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Sleep Timing and Quantity in Ecological and Family Context: A Nationally Representative Time-Diary Study

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Abstract

Associations between children's sleep behaviors and demographic characteristics, child school schedules and out-of-school activity choices, and family functioning were estimated using data from a nationally representative sample of 2,454 children aged 5-19 years. Total hours of sleep as well as bedtimes and waketimes were estimated using a time-diary approach. Predictors of sleep behaviors were examined separately for younger (5 to 11.9 years) and older children (12 to 19 years) and for weekday and weekend sleep behaviors. Older African American children, younger Asian children, and all children with earlier school start times and longer travel times to school reported fewer overall hours of sleep. Greater time watching television predicted fewer hours of weekday sleep for younger children, whereas greater time on homework predicted less sleep for older children. For both younger and older children, greater time spent on religious activities was associated with fewer hours of sleep while time spent eating meals was associated with greater hours of weekday sleep. For younger children, parental warmth was associated with earlier weekday bedtimes, and parenting stress was associated with less weekday sleep. For older children, family economic strain predicted later bedtimes, and parental rules predicted greater hours of sleep due to earlier bedtimes. For weekend sleep, African American ethnicity was once again associated with fewer sleep hours for older children, whereas Hispanic ethnicity and higher parental education predicted fewer sleep hours for younger children. There was less of an impact of family functioning variables in weekends, and a larger impact of activity choices: watching television, using the computer or playing video games, sports, religious activities, socializing, and part-time employment were all associated with fewer total hours of sleep on weekend nights.

Introduction

What factors influence children's sleep behavior? The answer to this question is of great importance to researchers, educators, parents and policymakers because children's sleep habits, including their bedtimes, waketimes, total hours of sleep, and overall sleep quality influence children's emotional states and their cognitive performance in the short term, and are thought to have important influences on children's long-term emotional and physical health. Experimental studies have found that children's daytime cognitive and behavioral functioning are substantially impaired following even a slight truncation in the amount of sleep the previous night (Sadeh, Gruber, & Raviv, 2003). In addition, a growing body of work has found associations between sleep and children's cognitive and social functioning, including maladjustment in preschoolers (Bates, Viken, Alexander, Beyers, & Stockton, 2002) and internalizing problems in middle childhood (Hofferth & Sandberg, 2001). Lack of sleep among adolescents has been shown to put them at increased risk of depression and school problems and even motor-vehicle accidents (Fredriksen, Rhodes, Reddy, & Way, 2004; Wolfson & Carskadon 1998; Carskadon, Acebo, & Jenni, 2004). A substantial body of evidence has linked adult sleep to adult BMI and obesity (Vorona, Winn, Babineau, Eng, Feldman, & Ware, 2005; Vgontzas, Bixler,& Chrousos, 2005; Nieto, et al., 2000), and has demonstrated the hormonal pathways by which truncated and/or disrupted sleep are associated with increased appetite and impaired metabolic regulation (Spiegel, Leproult & van Cauter, 2003). Evidence is also emerging for associations between child sleep, BMI and obesity (Gupta et al., 2002; Locard, et al., 1992; Sekine et al., 2002; Marcus, et al., 1996), even in prospective, longitudinal studies (Agras, Hammer, McNicholas, & Kraemer, 2004; Reilly et al., 2005; Snell, Adam & Duncan, 2005).

While a substantial body of research examines the short and long-term effects of inadequate sleep on children's cognitive, behavioral and social functioning, and physical and

mental health, less is known about what *causes* sleep behaviors in children and adolescents. Although medical problems contribute to some variations in child sleep (Stein, Mendelsohn, Obermeyer, Amromin & Benca, 2001) considerable variation exists in sleep timing and quality among children without obvious medical problems. Researchers and practitioners hypothesize that children's sleep patterns are determined by a combination of physiologically-driven sleep needs and behavioral and psychosocial factors, both of which may change with development (Carskadon, 2002; Dahl, 1996, 2005)

Recently, scholars have called for more research aimed at understanding the social determinants of children's sleep habits by exploring the role of children's broad social environments, their family characteristics and processes, and their personal characteristics and activities. After reviewing existing data on the social and developmental determinants of children's sleep habits, the current study brings these lines of research together to investigate the independent and joint impacts of demographic variables, structural constraints (e.g. school start times), family process variables, and children's personal characteristics and activities on sleep behavior, in particular total hours of sleep and bedtimes and waketimes on weekdays and weekends, in a large, nationally representative sample of children and adolescents.

Family SES, race-ethnicity and sleep

Previous research on child and adolescent sleep has been more likely to control for demographic variables such as race and socioeconomic status (SES) rather than approaching them as variables of interest. This is unfortunate as demographic variations in sleep timing and quality could provide clues to more proximal processes influencing children's sleep. In addition, among researchers studying socioeconomic and racial disparities in health outcomes, there has been interest in identifying whether sleep may play a role in mediating or moderating effects of demographic variables on physical and mental health outcomes (Moore, Adler, Williams &

Jackson, 2002). Moore et al. (2002) found that sleep quality mediated the association between SES and perceived physical health. They also found a significant and negative interaction between sleep quantity and sleep quality, suggesting that higher sleep quantity may be particularly important for physical health for those with lower sleep quality, which may be more prevalent among adults from lower socioeconomic backgrounds, who report increased prevalence of sleep disturbance (Hunt, McEwen and McKenna, 1985).

Sleep has been identified as a potential mediator of associations between stress-related cognitions and immune functioning (Hall et al., 1989). Considering that individuals from lower SES backgrounds are more likely to experience high levels of psychosocial stress (Stronks, van de Mheen, Looman & Machenbach,1998) and negative life-events (McLeod, 1990), sleep-related immune changes may represent one mechanism for associations between low SES and poor physical health. Similarly, Van Cauter and Spiegel (1999) noted that sleep loss predicts a number of physiological changes commonly associated with the process of aging (e.g. elevated cortisol, decreased tolerance for glucose) suggesting that sleep loss may contribute to allostatic load and facilitate the development of chronic conditions prevalent in low SES populations (i.e. obesity, diabetes, and hypertension). Thus, understanding socioeconomic and racial-ethnic variations in sleep timing in children could help contribute to our understanding of the origins of and mechanisms for socioeconomic and racial-ethnic disparities in health outcomes.

Few studies have examined children's sleep behavior in economically and ethnically diverse samples. Spilsbury et al. (2004) investigated sleep patterns and sleep disordered breathing in an urban, community-based sample of 8- to11-year-old children (of which one-third were ethnic minorities) and found significant ethnic differences in sleep behavior; ethnic minority children were more likely to go to bed after 11 PM, and approximately 43% of 10- to 11-year-old minority boys reported less than 9 hours of sleep. This study also found that night-

to-night variability of sleep was higher among minority children. Recent work with a nationally representative sample by Snell, Adam, and Duncan (2005) also found associations between young (aged 5 to 12) children's race, their sleep times and bedtimes, indicating that African American children slept less and went to bed later than other groups.

Developmental processes and sleep behavior

It is well established that as children go through puberty, their sleep patterns and circadian rhythms change (Carskadon, 1999). Key changes in sleep patterns and needs associated with puberty include phase delay, or the tendency toward later sleeping and waking times, and irregular sleep patterns; weekend sleep schedules being significantly different than sleep schedules during the regular week (Acebo & Carskadon, 2002). Many adolescent appear to catch-up on sleep during the weekend, with younger adolescents on average increasing weekend sleep by 1 hour and 50 minutes (Snell, Adam, Duncan, 2005), compared to older adolescents (18 and up), whose average amount of catch-up sleep during the weekend exceeded 2 hours (Wolfson and Carskadon, 1998). Irregular sleep schedules are thought to contribute to a shift in sleep phase, trouble falling asleep or awakening, and poor quality of sleep (Dahl & Carskadon, 1995), which may result in excessive sleepiness and as such affect adolescent functioning in various domains. While sleep behavior of all adolescents is characterized by bedtime delay, insufficient sleep during the school week and inconsistent sleep patterns between the school week and weekends, these characteristics are more pronounced for older rather than younger teenagers (Carskadon, 2002). This may be because adolescent sleep habits emerge not just from developmental and biological changes but also through social and psychological processes.

Child and adolescent school schedules and sleep

Previous research has shown that the transition to early school start times associated with the move from elementary to middle and from middle to high school is associated with

significant decreases in total sleep time and a disruption of sleep schedules for young adolescents (Carskadon et al., 1998; Dahl & Lewin, 2002 ; Wolfson & Carsadon, 1998). Effects of earlier school start times are further exacerbated by the fact that adolescents tend to go to bed at approximately the same time regardless of their school start times (Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998; Dahl & Lewin, 2002), and early start times are particularly problematic for those adolescents who are more *evening types* in their preferred patterns of sleep and arousal (Carskadon, Vieira, & Acebo, 1993; Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002). Both the decreased amount of sleep overall on school nights resulting from early school schedules (Carskaon, 2002; Hansen et al., 2005) as well as the associated increased degree of discrepancy between weekday and weekend sleep (Acebo & Carskadon, 2002; Wolfson & Carskadon, 1998) have been found to be associated with increased daytime sleepiness, impaired cognitive functioning, and mood disturbances in adolescents.

Child and adolescent activity choices and sleep

Adolescent sleep behavior is also influenced by the type of activities children choose to engage in. The activity choices most examined in the literature include television viewing habits and computer use. Increased television viewing, especially around bedtime, has been linked to increased sleep disturbances such as nightmares (Van den Bulck, 2000) and anxiety around sleep (Owens, Maxim, McGuinn, Nobile, Msall, & Alario, 1999). This is particularly the case in the context of the presence of a television set in the child's bedroom (Van den Bulck, 2004; Owens et al. 1999): Children with a television set in their room tend to go to bed significantly later on weekdays and weekend days and get up significantly later on weekend days; overall, they spend less time in bed on weekdays. Using a randomly selected sample (N=2546) of 1st and 4th grade students from 15 schools in Flanders, Belgium, Van de Bulck (2004) found that children who have a computer in their room went to bed significantly later on weekdays and weekend days and

got up earlier on weekdays, spending significantly less time in bed. They suggest that playing a computer game or using the Internet at night delays bedtime and shortens sleeping hours. In addition to affecting sleep-timing behavior, a recent experimental study in a sample of adult males suggests that playing an exciting computer game may also affect sleep quality by significantly increasing sleep latency while reducing total amount of REM sleep (Higuchi, Motohashi, Liu, & Maeda, 2005). This is potentially caused by exposure artificial light (Boivin, Duffy, Kronauer, & Czeisler, 1996; Zeitzer, Dijk, Kronauer, Brown, & Czeisler, 2000) or increased human alertness in response to light exposure (Cajochen, Zeizter, Czeisler, & Dijk, 2000). Thus, television and computer use may affect children through influencing both behavioral choices regarding sleep timing, and the quality of the sleep that is obtained.

Other activities that have been shown to be relevant for children's sleep timing include time spent on academic obligations, such as homework, and extracurricular activities such as sports, employment and socializing with friends (Carskadon, 2002). Rarely in prior research have multiple activity choices been examined simultaneously in the context of the same study such that their relative impacts can be compared, and no prior research, to our knowledge, has examined the impact of activity choices on sleep timing on both weekdays and weekends in a nationally representative sample using a time-diary approach.

Parental characteristics, parenting and family emotional climate

Although prior studies focusing on infants and preschool-aged children have explored the effects of a variety of parent and family characteristics on a wide range of sleep behaviors (Morrell, 1999; Rona, Li, Gulliford, & Chinn, 1998; Sadeh & Anders, 1993), few studies have explored associations among family processes and sleep in samples of older children and adolescents. In a sample of 448 11-year-old children, Meijer (2001) found that parental rules regarding sleep were associated with children's total time in bed. Children who had their own

bedroom or whose parents checked in on the child's room after they had gone to bed or enforced an immediate "lights off" policy spent significantly more time in bed; children who decided their own bedtimes spent significantly less time in bed. However, parenting rules were not associated with children's sleep quality in the Meijer et al. (2001) study, and longer time in bed did not contribute to higher quality sleep. Owens-Stively, Frank, Smith, Hagino, Spirito, Arrigan, et al. (1997) did find an effect of parenting on sleep quality—comparing 52 children without sleep disorders sampled from a primary care setting to 80 children with various disorders sampled from a pediatric sleep clinic (mean age = 5.7 years), they found an association between sleep disturbances and ineffective parenting strategies (in particular lack of limit setting and inadequate rule enforcement) in the general pediatric sample.

The emotional climate of the family environment also appears to be important for sleep; in a sample of 4,187 15-year-old Finnish adolescents, perceived (better) home atmosphere had a significant and positive association with subjective sleep quality (Tynjala, Kannas, Levalahti, & Valimaa, 1999) for both boys and girls. Seifer, Sameroff, Dickstein, & Hayden, (1996) found that maternal psychiatric illness of any sort and observer ratings of poor family functioning were related, to a modest but significant degree, to child sleep habits, including bedtime problems and short sleep times. Finally, El-Sheikh, Buckhalt, Mize & Acebo (2006) found associations between levels of marital conflict in the home and children's sleep quantity and quality, with implications for their levels of daytime sleepiness.

The present study

While some initial evidence exists regarding the impact of demographic factors, children's activities, parental rules, and family climate on children's sleep habits, rarely have each of these factors been examined simultaneously to reveal the extent to which they have independent and joint effects on children's sleep behavior. In addition, prior research, although

in some cases utilizing large community-based samples, has rarely used nationally representative data including a wide range of socioeconomic and racial-ethnic groups. While some studies have utilized objective measures such as actigraphy to determine sleep timing and quality, others, particularly the larger studies, have relied on global or stylized self-report (questionnaire or interview responses in which average or typical patterns of sleep behaviors are reported by children or their parents).

In the current study, we simultaneously examine the contributions of racial/ethnic, socioeconomic and other demographic factors, structural constraints such as school start times, child and adolescent activity choices, and parental rules and family climate to children's total hours of sleep and sleep timing (bedtimes and waketimes), and examine whether these processes differ for younger and older adolescents in a large, nationally representative sample. Rather than relying on stylized self-report, we utilize a time-diary approach—having children report on all their activities (including sleep) on each of two randomly selected days (one weekday, one weekend day) in their lives, an approach which is thought to be less prone to socially desirable responding than stylized reporting. The advantages of our study include our focus on multiple social influences on sleep timing, use of a time-diary approach, examination of whether processes vary by child age and for weekday vs. weekend sleep, and our ability to examine demographic and racial-ethnic variations and generalize our results widely due to the nationally representative nature of the sample.

Method

Participants

We use data from the second wave of the Child Development Supplement (CDS) of the Panel Survey of Income Dynamics (PSID). The PSID is a nationally representative, longitudinal dataset consisting of survey data on approximately 8,000 of the same families and individuals

collected since 1968. In 1997, all PSID families who had children between birth and 12 years of age were recruited to participate in the CDS. All children in families with one or two children were included in the study. When there were more than two children in the home that met the eligibility requirement, a random selection process was performed to select two children. In the first wave of the CDS, 2,394 families participated, providing information on a total sample of 3,563 children. The second round of data collection took place in 2002-03 when 2,021 families were successfully re-interviewed, resulting in a total of 2,907 child interviews. The reduction in the sample is due to reclassification of the eligibility status of some sample participants (83 children) and also due to nonresponse among the remaining eligible CDS families (573 children) from the first wave. Accounting for both sources of attrition in the first wave, the second wave re-interview rate is 81.6%. For the current analysis, we also drop children who are not currently in primary or secondary school (50 children) and children without time diary sleep data (403 children). We adjust for attrition in the sample that may occur non-randomly across participant characteristics by using weights provided by the CDS for this purpose. The final sample for our analysis is 2,454 children and their 1,718 families.

Procedures and Measures

This study uses information taken from each child's Primary Caregiver (PCG) as well as from each child's time diary. The primary caregivers answered questions regarding their child's health and behavior, characteristics of the household (including income, parental education, work schedules, and family composition), and family processes. The survey was administered to the primary caregiver either in the home as an interview or through a telephone interview.

The CDS time diary was a paper diary that was mailed ahead before the scheduled interview with instructions to complete the diary regarding one weekday and one weekend day prior to the interview. The weekday (Monday-Friday) and weekend time-diary days were

randomly selected when the interviewer completed the initial contact for the household. There was no substitution of diary days once they were assigned. During the in-house CDS interview or by telephone, the interviewer reviewed and edited the diary with the child and primary caregiver. If the diary was not completed in advance, the interviewer administered the diary as an interview about the originally selected days.

The time diaries provide a detailed chronology of the type, number, duration, and location of activities for the two randomly selected 24-hour periods. The time diary asked the child or primary caregiver to record the child's flow of activities over a 24-hour period beginning at midnight of the randomly designated day, and start and end times were recorded in hours, minutes, and second. Respondents recorded the primary activity that was going on at that time, when it began and ended, and whether any other activity was taking place. Each child's time diary had from 15 to 40 entries per diary day, with an average of 20 activities per diary day. To facilitate data analysis, the study organizers then assigned each diary activity to one of 365 activity codes and further assigned them to one of 39 different activity categories. Coding of diary entries was conducted by professional coders employed by the data collection organization; inter-rater reliability on this coding was 94% (unfortunately, Cohen's Kappa statistics were not provided, but should not be substantially lower due to the large number of categories employed).

With child-based sampling weights, the time diaries give a representative national sample of children's activities and can be converted into traditional time use aggregates, which are known to provide less biased estimates of time spent on activities than global or "stylized" self-reports of time spent on activities (Juster, Ono and Stafford, 2003), particularly among Hispanic, African American and low-income groups, who are particularly susceptible to socially desirable responding (Ross & Mirowsky, 1984; Bardwell & Dimsdale, 2001).

Outcome measures

Our dependent variables are measures of children's weekday total sleep time, bedtime, and waketime derived from the time diary reports. Because the diary spans 24 hours starting at midnight, waketime and bedtime recorded for that day are used to estimate total sleep time.

Child and family demographic measures

Three child demographic variables were examined: age, gender and ethnic background. Age was measured in terms of months from birth to the time of the interview in 2002. It ranged from 5.5 to 19.1 years. For gender, boys were given a code of "1," and girls were given a code of "0." Dummies for race and ethnicity were created (African American, Hispanic, Asian, and other race or ethnicity, with non-Hispanic whites being the reference group).

Parental income, parental education, marriage status, family size, and parental work hours were all included as family socioeconomic variables. We included a measure of average family income in 2000 in tens of thousands of dollars (continuous measure). The family income measure used for this sample was based on the income reported in the core PSID interview for 2001. The PSID-CDS provides information reported by the primary caregiver on the education of the head of the household (either male or female, but generally male) and the spouse or cohabitor in the household if one is present. The education of the spouse or cohabitor is available only when there are two adult individuals in the household. Our measure of parental education is obtained by averaging the available parents' total number of years of education. We measured family structure with a dummy variable indicating whether the head of household was married or not. The total number of children in the family is a continuous variable ranging from 1 to 9 individuals. The head of household's total work hours was a continuous variable that ranged from 0 to 100 hours, while the spouse/cohabitor's total work hours ranged from 0 to 99 hours.

Child well-being

Our child well-being measures included measures of child health, as well as the child's internalizing and externalizing behavior problems. The child's health was measured with a single item that asks the primary caregiver to rate the child's health on a scale of 1 (excellent) to 5 (poor). This item was reverse coded for ease of interpretation. The Internalizing Behavioral Problem Index and Externalizing Behavioral Problem Index were used to measure children's externalizing and internalizing behavioral problems. The CDS uses the same set of items for Internalizing and Externalizing behavior problems as was used in the National Longitudinal Study of Youth, which were originally developed by Peterson & Zill (1986). Children's scores for the Internalizing BPI items were summed and standardized, and their scores for the Externalizing BPI items were summed and standardized. Although these child well-being variables could be viewed as outcome variables, we include them as control variables to help ensure that our estimates of the impact of family processes and our other independent variables on sleep timing are not confounded by characteristics of the child that may contribute both to our independent variables and to individual differences in sleep timing.

Child school schedule, weekday activity variables, and weekend activity variables

We used the weekday time diaries to measure what time that day the child's school started and ended, the total time that child spent traveling to school from home, and the time spent doing various activities on the weekdays. We used the weekend time diaries to measure the amount of time children spent doing various activities on the weekend. The weekday and weekend activities included in our analysis were: watching television, playing video games or playing on the computer, doing sports, doing homework, engaging in religious activities, socializing, and eating meals (including breakfast, lunch, and dinner, but not snacks). Socializing included visiting with others, going to parties, and going to bars or out dancing. Sports included

both organized activities, such as team sports, as well as unorganized sports such as working out at the gym, skateboarding, or rollerblading. For the older children, we also included an activity measure for the amount of time spent working (part-time employment). All activity variables are reported in the metric of hours spent on that activity that day.

Family process variables

Family processes were assessed with six measures: PCG warmth, family rules, family economic strain, PCG parenting stress, PCG psychological distress, and family conflict.

The warmth scale, designed by Child Trends, Inc. for the JOBS Child Outcomes Study, was composed of the responses of the primary caregiver to the following questions: How many times in the last month have you told child that you: Love him/her? Spent time with him/her doing favorite activities? Talked about things that interest him/her? How many times have you told him you appreciated something he did? Talk about other relationships, such as his/her friends? Talk about current events? Talk with your child about his or her day? Response items are based on a scale of 1-5, where 1 indicates "Not in the past month," 2 indicates "1 or 2 times in the past month," 3 indicates "About once a week," 4 indicates "Several times a week," and 5 indicates "Every day." Items were summed then standardized for ease of interpretation and comparison with other variables. The alpha for the warmth scale was .82.

Family rules was composed of the primary caregiver's response to whether or not there were household rules for the following issues: amount of TV, type of TV watched, eating sweets, with whom your children interacts, after school activities, and when children should do homework. The questions come from the Detroit Area Study 1997. Items were summed then standardized. The alpha for the family rules scale was .76.

Family economic strain was determined by caregiver reports of whether or not the primary caregiver did any of the following or have any of the following happened as a result of

economic problems in the last 12 months: sold possessions or cashed-in life insurance, postponed major purchases, postponed medical care, borrowed money, applied for government assistance, filed for bankruptcy, behind in paying bills, loan to pay debts, a visit from a creditor, lien against property, property repossessed, moved to a cheaper residence, moved in with others, and/or sent children to live elsewhere. These items were drawn from Glen Elder's and Rand Conger's work measuring experiences of economic or financial stress and strain and practical responses to such financial pressures (Conger & Elder, 1994). Items were summed then standardized to form a family financial strain scale, with higher scores reflecting greater economic strain. The alpha for this scale was 0.70.

Parenting stress was determined by the primary caregiver's report on their level of agreement with the following three statements regarding the focal child: There are some things that child does that really bother me a lot; I find myself giving up more of my life to meet child's needs than I ever expected; and I often feel angry with child. Response items are based on a scale of 1-5, where 1 indicates "Not at all true" and 5 indicates "Completely true." Items were summed then standardized to form a caregiver parenting stress scale, with higher scores reflecting greater parenting stress. The alpha for the parenting stress scale was 0.68.

Items from the Kessler's K-6 Non-Specific Psychological Distress Scale were used to measure caregiver psychological distress. The K-6 includes six items that queried the primary caregivers about whether they felt nervous, hopeless, restless, everything was an effort, so sad couldn't be cheered up, and/or worthless during the prior four weeks. Response items are based on a scale of 1-5, where 1 indicates "all of the time" and 5 indicates "none of the time." The items were reverse coded, summed, then standardized. The alpha was 0.84.

Family conflict was measured by the primary caregiver reporting how much they agreed with the following five statements: family fights a lot, throws things, calmly discusses, criticizes,

hits each other. Response items were based on a scale of 1-5, where 1 indicates "completely disagree" and 5 indicates "completely agree." These items were taken verbatim from NSFH to examine methods of conflict resolution among family members (Sweet, Bumpass, & Call, 1988). The items were appropriately reverse coded, summed, then standardized. The alpha was 0.78.

Results

Analyses

After a brief examination of bivariate relationships, multiple regression analyses were conducted to examine the associations between children's sleep behaviors and their demographics, schedules, and family processes. All control and independent variables were entered simultaneously in the model such that the unique contribution of each could be observed. When modeling weekday sleep behaviors, we included the measures of school start, school end, and school travel times and the measures of weekday activities. When modeling weekend sleep behaviors, we included the measures of weekend activities. Several mediational models were also examined, in which control and demographic variables were entered prior to child activity and family process variables—these models are not presented in full detail because they are time and space-consuming and did not for the most part alter or add to our interpretation of the results of the simultaneous models.

We expected theoretically that associations might vary considerably between younger versus older children, and preliminary analyses suggested this was indeed the case. As a result, we present regressions separately for younger (aged 5 to 11.9) and older (aged 12 to 19) children. This division was selected because many children move from elementary to junior high school, and from pre-adolescence into adolescence around age 12. With these transitions come greater school pressures, different school schedules, and greater autonomy, all of which may have some

influence on sleep schedules. Differences in coefficients for younger versus older children were tested by running a full model with age interactions.

All analyses were weighted with PSID-supplied probability weights that are inversely proportional to the likelihood of being selected into and continuing to participate in the sample. Probability weights allow us to generalize to our population of inference, which includes all children living in the United States. We use a dummy variable indicating who has missing data and assign the mean value on the variable for those individuals (there was little missing data for children in our sample). In all regressions, standard errors have been adjusted using Huber-White methods to account for the lack of independence caused by family clustering of sample children.

Descriptive Analyses

Descriptive statistics (means and standard deviations) for the variables in this study, presented separately for younger and older children, are shown in Table 1. Pearson correlations for the associations between the independent variables and sleep behaviors on weekdays and weekends are presented in Table 2, and correlations between independent variables are presented in Table 3. As is apparent from these tables, sleep behaviors had first-order associations with many variables of interest, and many of our independent variables of interest are significantly intercorrelated. For the sake of parsimony, however, we forgo discussion of these simple associations and instead focus on the independent effects of each variable on younger and older children's weekday and weekday sleep, as determined by our multiple regression analyses.

Regression analyses predicting weekday sleep behaviors

Table 4 presents the results of a regression analyses testing associations between child weekday sleep behaviors and child and family characteristics, by child's age group, younger (5 to 11.9 years) and older (more than 12 to 19 years).

Starting with child demographics, we find that, within the younger age group, child's age is associated with fewer total hours of sleep during the week, due to later bedtimes for older children within the younger age group. Child's age is not associated with total sleep time for older children, but only because it is positively associated with both bedtime and waketime. Older boys go to bed .30 of an hour earlier than older girls on weekdays, but wake up earlier as well; there is no overall effect on total weekday sleep. We find that older black children sleep on average .46 of an hour less than white children, due to a combination of later bedtimes and earlier waketimes, while there is no difference for young black children versus young white children. Although not presented in Table 3, if the school start time and school travel time variables are removed from the model, the coefficients are even larger, with older black children sleeping .60 of an hour fewer a night than older white children, in part due to a waketime .30 of an hour earlier than older white children. Put another way, there is a substantial difference in total sleep time by race for older children that is partially, but not entirely explained by scheduling and travel variables. Younger Asian children sleep .68 of an hour less than young white children on weekdays, due mostly to later bedtimes, while this is not true for older Asian children.

Younger children's health is negatively associated with total weekday sleep time; for every point increase in health, young children's total sleep time declined by .18 of an hour, due to mostly to earlier waketimes. Internalizing and externalizing behavioral problems were not associated with any of the weekday sleep outcomes when the demographic, activity, and family process variables are included in the model.

Surprisingly, family socioeconomic characteristics had only small associations with children's weekday sleep behaviors above and beyond the other variables in the model, and we found no evidence that these associations were moderated by children's age; while some

coefficients were significant for one age group and not the other, differences between age groups were not statistically significant. The total number of children in the household was however associated with earlier bedtimes and earlier waketimes for younger children.

Children's school schedule and time spent traveling to school were highly associated with weekday sleep behaviors, and many of these associations were moderated by child's age. Although school start time is associated with both younger and older children's total sleep times (due almost entirely to its association with waketime), it has a more powerful effect for older children. For younger children, a school start time that is an hour later is associated with a .33 of an hour increase in total weekday sleep time; while for older children, an hour later school start time is associated with a .58 of an hour increase in total sleep time. The same is true for the time children spend getting to school; for every additional hour younger children spend getting to school, their total weekday sleep time decreases by .69 of an hour, while for older children, it decreases by 1.41 hours, again due almost entirely to earlier waketimes. Although earlier school start times, as well as increased travel times, are associated with earlier bedtimes, none of these associations are statistically significant and none come close to compensating for the large effects early school start times and increased travel times have on children's wake-up time. These findings suggest that school schedules have significant effects on younger and older children's sleep behaviors but that the greatest effects are observed on sleep behaviors of older children.

Time spent watching television on weekdays is associated with younger, but not older, children's total sleep time. For each additional hour young children spend watching television, total sleep time declines by .12 of an hour, due to later bedtimes. Older children's schedules are also associated with time watching television, but because time spent watching television is associated with both an increase in bedtime and waketime of .18 of an hour later, there is no

effect on total sleep time. There is no overall effect on weekday sleep time from playing on the computer/playing video games, but there are positive associations between time spent on this activity and both later bedtimes and waketimes for all children. Time spent on sports is positively associated with later waketimes for older, but not younger children. Time spent on homework does not have a statistically significant effect on total sleep time for younger children, but for older children, every hour spent on homework decreases total sleep time by .20 of an hour, due to both later bedtimes and earlier waketimes. Time spent doing religious activities on weekdays is negatively associated with total sleep time for both younger and older children, mostly due to later bedtimes for younger children. Time spent socializing on weekdays is not associated with overall sleep time, but it is associated with later bedtimes for younger children and later bedtimes and waketimes for older children. The association between socializing and bedtime is significantly stronger for older than younger children. Time spent eating meals is positively associated with total weekday sleep time for both younger and older children; each additional hour spent eating meals is associated with a .37 of an hour increase in total sleep time for younger children and a .57 of an hour increase in total sleep time for older children, due to later waketimes for younger children and earlier bedtimes and later waketimes for older children. For older children, time spent working on weeknights is not associated with overall sleep length, although it is associated with slightly later bedtimes (.07 of an hour, at $p < .10$) and waketimes (.08 of an hour).

Finally, we examine the association between our family process variables and children's weekday sleep. The association between parental warmth and child sleep time is moderated by child's age: Parental warmth is associated with longer weekday sleep times for younger children due to significantly earlier bedtimes for younger children (-.07 of an hour per SD parental warmth). It is also associated with shorter sleep times for older children (-.08 of an hour per SD,

$p < .10$), such that there is a statistically significant difference between the younger and older child coefficients. Interestingly, parental rules has no association with sleep time for younger children, but every standard deviation increase in parental rules is associated with a .25 of an hour increase in total sleep time for older children, due in part to earlier bedtimes and in part to later waketimes. Economic strain is also moderated by age; increased economic strain is associated with later bedtimes for younger children (.07 per SD economic strain), but there is no overall effect on total sleep time. Finally, a one standard deviation increase in parenting stress is associated with a .08 of an hour decrease (at $p < .10$) in total sleep time for younger children.

The full models do a reasonably good job of explaining weekday sleep behaviors: R^2s range from 23% for young children's bedtime to 36% for older children's waketimes.

Regression analyses predicting weekend sleep behaviors

Table 5 presents the results of regression analyses testing associations between child weekend sleep behaviors and child and family characteristics, by child's age group, older (over 12 to 19 years) and younger (5 to 11.9 years). In contrast to our findings for weekday total sleep time, child age is not associated with total weekend sleep time within the younger or older age groups (although the difference in total hours of sleep between the two age groups is significantly different, with younger children on average sleeping 10.7 hours on the weekends and older children on average sleeping 10.3 hours on the weekends). This is because, within both younger and older age groups, older children both go to bed later and wake-up later on the weekend. However, the association between age and bedtime is stronger for older children; for each additional year of age for younger children, weekend bedtime increases by .11 of an hour, while for older children, weekend bedtime increases .19 of an hour for each year of age. Older boys tend to sleep .37 of an hour more than older girls on the weekend, due mostly to the fact that they go to bed .30 of an hour earlier than older girls. We find that older black children sleep

on average half an hour less than white children on the weekend, due to a combination of later bedtimes and earlier waketimes. Younger black children wake up .32 of an hour later than younger white children. Young Hispanic children sleep .40 of an hour less and older Hispanic children sleep .50 of an hour less than white children on weekends, due to a combination of later bedtimes and earlier waketimes. Younger Asian children have a waketime .59 of an hour later than white children.

None of the child health or behavioral measures is associated with weekend sleep at standard levels of significance, but demographic factors had significant associations with weekend sleep. Every $10,000 increase in parental income was associated with a .01 of an hour later weekend waketime of for older children. Every additional year in parental education was associated with a decline in total weekend sleep time of .07 of an hour for younger children, due to earlier waketimes. Each additional year in parental education was associated with .05 of an hour later bedtimes for older children. Being in a married couple household was associated with a decline in weekend sleep of .37 of an hour for older children, although this effect was only present at $p < .10$. The total number of children in the household was associated with earlier bedtimes and earlier waketimes for younger children, and earlier bedtimes for older children.

We also included children's school schedule and travel variables in the weekend regression to compare their influence on weekend sleep behavior to their influence on weekday sleep behavior, with the hypothesis that the weekday schedule may continue to influence the weekend sleep-wake schedule due to either biological or social entrainment of schedules. Although there were no significant associations between these variables and older children's sleep behaviors, there were for younger children, although effects were substantially smaller than the weeknight coefficients. For every hour later weekday school start time for younger children, their weekend bedtimes and waketimes are increased by .11 of an hour and .12 of an hour,

respectively. For every hour young children spend traveling to school on the weekdays, weekend waketime is .37 of an hour earlier. These results suggest that younger children's sleep schedules are "shifted" across both weekday and weekend in response to weekday school schedules, but that older children's schedules are not as significantly affected.

A large number of scheduling variables are associated with sleep time on the weekends. Increased time spent watching television is associated with decreases in sleep time for both younger (.15 of an hour) and older children (.16 of an hour) due to later bedtimes. Increased time spent on the computer or playing video games is also associated with decreases in both younger (.16 of an hour) and older children's (.23 of an hour) total sleep time on weekends, also mainly due to later bedtimes. For each additional hour young children spend doing sports, total sleep time declines by .15 of an hour, mainly due to earlier waketimes. Time spent doing religious activities is negatively associated with total sleep on weekends for both younger (.07 of an hour) and older children (.19 of an hour), due to earlier waketimes. Socializing is also associated with decreased sleep times for both younger and older children, due to later bedtimes. Each hour spent socializing is associated with a decrease in total sleep time of .13 of an hour for younger, and .21 of an hour for older children. Time spent eating meals is not associated with overall sleep time on weekends, but is associated with earlier bedtimes for younger children and both earlier bedtimes and waketimes for older children. Working on the weekend is associated with .25 of an hour less total sleep time for older children, due mostly to earlier waketimes. Homework is the only activity variable that does not influence children's weekend sleep schedules.

Finally, our family process measures are not associated with overall sleep time on weekends, but increased parental warmth is associated with earlier weekend waketimes for both younger (at $p < .10$) and older (at $p < .05$) children, while increased economic strain is associated with later waketimes for younger children only. Greater parental psychological distress is

associated with earlier waketimes for young children, while increased family conflict is associated with later bedtimes (at $p < .10$) for young children.

The total variance accounted for in the weekend models are substantially lower than the weekday models, possibly because school times and school travel times have such a large impact on children's sleep behaviors during the week. For the weekend models, the R^2s range from 12% for younger children's waketime to 26% for older children's bedtime.

Discussion

The results of our study confirm many prior findings regarding influences on children's sleep (see Carskadon, 2002), but add to the prior literature in several ways. First, the large sample size and nationally representative nature of the data increase our confidence regarding the generalizability of the results, and also allowed us to examine associations between socioeconomic status and race/ethnicity on children's sleep hours and timing. Second, our simultaneous examination of family process variables along with demographic variables, structural variables and child activities allowed us to present the unique effects of each variable, such that the effects we presented are not easily attributable to confounding with other variables. Third, models are examined separately for younger and older children and for weekday vs. weekend sleep timing, allowing us to examine the extent to which processes were similar for younger and older children and for weekdays vs. weekends. Finally, a time-diary approach to reporting sleep timing is utilized, which is thought to be less subject to reporting bias than global or stylized self-reports in which the individual is asked to report on "typical" levels.

In general, our results demonstrate that children's sleep behaviors are influenced by a combination of demographic variables, in particular race/ethnicity, structural variables (e.g. school start times and travel times), child activity choices, and family functioning variables.

Models were found to vary in meaningful ways for younger and older children and for weekday versus weekend sleep.

Impact of structural variables. Among our findings, the largest effect sizes were for the impact of the structural variables including school start times and school travel times on total hours of weekday sleep. While prior research has emphasized the importance of school start times for child and adolescent sleep and well-being (Carskadon, 2002; Hansen et al., 2005; Wolfson & Carskadon, 1998), to our knowledge, studies have not previously reported the effects of travel times to and from school. The effect size of this variable on weekday sleep was among the largest found in this study, with younger children getting .69 of an hour less sleep per hour of additional travel time to and from school, and older children getting 1.4 hours less sleep per hour of additional travel time to and from school. Most of these effects on total weekday sleep were driven by changes in waketimes, with no significant effects on bedtimes being found, suggesting that children and adolescents are not adjusting their bedtimes to take into account their earlier waketimes. For the adolescents, this is consistent with prior literature suggesting that biological shifts in sleep schedules make it difficult for adolescents to shift to an earlier bedtime (Wolfson & Carskadon, 1998). Younger children, however, also showed no significant adaptation of bedtimes in response to their schooling schedules, suggesting that preferences regarding bedtimes also have social determinants. Interestingly, there is a trend for school scheduling effects to carry over to affect younger children's weekend sleep, suggesting that young children (or their families) become entrained to a sleep-wake schedule set by their weekday schedule. No such school schedule carry-over effects are found for adolescent weekend sleep. While experts on adolescent sleep have lobbied for changes to earlier school start times in order to improve the hours of sleep children and adolescents receive, our results suggest that education policymakers also need to take into account children's travel times as an important factor contributing to their

sleep debt. A consideration of the impact of school travel times on children's sleep is relevant to current policy debates, given current trends towards closures of low-performing schools, often in low-income neighborhoods, which may result in increased travel times for children.

Demographic Variables. Another noteworthy finding was the fact that older African American children slept significantly fewer hours, on both weekdays and weekends. For weekday sleep, this effect was partially, but not fully mediated by the structural variables mentioned above, in particular by time spent traveling to and from school, which is longer for our African American participants. Whether this is due to African American families choosing to send their adolescent children to schools farther from their homes, due to official policies that send these children farther for their schooling, or due to high schools being more dispersed or travel methods less efficient in the neighborhoods these children most often reside, cannot be determined from the current data. Regardless, the combination of earlier school start times and larger travel times is at least partially responsible for older African American children getting up earlier (see Table 2) and obtaining fewer overall hours of sleep on weekdays. For both weekdays and weekends, significantly later bedtimes for older African American youth also contribute to these youth receiving less sleep. These effects are significant controlling for all of our other demographic, activity and family functioning variables, thus why African American youth are going to bed later than other youth in the same age range is not clear. Prior research on the impact of shortened sleep suggests, however, that this is a behavioral pattern with potentially important health consequences—shortened sleep can contribute to a variety of physiological changes that are associated with increased risk for health problems such as obesity, diabetes, and hypertension (Spiegel, Leproult & Van Cauter, 2003, 2005). The possibility that shorter sleep times, starting in the adolescent years, could play a role in the greater incidence of these disorders in African American adults should be examined in future research.

Asian children in the younger age group were found to get less weekday sleep due mostly to later bedtimes. The later bedtimes for Asian youth were not explained by the demographic, family process (rules, warmth, conflict) or activity variables (socializing, homework, religious activity, etc.); as with the African American older youth, it is not clear why the younger Asian youth are going to bed later. Given the relatively small number of Asian youth in the study, this result should be replicated with a larger sample of Asian youth and the ability to examine subgroups within this larger category. Finally, younger Hispanic children were found to get less sleep on the weekends, primarily due to earlier waketimes. The reason for these earlier waketimes is unclear. These latter two racial-ethnic effects are potentially of less concern for health outcomes because they are not pervasive across both weekday and weekend sleep, thus allowing some catch-up sleep. On the other hand, greater variability in sleep scheduling is in and of itself thought to be detrimental for health outcomes (Acebo & Carskadon, 2002).

A final demographic effect of interest is the fact that the total number of children in the household was associated with earlier bedtimes and earlier waketimes for younger children on both weekdays and weekends, and earlier bedtimes for older children on weekends—perhaps this is due to increased experience on the part of parents and resulting knowledge regarding the importance of early bedtimes, or due to slightly older siblings being put to bed at the same time as their younger siblings in order to simplify bedtime routines.

Children's activities. Several activity variables were important for overall hours of weekday sleep and sleep timing including time watching television (for younger children) and time spent on homework (for older children), although the effect of these variables is relatively small, just .12 of an hour less sleep for every hour of TV, and .20 of an hour less sleep for every hour of homework. Television viewing was related to later bedtimes on weekdays, while greater hours of homework was related to earlier waketimes on weekdays. Hours of television viewing

also predicted fewer hours of sleep on weekends for both younger and older children, whereas, not surprisingly, homework did not play a role in weekend sleep. Computer use and videogame playing played a role in weekday bedtimes for all children, but did not influence their overall sleep hours due to later waketimes. A wide array of other voluntary child activity variables that were not significant for weekday sleep did come into play in predicting weekend sleep hours, including time spent on the computer or video games, time spent on sports, and time spent socializing for all children, and time spent working for older children. Television viewing, video games, and socializing all contributed to later bedtimes, whereas sports and older children's work contributed to lower sleep hours as a result of earlier waketimes.

In contrast to the other activities mentioned, greater time spent at meals was associated with greater sleep on weekdays. Greater time at meals may be a proxy for shared family time or for a high level of structure in the home, as it is likely that longer mealtimes are associated with more sit-down meals in which the family eats together. The fact that time spent at meals is positively associated with family rules and family warmth and negatively associated with family conflict supports this interpretation (see Table 3).

The fact that greater involvement in religious activities predicted less total hours of sleep on both weekdays and weekends is perhaps more surprising—while we might expect high religious activity involvement to also predict positive family process characteristics and stricter rules regarding bedtimes, there were no first order associations between religious activities and any of the family functioning variables. Although weekday religious activity involvement was associated with later bedtimes for younger children, the effect of religious activities on children's weekend sleep was due to earlier waketimes, particularly on weekends, and the fact that overall weekend sleep hours are lower suggests that children are not adjusting their bedtimes to account for their involvement in religious activities in the weekend morning hours.

One could argue that greater time spent doing *any* activity is likely to relate to fewer hours of sleep because the child has only a finite hours in a day, but the fact that some activities, such as more time spent at meals, relates to greater hours of sleep refutes this as the sole explanation of our activity variable effects.

Family functioning variables. Although family functioning variables played a role in weekday sleep, there were very few effects of family functioning variables for weekend sleep after controlling for the rest of the variables in the model. Stress with the parenting role was marginally related to fewer overall hours of weekday sleep in younger children, while parenting warmth was related to earlier weekday bedtimes for younger children, and parental rules were related to earlier bedtimes and greater total hours of sleep for older children on weekdays. Importantly, the family rules variable did not include questions about sleep timing, rather, the question asked about the presence of rules regarding amount of TV, type of TV watched, eating sweets, and choices regarding friends, after-school activities and homework. We did examine the effects of actual participation in most of the activities referred to in the rules, many of which did predict sleep behaviors, but the effect of family rules is significant above the effects of these activity variables. It is likely that parents who have rules regarding these matters also have rules regarding bedtimes, and may be more likely to closely regulate child sleep time behavior.

Family economic strain was an additional predictor of younger children's sleep, in particular being associated with later bedtimes. This effect is not mediated by family structure or parent work hours, although it is possible that the scheduling of parent work differs for families with greater economic strain (i.e. parents may work evening shifts), contributing to a delayed bedtime for their children. It is worth noting that the effects of financial strain are independent socioeconomic variables such as education and incomes, and there were no differences between children's sleep hours and timing in married vs. unmarried families. When simple correlations

(Table 2) are examined, family conflict does predict significantly fewer sleep hours and later bedtimes. With the other variables in the model, however, this effect is only present at the trend level predicting later bedtimes for younger children on weekends. Importantly, however, prior research finding associations between family conflict and child sleep have noted that child report of conflict is a more effective predictor than parent report (which was utilized in the current study), as child perceptions of conflict are important for its impact on their functioning (El-Sheikh et al., 2006).

In general, although the effects are not large or consistent across weekdays and weekends, the family process variables relate to children's sleep in the expected direction – positive parenting behaviors, such as reasonable levels of control and warmth, and low levels of stress both regarding parenting and regarding family finances, and lower levels of conflict were related to more desirable child sleep behaviors. Interestingly, parent psychological distress had relatively few associations with children's sleep timing in the current study – for weekends only, higher parental distress was associated with earlier waketimes for younger children. This stands in contrast to prior research showing strong associations between parent emotional well-being and child sleep timing (Seifer et al., 1996; Zuckerman et al., 1987).

Comparisons of weekend vs. weekday sleep. Contrasting the effects for weekdays vs. weekends, it is clear school start times and travel times have the largest effects on weekday sleep. Parental warmth and rules appear to have larger effects on weekday sleep, while children's voluntary activities have larger and more consistent effects for weekend sleep. Parents appear to ease up and give children greater say over their activity choices and sleep behaviors on weekends, with the effect that those activities in turn are greater determinants of children's weekend sleep hours, and family functioning variables appear to have a slightly decreased effect.

This is in line with prior research on children's reports of their own perceptions of the determinants of their weekday and weekend sleep (see Carskadon, 2002).

Implications of normative variations in sleep timing in the CDS sample

At this point, the reader may be wondering whether the types of variations in sleep found in the current study truly have any meaningful association with health outcomes. While we do know that shortened sleep has implications for physiology and health in laboratory studies, those studies featured relatively extreme shortening of sleep hours, rather than naturally occurring variations in sleep such as those described in the current study. What information do we have regarding the impact of sleep hours on the well-being of the youth in this study? Prior analyses of these data, aimed at examining the consequences of shortened sleep for children's health outcomes, found that fewer hours of sleep, among the children in the CDS sample, was related to greater BMI and risk for overweight and obesity five years later, controlling for baseline BMI (Snell, Adam & Duncan, 2005). Thus, at least for obesity-related health problems, shortened sleep hours are placing children who sleep less than others at greater health risk. Further research should examine consequences for emotional health and cognitive performance.

Alternative explanations, study limitations, caveats and conclusions

Given the cross-sectional nature of our data, the directionality of our findings are subject to debate—it is certainly possible that the timing and quality of children's sleep may in turn influence children's activity choices and the quality of their family life. Indeed, insufficient sleep can cause behavioral and mood changes that may have an impact on behavior and on family processes, which in turn may further impact on child sleep, making associations between child sleep, behavior, and family functioning cyclical in nature. If this is the case, improvements in child behavior, child sleep, or family climate may all serve as effective approaches to breaking this negative cycle. Reverse causality explanations are much less likely for other variables in the

study, such as the impact of school travel times on children's sleep hours (particularly for younger children, who are unlikely to be responsible for their own transport to and from school). In addition, third variable explanations for the reported effects are less likely due to the large number of control variables included, such that the effects reported reflect the association of each variable with children's sleep net of all the other variables in the model. One could perhaps argue that too many controls are employed, but in our opinion it is more serious to falsely attribute effects to a variable than failing to find significance for certain variables due to our substantial number of controls.

Several final caveats of our study should be noted. First, although our study measured to influence of many broad social-ecological variables on children's sleep patterns, we did not have measures of children's proximal sleep ecology, such as their sleeping arrangements (sleeping alone, sharing beds with siblings, parents, pets or other bed partners), which may have important influences on sleep (Worthman & Melby, 2002). Second, our study focused on sleep timing, rather than sleep efficiency and quality, which are important factors in determining the impact of children's sleep on their functioning and health (Dahl, 1996; Sadeh, Gruber & Raviv, 2002). Third, any form of self-reported sleep timing is likely to be less accurate than an objective approach to measurement of sleep timing such as actigraphy (Sadeh, Raviv & Gruber, 2000). The fact that our average hours of sleep both on weekends and weekdays are longer than those typically found with actigraphy in children (Sadeh, Gruber & Raviv (2003) and adolescents (Hansen et al., 2005) suggests that our measure is capturing some time in bed during which children are not sleeping, either due to the time taken to fall asleep or due to wakeups during the night that are not accounted for by the time diary. Given the large numbers of children involved, however, objective sleep assessment using actigraphy was a possibility. Of the self-report alternatives, however, we believe the time diary approach is better than a global or stylized

reporting of sleep over a larger period, because stylized reports are more subject to reporting bias, in particular for certain SES and racial/ethnic groups (Juster, Ono and Stafford, 2003; Ross & Mirowsky, 1984; Bardwell & Dimsdale, 2001). The time diary approach does have the disadvantage of relying on only two days of experience per person, and there is no guarantee for any individual that that day reflects an average or typical day in their life. Across large numbers of individuals, however, given that the days are randomly selected for each person, the time diary data should be representative of the aggregate activity and sleep experiences of any group.

As a result, we believe that our approach of using time diary reports of activities and sleep on randomly selected days in a large, nationally representative sample of children reflects a reasonably accurate depiction of the multiple influences on children's sleep timing behavior. The results of this study confirm much prior research suggesting that these influences include: demographic variables, structural constraints such as school schedules (and a new finding of children's travel times to school), and children's activity choices on weekdays and weekends. Controlling for all of these other influences, family variables, including the rules and emotional climate the family provides, also matter for child and adolescent sleep.

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Table 1
Description of Sample

	Younger (N=1267)		Older (N=1187)		*t* statistic for mean differences	
	Mean	SD	Mean	SD		
Outcome measures:						
Hours of sleep (weekday)	9 hrs 49 min	1 hr 6 min	8 hrs 37 min	1 hr 40 min	-19.62	***
Bedtime (weekday)	9:09 PM	57 min	10:24 PM	1 hr 17 min	26.68	***
Waketime (weekday)	6:58 AM	48 min	7:02 AM	1 hr 35 min	2.19	*
Hours of sleep (weekend)	10 hrs 47 min	1 hr 26 min	10 hrs 15 min	2 hrs	-6.67	***
Bedtime (weekend)	9:25 PM	1 hr 9 min	10:48 PM	1 hr 32 min	23.91	***
Waketime (weekend)	8:12 AM	1 hr 10 min	9:04 AM	1 hr 44 min	14.12	***
Child demographics						
Child's age	8.90	1.81	15.20	1.87	85.73	***
Child is male	0.49	0.50	0.49	0.50	-0.69	
Child is non-Hispanic black	0.14	0.34	0.17	0.37	1.27	
Child is non-Hispanic white	0.64	0.48	0.63	0.48	-0.23	
Child is Hispanic	0.15	0.35	0.13	0.34	-1.58	
Child is Asian	0.03	0.18	0.03	0.17	-0.34	
Child is other race or ethnicity	0.05	0.22	0.04	0.20	-0.43	
Child well-being and socioeconomic controls						
Child's health	4.42	0.77	4.42	0.82	-0.76	
Internalizing behavioral problems	-0.04	0.53	0.03	0.61	1.56	
Externalizing behavioral problems	0.02	0.59	-0.04	0.60	-3.56	*
Family income (in $10,000)	6.22	6.04	7.96	10.38	5.15	***
Average parental education (in years)	12.39	3.68	12.40	3.71	0.43	
Married couple household	0.65	0.48	0.66	0.47	0.18	
Head's working hours	42.45	15.79	41.85	14.83	-1.51	
Wife's working hours	18.98	19.50	23.29	20.63	4.21	***
Total number of children in household	2.35	1.01	2.33	1.19	-1.43	
School start, end, and travel time						
School start time	8:09 AM	40 min	7:56 AM	42 min	-6.14	***
School end time	2:44 PM	54 min	2:44 PM	1 hr	-0.05	
Time spent traveling to school from home	0.26	0.28	0.26	0.25	0.62	
Weekday activities (in hours)						
Watching TV	1.68	1.62	1.88	1.84	3.12	**
On computer or doing video games	0.38	0.81	0.84	1.41	8.15	***
Sports	0.15	0.50	0.19	0.62	2.68	*
Homework	0.56	0.67	0.81	1.14	3.89	***
Religious activities	0.09	0.36	0.08	0.39	0.41	
Socializing	0.15	0.59	0.33	1.02	3.97	***
Meals	0.74	0.46	0.58	0.46	-9.71	***
Work	NA	NA	0.23	1.04		
Weekend activities (in hours)						
Watching TV	2.85	2.18	2.87	2.38	0.42	
On computer or doing video games	0.77	1.21	1.30	2.04	5.43	***
Sports	0.38	1.00	0.37	1.00	0.52	
Homework	0.11	0.38	0.35	0.91	7.48	***
Religious activities	0.68	1.30	0.54	1.29	-1.38	
Socializing	0.61	1.50	0.80	1.68	2.03	*
Meals	1.09	0.60	0.76	0.60	-12.61	***
Work	NA	NA	0.38	1.46		
Family functioning measures (standardized)						
PCG warmth	0.29	1.07	-0.23	1.22	-11.47	***
Family rules	0.29	0.79	-0.50	1.10	-20.72	***
Family economic strain	0.02	1.25	-0.12	1.13	-3.04	**
PCG parenting stress	-0.17	0.92	0.05	1.03	5.02	***
PCG psychological distress	-0.04	1.14	0.03	1.21	-0.04	
Family conflict	-0.11	1.24	-0.02	1.20	1.85	+

***p <.001. **p<.01. *p <.05. +p <.10.
Note: All weekday activity means are significantly different from weekend activity means at p <0.01.

Table 2
Correlations Between Predictors and Sleep Behaviors (N=2454)

	Weekday			Weekend		
Independent Variable	Hours of Sleep	Bedtime	Waketime	Hours of Sleep	Bedtime	Waketime
Child's age	-0.41**	0.52**	0.06*	-0.15**	0.48**	0.30**
Child is male	0.04	-0.02	0.02	-0.03	-0.01	-0.04
Child is non-Hispanic black	-0.09**	-0.03	0.03	-0.02	-0.04	-0.07**
Child is non-Hispanic white	0.08**	0.06*	-0.07**	-0.00	0.08*	0.08**
Child is Hispanic	0.02	-0.04*	0.04	0.02	-0.04*	-0.02
Child is Asian	0.00	0.00	0.03	0.02	-0.03	0.01
Child is other race/ethnicity	0.03	-0.01	0.03	0.03	-0.03	0.00
Child's health	-0.01	-0.02	-0.03	-0.01	-0.02	-0.03
Internalizing behavioral problems	-0.01	0.01	0.00	0.03	-0.01	0.03
Externalizing behavioral problems	0.06**	-0.05*	0.03	0.04	-0.05*	-0.00
Family income (in $10,000)	-0.08**	0.09**	-0.01	-0.05*	0.10**	0.04
Average parental education (in years)	0.00	0.00	0.01	-0.04	-0.02	-0.06*
Married couple household	0.04	-0.02	0.03	-0.04	-0.04	-0.08**
Head's working hours	-0.03	0.02	-0.01	-0.06**	0.02	-0.05*
Wife's working hours	-0.06*	0.05*	-0.02	-0.04	0.05	0.01
Total number of children in household	0.10**	-0.08*	0.04	0.06*	-0.11**	-0.04*
School start time	0.29**	-0.01	0.34**	0.02	-0.02	0.00
School end time	0.07**	-0.03	0.05*	0.03	0.00	0.04
Time spent traveling to school from home	-0.22**	-0.06**	-0.35**	-0.01	-0.02	-0.03
Watching TV	-0.04	0.22**	0.19**	-0.13**	0.15**	0.00
On computer or doing video games	-0.06**	0.23**	0.20**	-0.14**	0.19**	0.04
Sports	0.02	0.06**	0.09**	-0.02	-0.00	-0.02
Homework	-0.16**	-0.00	-0.20**	-0.03	0.04*	0.01
Religious activities	-0.05*	0.02	-0.05*	-0.04	-0.14**	-0.18**
Socializing	-0.01	0.19**	0.18**	-0.10**	0.16**	0.03
Meals	0.23**	-0.17**	0.12**	0.04	-0.21**	-0.16**
Work (older only)	-0.06	0.11**	0.03	-0.10**	0.09**	-0.04
PCG warmth	0.11**	-0.17**	-0.05*	0.02	-0.16**	-0.13**
Family rules	0.21**	-0.31**	-0.07**	0.09**	-0.25**	-0.15**
Family economic strain	0.01	-0.01	-0.01	0.01	-0.01	0.02
PCG parenting stress	-0.07**	0.08**	-0.01	-0.01	0.06**	0.05*
PCG psychological distress	-0.01	-0.00	-0.01	0.01	-0.03	-0.02
Family conflict	-0.05*	0.05*	-0.01	0.01	0.05*	0.06**

* $p < .05$. ** $p < .01$.

Table 3

Correlations Between Independent Variables (N=2454)

	Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	Child's age	1.00															
(2)	Child is male	-0.02	1.00														
(3)	Child is non-Hispanic white	-0.02	-0.03	1.00													
(4)	Child is non-Hispanic black	0.05*	0.04	-0.77**	1.00												
(5)	Child is Hispanic	-0.03	-0.01	-0.28**	-0.23**	1.00											
(6)	Child is Asian	-0.01	-0.00	-0.22**	-0.18**	-0.07**	1.00										
(7)	Child's health	-0.03	-0.01	0.20**	-0.16**	-0.09**	0.01	1.00									
(8)	Internal. behavioral problems	0.04	0.01	-0.07**	0.03	0.07**	0.02	-0.27**	1.00								
(9)	External. behavioral problems	-0.09**	0.05*	-0.05*	0.04*	-0.01	0.02	-0.24**	0.71**	1.00							
(10)	Family income (in $10,000)	0.10**	-0.03	0.29**	-0.24**	-0.09**	0.01	0.17**	-0.09**	-0.11**	1.00						
(11)	Parental education	-0.00	-0.02	0.29**	-0.14**	-0.25**	-0.04*	0.13**	-0.10**	-0.11**	0.27**	1.00					
(12)	Married couple	-0.02	-0.00	0.32**	-0.39**	0.12**	0.00	0.13**	-0.18**	-0.20**	0.26**	0.22**	1.00				
(13)	Head's working hours	-0.03	-0.01	0.20**	-0.23**	0.04	0.02	0.11**	-0.05*	-0.05*	0.21**	0.14**	0.28**	1.00			
(14)	Wife's working hours	0.09**	0.00	0.18**	-0.19**	0.03	-0.02	0.10**	-0.09**	-0.11**	0.21**	0.09**	0.41**	0.20**	1.00		
(15)	Total number of children	-0.06**	-0.04	-0.08**	0.00	0.13**	0.02	-0.03	0.01	0.03	-0.06**	-0.10**	0.06**	-0.04*	-0.05*	1.00	
(16)	School start	-0.14**	0.02	0.07**	-0.10**	0.00	0.05*	0.04	-0.01	0.03	-0.02	-0.00	0.05*	0.01	-0.04	0.04	1.00
(17)	School end	-0.01	0.03	-0.06**	0.07**	-0.03	0.01	-0.01	0.03	0.05*	-0.02	-0.02	-0.04*	-0.00	0.01	-0.03	0.21**
(18)	Travel to school from home	0.03	0.05*	-0.08**	0.13**	-0.08**	-0.03	0.01	0.01	-0.00	-0.05*	-0.01	-0.07**	-0.07**	-0.02	-0.02	-0.03
(19)	TV (weekday)	0.07**	0.02	-0.11**	0.10**	0.02	0.01	-0.11**	0.05*	0.04*	-0.08**	-0.11**	-0.04	-0.05*	-0.02	0.05*	-0.01
(20)	Computer/ video games (weekday)	0.17**	0.18**	0.08**	-0.05*	-0.05*	-0.01	0.03	-0.04*	-0.05*	0.04*	0.03	0.02	0.01	0.01	-0.06*	-0.01
(21)	Sports (weekday)	0.05*	0.14**	-0.01	0.03	-0.01	-0.03	-0.04	-0.01	0.03	-0.02	-0.03	-0.01	-0.04	0.00	0.05*	-0.03
(22)	Homework (weekday)	0.09**	-0.05*	-0.04*	0.01	0.04	0.04	0.04	0.00	-0.06**	0.10**	0.08**	0.06**	0.02	0.02	-0.04	-0.08**
(23)	Religious activities (weekday)	0.00	-0.02	0.06*	-0.03	-0.03	-0.01	0.01	-0.02	-0.04*	-0.01	0.06*	0.07**	0.00	0.04	-0.01	-0.01
(24)	Socializing (weekday)	0.11**	0.02	0.02	-0.01	-0.01	-0.01	0.01	0.00	0.02	0.02	0.03	-0.05*	-0.04	-0.00	-0.02	0.04*
(25)	Meals (weekday)	-0.23**	0.02	0.08**	-0.09**	0.02	0.01	0.03	-0.02	-0.01	0.02	0.05*	0.04	0.01	-0.01	0.00	0.10**
(26)	Work (weekday, older only)	0.27**	-0.03	0.01	0.01	-0.01	-0.03	-0.00	-0.04	-0.04	-0.01	-0.02	-0.05	-0.01	0.02	-0.02	0.02
(27)	Warmth	-0.24**	-0.09**	0.13**	-0.11**	-0.02	-0.03	0.11**	-0.06**	-0.06**	0.03	0.09**	0.05*	0.02	0.03	-0.03	0.04*
(28)	Family rules	-0.43**	0.05*	-0.20**	0.18**	0.03	0.02	-0.04*	0.02	0.05*	-0.13**	-0.01	-0.07**	-0.04	-0.10**	0.12**	0.01
(29)	Economic strain	-0.08**	0.03	-0.12**	0.13**	-0.05*	0.03	-0.11**	0.18**	0.20**	-0.16**	-0.15**	-0.21**	-0.09**	-0.12**	0.08**	0.01
(30)	Parenting stress	0.09**	0.02	-0.09**	0.12**	-0.02	-0.03	-0.21**	0.48**	0.57**	-0.08**	-0.07**	-0.16**	-0.05*	-0.11**	-0.07**	-0.01
(31)	Psych. distress	-0.02	-0.01	-0.12**	0.06**	0.10**	0.02	-0.17**	0.35**	0.32**	-0.11**	-0.13**	-0.15**	-0.07**	-0.11**	0.06**	0.02
(32)	Family conflict	0.05*	-0.02	-0.18**	0.23**	-0.06**	-0.01	-0.13**	0.22**	0.26**	-0.15**	-0.12**	-0.40**	-0.14**	-0.25**	0.07**	-0.02

* $p < .05$. ** $p < .01$.

Table 3

Correlations Between Independent Variables (N=2454)

	Independent Variable	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
(1)	Child's age																
(2)	Child is male																
(3)	Child is non-Hispanic white																
(4)	Child is non-Hispanic black																
(5)	Child is Hispanic																
(6)	Child is Asian																
(7)	Child's health																
(8)	Internal. behavioral problems																
(9)	External. behavioral problems																
(10)	Family income (in $10,000)																
(11)	Parental education																
(12)	Married couple																
(13)	Head's working hours																
(14)	Wife's working hours																
(15)	Total number of children																
(16)	School start																
(17)	School end	1.00															
(18)	Travel to school from home	0.04	1.00														
(19)	TV (weekday)	-0.08**	-0.11**	1.00													
(20)	Computer/ video games (weekday)	-0.04	-0.08**	0.01	1.00												
(21)	Sports (weekday)	-0.03	-0.06**	0.01	0.05*	1.00											
(22)	Homework (weekday)	0.04*	0.10**	-0.18**	-0.13**	-0.08**	1.00										
(23)	Religious activities (weekday)	-0.04*	0.02	-0.09**	-0.06*	-0.01	0.02	1.00									
(24)	Socializing (weekday)	-0.09**	-0.11**	-0.06**	-0.02	-0.02	-0.13**	-0.03	1.00								
(25)	Meals (weekday)	-0.04	-0.14**	0.04	0.01	-0.01	0.01	0.03	-0.03	1.00							
(26)	Work (weekday, older only)	-0.13**	-0.02	-0.11**	-0.08**	-0.06	-0.08*	-0.05	-0.02	-0.12**	1.00						
(27)	Warmth	-0.00	-0.00	-0.08**	-0.08**	-0.02	0.03	0.00	-0.05*	0.12**	-0.06	1.00					
(28)	Family rules	0.06**	0.06*	-0.06**	-0.13**	-0.02	0.02	0.02	-0.10**	0.15**	-0.14**	0.24**	1.00				
(29)	Economic strain	0.00	0.03	0.04	-0.02	0.01	-0.02	-0.04	-0.03	-0.01	0.03	-0.01	0.05*	1.00			
(30)	Parenting stress	0.01	0.03	0.02	-0.00	0.03	-0.01	-0.02	-0.01	-0.04	0.01	-0.12**	-0.01	0.14**	1.00		
(31)	Psych. distress	0.01	-0.00	0.04*	-0.06**	0.02	0.02	-0.04	-0.03	-0.04	-0.02	-0.04	0.02	0.27**	0.31**	1.00	
(32)	Family conflict	-0.00	0.04*	0.08**	0.01	0.02	-0.02	-0.03	0.00	-0.08**	0.01	-0.15**	-0.04	0.24**	0.24**	0.21**	1.00

* $p < .05$. ** $p < .01$.

Table 4

Regressions predicting weekday sleep behaviors by child's age

	Hours of sleep		Bedtime		Waketime	
	Younger	*Older*	*Younger*	*Older*	*Younger*	*Older*
Child demographics						
Child's age	-0.087**	-0.050	0.104**	0.156**	0.017[b]	0.107*
	(0.023)	(0.039)	(0.020)	(0.029)	(0.015)	(0.045)
Child is male	0.004	0.078	-0.001[a]	-0.278**	0.003	-0.200+
	(0.073)	(0.110)	(0.062)	(0.077)	(0.050)	(0.105)
Child is non-Hispanic black	-0.068[a]	-0.456**	0.120	0.282**	0.052[b]	-0.174
	(0.114)	(0.161)	(0.084)	(0.103)	(0.081)	(0.126)
Child is Hispanic	0.009	0.027	0.141	0.119	0.150	0.146
	(0.138)	(0.301)	(0.115)	(0.155)	(0.094)	(0.290)
Child is Asian	-0.682**[a]	0.508	0.540*[b]	0.009	-0.143[b]	0.517
	(0.226)	(0.505)	(0.260)	(0.226)	(0.151)	(0.330)
Child is other race	-0.200	0.195	0.339+	0.251	0.139	0.446
	(0.204)	(0.457)	(0.190)	(0.277)	(0.138)	(0.383)
Child health and behavior measures						
Child's health	-0.176**[b]	0.018	0.067	-0.026	-0.109*	-0.007
	(0.061)	(0.074)	(0.043)	(0.069)	(0.051)	(0.083)
Internalizing behavioral problems	0.082	-0.115	-0.088	0.022	-0.007	-0.094
	(0.092)	(0.170)	(0.073)	(0.091)	(0.064)	(0.161)
Externalizing behavioral problems	-0.041	0.287	0.071	-0.028	0.030	0.260
	(0.089)	(0.183)	(0.072)	(0.116)	(0.059)	(0.190)
Family socioeconomic measures						
Family income in $10,000	-0.008	-0.003	0.008	0.002	-0.001	-0.001
	(0.007)	(0.003)	(0.005)	(0.002)	(0.004)	(0.003)
Average parental education	0.000	0.003	0.006	0.035*	0.006	0.038
	(0.018)	(0.032)	(0.016)	(0.017)	(0.012)	(0.028)
Married couple household	0.044	-0.291+	0.075	0.157	0.119+	-0.134
	(0.095)	(0.167)	(0.085)	(0.123)	(0.062)	(0.155)
Head's working hours	-0.001	-0.004	0.003	0.005+	0.001	0.000
	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.004)
Wife's working hours	0.000	0.003	-0.000	-0.003	-0.000	0.000
	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.003)
Total number of children	0.001	0.145	-0.065+	-0.049	-0.065*	0.096
	(0.037)	(0.101)	(0.034)	(0.040)	(0.027)	(0.089)
School start and end time, travel time						
School start time	0.330**[a]	0.579**	0.074+	0.048	0.404**[a]	0.627**
	(0.056)	(0.073)	(0.041)	(0.058)	(0.050)	(0.065)
School end time	0.077*	0.101	-0.036	0.080+	0.041*[b]	0.181**
	(0.031)	(0.063)	(0.028)	(0.047)	(0.017)	(0.054)
Time spent traveling to school from home	-0.687**[a]	-1.412**	-0.095	-0.134	-0.782**[a]	-1.545**
	(0.147)	(0.197)	(0.121)	(0.141)	(0.107)	(0.170)
Weekday activities (in hours)						
Watching TV	-0.120**[a]	0.005	0.164**	0.178**	0.044+[a]	0.184**

	(0.028)	(0.039)	(0.024)	(0.026)	(0.023)	(0.032)
On computer or doing video games	-0.026	-0.069	0.095*	0.221**	0.070+	0.152**
	(0.047)	(0.047)	(0.040)	(0.035)	(0.039)	(0.042)
Sports	-0.091	0.123	0.114	0.101	0.023b	0.224**
	(0.098)	(0.076)	(0.086)	(0.067)	(0.057)	(0.077)
Homework	-0.063	-0.200**	-0.017	0.078*	-0.080*	-0.122*
	(0.059)	(0.056)	(0.053)	(0.037)	(0.037)	(0.054)
Religious activities	-0.369**	-0.207*	0.349**[b]	0.090	-0.020	-0.117
	(0.115)	(0.088)	(0.095)	(0.082)	(0.073)	(0.093)
Socializing	-0.078	-0.069	0.144*[b]	0.305**	0.066	0.235**
	(0.071)	(0.090)	(0.064)	(0.040)	(0.049)	(0.084)
Meals	0.369**	0.569**	-0.061[b]	-0.319**	0.307**	0.250+
	(0.077)	(0.144)	(0.086)	(0.087)	(0.074)	(0.129)
Work		0.011		0.073+		0.084*
		(0.044)		(0.038)		(0.042)
Family functioning measures						
Parental warmth	0.051[b]	-0.083+	-0.072*[b]	0.042	-0.021	-0.041
	(0.035)	(0.046)	(0.033)	(0.035)	(0.023)	(0.043)
Parental rules	-0.008[a]	0.247**	-0.009	-0.122*	-0.017[b]	0.125*
	(0.052)	(0.062)	(0.047)	(0.048)	(0.035)	(0.060)
Economic strain	-0.045	0.016	0.077*[b]	-0.037	0.032	-0.021
	(0.033)	(0.063)	(0.030)	(0.036)	(0.021)	(0.050)
Parenting stress	-0.079+	-0.055	0.057	0.022	-0.021	-0.032
	(0.044)	(0.087)	(0.039)	(0.047)	(0.031)	(0.081)
Psychological distress	0.016	-0.070	-0.012	0.008	0.003	-0.062
	(0.035)	(0.055)	(0.032)	(0.038)	(0.025)	(0.044)
Family conflict	-0.058	0.025	0.029	0.001	-0.029	0.026
	(0.039)	(0.058)	(0.035)	(0.034)	(0.025)	(0.048)
R-squared	0.235	0.268	0.229	0.313	0.299	0.358

Note. Standard errors have been adjusted using Huber-White methods

Note. Younger $N = 1267$; Older $N = 1187$.

+ $p<.10$. * $p<.05$. ** $p<.01$.

[a] Younger child coefficient is significantly different from older child coefficient at p <0.01.
[b] Younger child coefficient is significantly different from older child coefficient at p <0.05.

Table 5
Regressions predicting weekend sleep behaviors by child's age

	Hours of sleep		Bedtime		Waketime	
	Younger	*Older*	*Younger*	*Older*	*Younger*	*Older*
Child demographics						
Child's age	-0.032	0.001	0.112**[b]	0.193**	0.080**	0.193**
	(0.028)	(0.044)	(0.021)	(0.028)	(0.024)	(0.038)
Child is male	0.019	0.372*	-0.098	-0.296**	-0.079	0.076
	(0.096)	(0.160)	(0.076)	(0.104)	(0.079)	(0.134)
Child is non-Hispanic black	0.159	-0.504*	0.164	0.307+	0.324**	-0.196
	(0.165)	(0.231)	(0.123)	(0.170)	(0.123)	(0.189)
Child is Hispanic	-0.397*	-0.508+	0.132	0.380+	-0.265+	-0.128
	(0.181)	(0.291)	(0.154)	(0.209)	(0.149)	(0.274)
Child is Asian	0.338	0.105	0.252	-0.158	0.590*	-0.053
	(0.363)	(0.420)	(0.270)	(0.338)	(0.288)	(0.325)
Child is other race	-0.276	0.269	0.295	0.187	0.019	0.457
	(0.254)	(0.535)	(0.298)	(0.341)	(0.240)	(0.372)
Child health and behavior measures						
Child's health	-0.063	-0.078	-0.032	0.020	-0.094+	-0.058
	(0.073)	(0.094)	(0.058)	(0.078)	(0.055)	(0.084)
Internalizing behavioral problems	0.050	-0.175	-0.018	-0.107	0.032	-0.282
	(0.137)	(0.187)	(0.106)	(0.129)	(0.102)	(0.174)
Externalizing behavioral problems	-0.151	0.256	0.108	-0.040	-0.043	0.216
	(0.132)	(0.210)	(0.106)	(0.148)	(0.096)	(0.168)
Family socioeconomic measures						
Family income in $10,000	-0.005	0.008+	-0.004	0.005	-0.008a	0.013*
	(0.009)	(0.004)	(0.009)	(0.004)	(0.007)	(0.006)
Average parental education	-0.069**	-0.037	0.005	0.046*	-0.064**	0.009
	(0.026)	(0.034)	(0.020)	(0.022)	(0.022)	(0.033)
Married couple household	-0.066	-0.368+	0.121	0.232	0.055	-0.136
	(0.153)	(0.201)	(0.110)	(0.149)	(0.108)	(0.157)
Head's working hours	-0.005	-0.008	0.005+	0.002	0.000	-0.006
	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.005)
Wife's working hours	0.002	0.006	-0.001	-0.003	0.001	0.002
	(0.003)	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)
Total number of children	0.022	0.151	-0.120**	-0.145**	-0.099*	0.005
	(0.059)	(0.095)	(0.043)	(0.052)	(0.048)	(0.074)
School start and end time, travel time						
School start time	0.006	0.049	0.114*	0.076	0.120*	0.126
	(0.065)	(0.106)	(0.057)	(0.080)	(0.055)	(0.108)
School end time	0.069	0.057	-0.030	0.006	0.039	0.063
	(0.045)	(0.082)	(0.039)	(0.059)	(0.041)	(0.077)
Time spent traveling to school from home	-0.178	0.164	-0.188	-0.253	-0.366*	-0.089
	(0.186)	(0.242)	(0.163)	(0.172)	(0.151)	(0.226)
Weekend activities (in hours)						
Watching TV	-0.148**	-0.160**	0.126**	0.139**	-0.021	-0.021

	(0.029)	(0.045)	(0.025)	(0.028)	(0.024)	(0.033)
On computer or doing video games	-0.160**	-0.231**	0.131**[b]	0.240**	-0.028	0.009
	(0.044)	(0.042)	(0.036)	(0.038)	(0.031)	(0.029)
Sports	-0.153**	-0.075	0.057+	0.018	-0.096*	-0.057
	(0.044)	(0.072)	(0.030)	(0.068)	(0.039)	(0.085)
Homework	0.124	-0.104	-0.048	0.064	0.075	-0.039
	(0.184)	(0.072)	(0.131)	(0.051)	(0.128)	(0.057)
Religious activities	-0.068*	-0.193**	-0.041	-0.060	-0.108**[b]	-0.253**
	(0.034)	(0.047)	(0.026)	(0.041)	(0.030)	(0.043)
Socializing	-0.132**	-0.205**	0.114**	0.198**	-0.018	-0.006
	(0.032)	(0.042)	(0.031)	(0.029)	(0.025)	(0.038)
Meals	0.167	-0.147	-0.209**	-0.148+	-0.042	-0.295**
	(0.103)	(0.121)	(0.072)	(0.081)	(0.080)	(0.107)
Work		-0.250**		0.047		-0.202**
		(0.044)		(0.038)		(0.041)
Family functioning measures						
Parental warmth	-0.037	-0.093	-0.030	-0.028	-0.067+	-0.121*
	(0.052)	(0.070)	(0.044)	(0.048)	(0.039)	(0.059)
Parental rules	0.076	0.023	0.012	0.004	0.089	0.027
	(0.080)	(0.079)	(0.060)	(0.057)	(0.058)	(0.067)
Economic strain	0.050	-0.029	0.052	0.079	0.102**	0.050
	(0.051)	(0.079)	(0.038)	(0.056)	(0.038)	(0.062)
Parenting stress	0.016	0.002	-0.029	0.013	-0.013	0.016
	(0.066)	(0.093)	(0.056)	(0.068)	(0.053)	(0.075)
Psychological distress	-0.043	0.012	-0.035	-0.036	-0.078*	-0.024
	(0.049)	(0.071)	(0.042)	(0.049)	(0.038)	(0.055)
Family conflict	-0.027	0.004	0.064+	0.009	0.037	0.013
	(0.051)	(0.067)	(0.036)	(0.047)	(0.041)	(0.056)
R-squared	0.125	0.140	0.197	0.256	0.121	0.144

Note. Standard errors have been adjusted using Huber-White methods

Note. Younger $N = 1267$; Older $N = 1187$.

+ $p<.10$. * $p<.05$. ** $p<.01$.

[a] Younger child coefficient is significantly different from older child coefficient at p <0.01.

[b] Younger child coefficient is significantly different from older child coefficient at p <0.05.