path a) was significant ($t(180)=-3.95$, $p<.001$). Also significant was the unstandardized regression coefficients between household chaos and W1-to-W2 change in proportion of child's recommended sleep (path b) ($t(179)=-2.35$, $p<.05$) and between family resources and W1-to-W2 change in child sleep (path c) ($t(180)=2.54$, $p<.05$). Importantly, when household chaos was statistically controlled, the predictive association between family resources and residualized change in children's proportions of recommended sleep was no longer significant (path c'). Subsequent bootstrapping analyses indicated full mediation of the mediated pathway, ($B = .0008$, $SE = .0005$, 95% *CI* [.0001, 0018]). These analyses revealed that children in poorly-resourced families showed less positive change in proportion of child's recommended sleep than children in better-resourced families; and that such change was fully mediated by household chaos. Controlling for household chaos in this mediation model, family resources no longer predicted change in proportion of child sleep during kindergarten ($t(179)=1.81$, $p>.05$).

Analyses for hypothesis 1 through 4 were repeated with two additional covariates as an additional test of robustness. These variables included whether children were enrolled in an early learning program prior to kindergarten, which may have implications for home routines and family organization prior to kindergarten, and the length of time for each child between data collection waves. Such timing addresses potential seasonal variability in overall daylight exposure between data points. Inclusion of these covariates did not alter overall findings and all mediational pathways remained significant.

Discussion

To our knowledge, the present study is the first to demonstrate that household chaos is a viable mechanism accounting for the impact of environmental risk on child sleep during the transition to kindergarten. These findings are in line with recent research (Philbrook et al., 2020) on older children, linking higher levels family chaos as an intervening variable between family economic wellbeing and adolescent sleep quality. Sleep is a biological imperative and linked to student academic success (El-Sheikh et al., 2007; Hafner et al., 2017). Reducing household chaos, and thus promoting better sleep in children making the transition to kindergarten, represents an important intervention goal, perhaps particularly for children from under-resourced environments who are at particular risk for poor sleep and, in turn, a more challenging transition to formal schooling.

Of interest in the present study was the finding of an increase in the proportion of nights per week that children experienced nine or more hours of sleep during the initial transition to kindergarten (W1 to W2). This may be the result of an overall initial effort by parents to promote earlier bedtimes in their children when they first transition to kindergarten.

Importantly, however, results found that household chaos mediated connections between family resources and residualized change in the proportion of recommended child sleep in early kindergarten. While no similar findings appeared for change in sleep duration, it appears that children's adherence to a nightly schedule of sleeping at least 9 hours a night sleep was negatively impacted by household chaos. Whereas overall sleep duration maintained some continuity during the transition to kindergarten, proportion of recommended sleep did not. This finding demonstrates that household chaos may stand as an important predictor for whether parents are able to promote for their children transitioning to kindergarten a consistent minimum of 9 hours of sleep from night-to-night as matches the American Academy of Sleep Medicine (AASM) recommendations (Paruthi et al., 2016) for adequate sleep for children at kindergarten-age.

The present findings have several implications for future kindergarten transition interventions and studies. Future research should consider including both parent and child bedtime routines and sleep hygiene as well as family-level household chaos reduction, to support child sleep. As child sleep is imbedded in a larger family ecological context (Sadeh & Anders, 1993), future research can 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. Such an intervention with intent to mirror upcoming school schedules may be provided to parents during kindergarten registration, which typically occurs the Spring before kindergarten attendance.

Notably, most pre-kindergarten families have some form of bedtime routine prior to kindergarten (Hale et al., 2009; Mindell & Williamson, 2018). While these bedtime routines may exist, the quality behind such routines is unknown and whether routines adhere to good sleep hygiene or supports that are promotive of sleep gains. Interventions currently focused on promoting pre-kindergarten child and family bedtime routines (e.g. Leichman et al., 2020) may consider including a component on household chaos reduction, an environmental aspect that influences the whole family, beyond individual and collective routines. There is also wide interpretation of what composes a good bedtime routine. For some families, bedtime routines may comprise of the barebones, maneuvering a child into a bedroom and turning off the lights. For other families, quality bedtime routines include consistent and predicable activities repeated nightly and may include several adaptive activities that incorporate positive parent-child interactions and strategies to help down-regulate children's arousal in preparation for sleep (Mindell & Williamson, 2018). Clear family guidelines that describe quality routines as well as reduced household chaos should be developed and shared widely.

This study also 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). Results supported the hypothesis that family resources would be more clearly associated with child sleep than household income, thus suggesting that mothers'

overall perceived resources tie more directly to the family's lived-experience and in turn to child sleep.

The present study has several strengths. Two of the main study variables derived from observational assessment (household chaos) and objective actigraphy 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. Analyses also stood up when seasonal shifts and pre-kindergarten early learning program attendance were considered. 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.

At the same time, the present study has several limitations. Data analysis used the PROCESS macro in SPSS, which uses listwise deletion, excluded a total 28 families from data analysis. In addition, the demographic nature of the sample raises generalizability concerns, although Philbrook et al. (2020), whose sample consisted primarily of disadvantaged and lowresourced 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, the impact of household chaos on child sleep may transcend socioeconomic resources, although clearly more work is needed in this area. Lastly, and importantly, the present study does not address how prekindergarten and kindergarten bedtime routines and good sleep hygiene for children at kindergarten age may already be interacting with household chaos, conceptualized here as a "distal", family-level influence on child sleep. Indeed, studies that examine the manner in which distal ecological factors impact more proximal, in-the-moment family processes are rare. We hope the present study stimulates research in this area.

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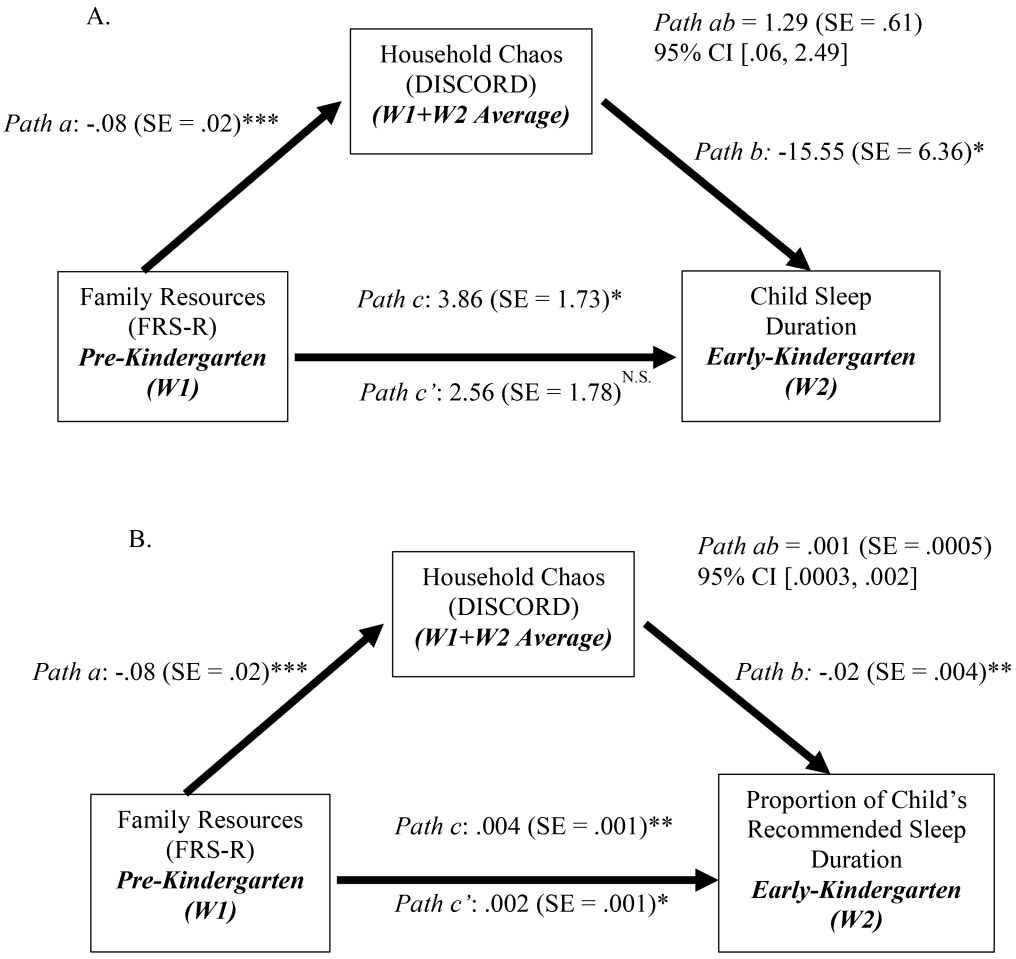

Figure 1:

Mediation Models depicting FRS-R as a Predictor and DISCORD as a Mediator of Child Sleep During Early-Kindergarten

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. Child sleep duration utilizes weekly sleep minutes. SE = Standard Error; W1 = Summer, PreKindergarten; W2 = Early Kindergarten (August/September). FRS-R and DISCORD are 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.

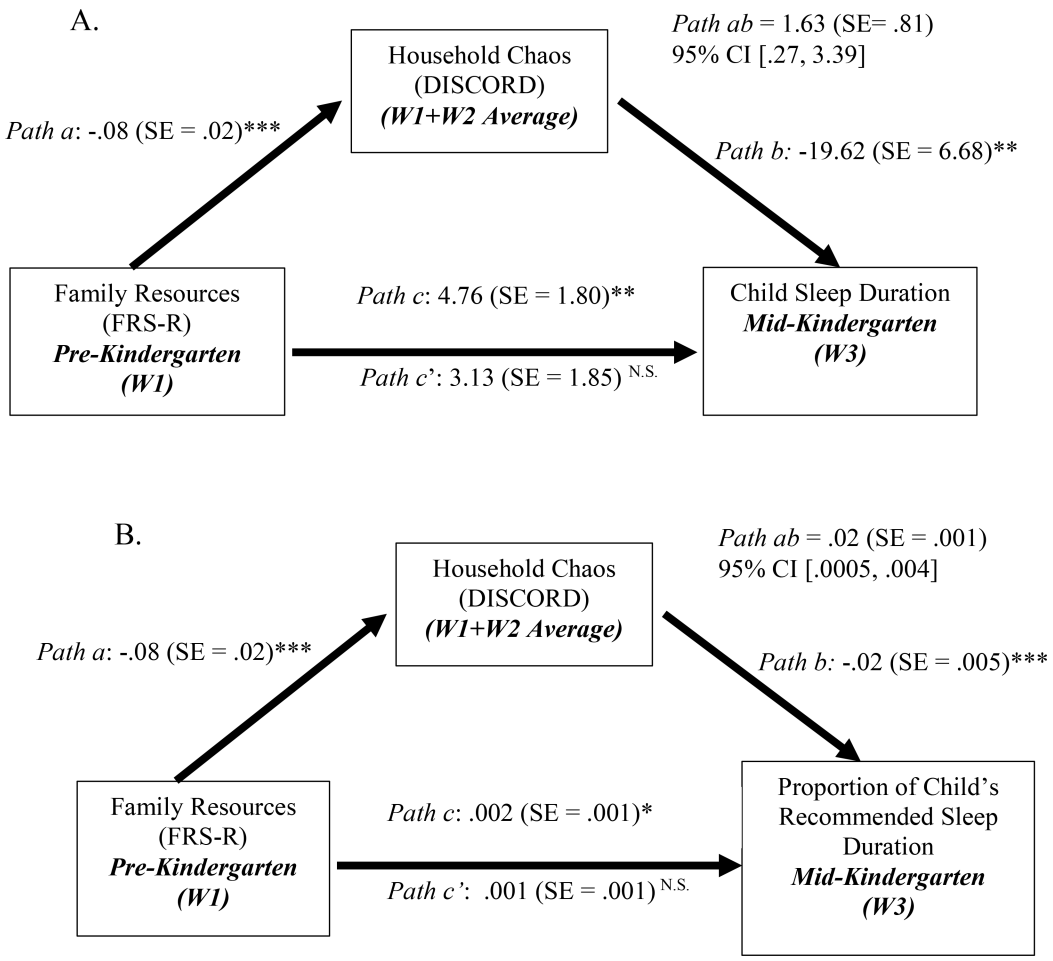

Figure 2:

Mediation Models depicting FRS-R as a Predictor and DISCORD as a Mediator of Child Sleep During Mid-Kindergarten

Note. *p<.05, ** p<.01, ***p<.001. N.S. = Not Significant. Figures control for maternal pre-kindergarten depressive symptoms and coparenting experiences. Nonstandardized coefficients reported. Child sleep duration utilizes weekly sleep minutes. SE = Standard Error; W1 = PreKindergarten (Summer); W2 = Early Kindergarten (August/September).W3 = Mid-Kindergarten (November/December). FRS-R and DISCORD are 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.

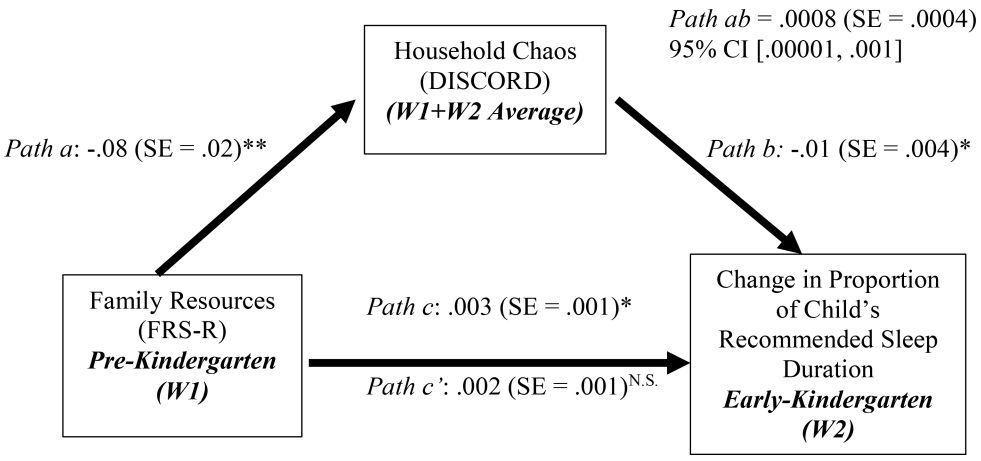

Figure 3:

Mediation Models depicting FRS-R as a Predictor and DISCORD as a Mediator of Residualized Change in Child Sleep During Early-Kindergarten

Note. *p<.05, ** p<.01, ***p<.001. N.S. = Not Significant. Figures control for maternal depressive symptoms, maternal coparenting experiences, and sleep variables at pre-kindergarten. Nonstandardized coefficients reported. SE = Standard Error; W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (August/September). FRS-R and DISCORD are 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.

Table 1.

Demographics of family study participants

	Child (n=230)	
Child Gender, N (%)		
Male	115(50)	
Female	115 (50)	
Age at Start of Study, Mean Age in Years (SD)		
Maternal Age	34.5 (4.98)	
Paternal Age	36.9 (7.08)	
Mother's Marital Status, N (%)		
Living with Partner	208 (93.3)	
Not Living with Partner	17 (6.7)	
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 (8.4)	
$30,000–$59,999	35 (15.7)	
$60,000–$89,999	66 (26.8)	
$90,000–$129,999	68 (30.4)	
$130,000–$159,999	26 (11.6)	
$160,000–$189,999	10 (4.4)	
$190,000 or more	5 (2.2)	
Not reported	1 (0.5)	
Highest Parental Education, N (%)	**Mothers**	**Fathers**
Did not Graduate High School	4 (1.8)	5 (3.0)
High School Degree	67 (30.2)	61 (26.8)
Associate's Degree	35 (15.8)	26 (15.7)
Bachelor's Degree	60 (27.0)	47 (28.3)
Graduate Degree	56 (25.3)	27 (16.2)
Race, N (%)		
White	174 (77.3)	
Black or African American	17 (7.6)	
American Indian or Alaska Native	1 (0.4)	
Asian	2 (0.9)	
Some other race	4 (1.8)	
Two or more races	27 (12)	
Ethnicity, N (%)		

	Child (n=230)
Latina/Latino	19 (8.3)
District, N (%)	
District 1	89 (38.7)
District 2	61 (26.5)
District 3	80 (34.8)

Note. Families self-identified race and ethnicity (whether they were Latina/Latino) 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) with scores can ranging from 20 to 100 and higher scores indicate higher perceived resources.

Table 2.

Descriptive Statistics of Main Study Variables

Variable	N	Mean	SD	Range
Sleep Duration (W1)	220	9.76 hrs.	.64	8.04 – 11.10
Sleep Duration (W2)	216	9.82 hrs.	.56	7.45 – 11.34
Sleep Duration (W3)	214	9.80 hrs.	.46	8.02 – 11.34
Proportion of Recommended Sleep (W1)	220	.79	.23	0 – 1
Proportion of Recommended Sleep (W2)	216	.86	.19	0 – 1
Proportion of Recommended Sleep (W3)	214	.84	.20	.14 – 2
Household Income	223	$85,000	$35,000	$5,000 - $200,000
M Family Resources (W1)	217	87.14	10.54	46 – 100
Household Chaos (W1 + W2 Average)	210	14.00	2.77	11 – 25.5
M Coparenting Experiences (W1)	203	121.97	19.91	48.0 – 153
M Depressive Symptoms (W1)	217	6.57	7.58	0 – 40

Note. N = Number of families; SD = Standard Deviation; W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (September/October); W3 = Mid-Kindergarten (November/December); M = Mother-Reported. Sleep duration values refer to average hours/day. Household income reported to the closest approximation. Additional income distribution is presented in Table 1.

Table 3:

Bivariate Pearson correlations of Main Study Variables

Variable	Sleep Duration (W1)	Sleep Duration (W2)	Sleep Duration (W3)	Proportion of Recommended Sleep (W1)	Proportion of Recommended Sleep (W2)	Proportion of Recommended Sleep (W3)	M Family Resources (W1)	Household Income (W1)	Household Chaos (W1 + W2 Average)	M Coparenting Experiences (W1)	D S
Sleep Duration (W1)	-										
Sleep Duration (W2)	.54**	-									
Sleep Duration (W3)	.51**	.56**	-								
Proportion of Recommended Sleep (W1)	.83**	.43**	.41**	-							
Proportion of Recommended Sleep (W2)	.47**	.79**	.45**	.42**	-						
Proportion of Recommended Sleep (W3)	.37**	.41**	.79**	.38**	.41**	-					
M Family Resources (W1)	.20**	.24**	.28**	.18**	.30**	.25**	-				
Household Income (W1)	.00	.11	.12	.08	.15*	.20**	.43**	-			
Household Chaos (W1 + W2 Average)	−.18*	−.26**	−.33**	−.20**	−.30**	−.40**	−.35**	−.45**	-		
M Coparenting Experiences (W1)	.03	.04	.08	.06	.20	.09	.29**	.09	.17*	-	
M Depressive Symptoms (W1)	−.12	−.10	−.12	−.12	−.10	−.14*	−.34**	−.17*	.10	−18*	

Note. W1 = Summer, Pre-Kindergarten; W2 = Early Kindergarten (September/October); W3 = Mid-Kindergarten (November/December). M = Mother.

* p <.05

** p<.01. Number of participants range from 192 to 220.