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Parental Work Schedules and Children's Cognitive Trajectories

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Abstract

Previous work has shown an association between mothers' nonstandard work schedules and children's well-being. We built on this research by examining the relationship between parental shift work and children's reading and math trajectories from age 5/6 to 13/14. Using data ($N=7,105$) from the National Longitudinal Survey of Youth and growth curve modeling, we found that children's math and reading trajectories were related to parents' type of nonstandard shifts (i.e., evening, night, or variable). We found that having a mother who worked more years at a night shift was associated with lower reading scores, having a mother work more years at evening or night shifts was associated with reduced math trajectories, and having a father work more years at an evening shift was associated with reduced math scores. Mediation tests suggest that eating meals together, parental knowledge about children's whereabouts, and certain after-school activities might help explain these results.

Keywords

academic achievement; cognitive trajectory; families and work; growth curve modelling; nonstandard work schedules; shift work

Work-family balance has become increasingly difficult for parents to achieve as the number of dual-earner families has continued to rise in recent decades (Bianchi, Robinson, & Milkie, 2006); accompanying this trend is an increase in the prevalence of nonstandard work schedules over the last 30 years (Presser, 2003). To juggle family and work demands, more parents, particularly those with young children, opt for "tag-team" parenting by working alternative shifts to ensure at least one of the parents will be with the children. Nonstandard schedules may give parents more time to supervise and monitor children but evening or night shifts may also reduce or eliminate parents' time with their children during dinner or night hours and therefore hinder the development of close and positive parent-child relationships and positive child outcomes. Additionally, a night or overnight shift may leave a parent so fatigued that the quality of the parent-child relationship suffers (Heymann, 2000a).

Parental nonstandard work schedules may impact child well-being both directly and indirectly through the parent-child relationship and the home environment, and through after-school activities. Nonstandard work combined with stressful work conditions and

scheduling problems may heighten work-family conflict and may have a negative impact on parenting behaviors (Barnett, Gareis, & Brennan, 2008). Maternal nonstandard work may also negatively affect child well-being by reducing mothers' time with children (Joshi & Bogen, 2007). Conversely, nonstandard work has been associated with positive impacts on child well-being when it increases time spent with fathers (Barnett & Gareis, 2007). Parents who work nonstandard schedules have been found to compensate for lost time in other ways, such as reducing leisure and sleep so as to protect time with children (Wight, Raley, & Bianchi, 2008).

Using a national longitudinal dataset that tracks 7,105 children and their families, this paper examines the relationship between parental nonstandard work schedules (e.g., evenings, nights, or irregular hours) and children's cognitive trajectories from ages 5 to 14. It builds upon and extends previous studies by paying particular attention to the associations between parental work schedules and parent-child relationships, home environments, and after-school activities and examining how these links are related to child cognitive outcomes. By parsing nonstandard work into three categories (fixed evening, fixed night, and variable shifts) and looking at the interactions between spousal work schedules, this paper further examines the complex arrangements families undertake to achieve work-family balance.

We build on the work-family balance literature that suggests that parents' experiences at the workplace may spill over and increase their stress at home. This spillover may influence parents' personal well-being, and, in turn, impact the parent-child relationship and child well-being. Similarly, parental work stress can cross over to other family members, negatively impacting family dynamics and child well-being. Stressful work conditions may lead to less positive family dynamics, including reduced time spent with children (Crouter & McHale, 2005), lower parental knowledge of children's whereabouts (Bumpus et al., 1999, 2006), and lower quality home environments (Menaghan & Parcel, 1995). By extension, to the extent that nonstandard schedules are stressful, they may affect these family dynamics and may impact child outcomes.

Equally importantly is the Ecological System perspective (Bronfenbrenner & Morris, 1998) emphasizing the importance of the interactions between children and their surrounding environment (e.g., parents) to their well-being. Indeed, the mixed findings of prior research on parental nonstandard work schedules may reflect differential effects of parental shift work at different developmental stages as discussed below. The review below focuses on the importance to child well-being of the parent-child relationship, the home environment, and after-school activities, all of which can be related to parental shift work.

Parental Work Schedules and Child Outcomes

Numerous studies have examined the associations between parental work schedules and child outcomes and found mixed results depending on age of child, the type of nonstandard schedule worked by the parent, and the patterns of both parents' work schedules (for two-parent families) (Han, 2008; Han & Waldfogel, 2007; Joshi & Bogen, 2007). A study of longitudinal data from the National Institute of Child Health and Human Development Study of Early Child Care revealed that both the timing and duration of maternal nonstandard work schedules tended to have negative relationships with children's cognitive well-being, particularly when begun in the first year of the child's life (Han, 2005). Similarly, a qualitative study found poorer educational outcomes, such as being suspended from school, for children whose mothers had worked evenings or nights over a 6-year period during childhood (Heymann, 2000a, 2000b). A few factors may account for the varied findings of previous studies. The effects of shift work likely vary by the type of nonstandard schedule. Parents who work evenings or nights are usually not home for dinner or evening activities but will often be available to provide supervision after school (although they may

be sleeping some of that time). Rotating and irregular shifts would have less predictable effects on parental time at home, which might make it harder for families to plan and attend events together but could also make it easier if the shift is employee-initiated rather than required by employers (Henly, Shaefer, & Waxman, 2006). Also, the effects of one parent's work schedule will depend on whether another parent is home, awake, and energized enough to take care of the child. Thus, the effects of shift work are likely to vary by both the type of shift and the patterns of both parents' work schedules (for two-parent families).

Parent-Child Relationship and Home Environment

Findings on parental work schedules and child well-being suggest that the parent-child relationship and the home environment may help explain the links between parental work schedules and child well-being. A supportive home environment, which includes parental warmth, consistent parental expectations about chores, and frequent family activities and meals provides a secure space for children to grow. Many studies have shown that strong parent-child connections and parent involvement protect against a variety of risks (Crouter & Head, 2002; Guilamo, Jaccard, & Dittus, 2010). Parental warmth and parent-child connections have been shown to promote parental knowledge of children's whereabouts, which, in turn, has been shown to lower children's involvement in risky behaviors (Crouter, Bumpus, Head, & McHale, 2001; Stattin & Kerr, 2010). Work stress, however, can spill over and directly affect the quality of the home environment and parent-child relationships (Cinamon et al., 2007). Work stress has been found to function differently for mothers and fathers. Galambos and colleagues (1995) found feelings of work overload to be associated with parental stress and, in turn, poorer parent-child relationships and negative adolescent behavior, and also determined that this spillover operated differently for mothers and fathers with mother acceptance mediating the relationship for mothers and parent-adolescent conflict mediating the relationship for fathers. Crouter and colleagues (1999) found that mothers were more likely to be affected by work stress crossover, with feelings of overload linked to both their spouses' work pressure and their own, whereas fathers' feelings of overload were only associated with their own work pressure. Mothers brought work-related emotions home, whereas fathers left work at the workplace (Schneider & Waite, 2005). Thus, mothers were more likely to transfer their work-related emotions to their children, whereas fathers were more likely to shield them from negative work experiences. This result perhaps explains why studies have found more effects associated with maternal employment but not paternal employment on child outcomes.

In a study using a local U.S. sample of 376 working- and middle-class families, Davis et al. (2006) found that although mothers who worked nonday shifts reported a more intimate relationship with their children than those working day shifts, fathers who worked nonday shifts knew significantly less about their children's daily activities than fathers who worked day shifts. When examining adolescents, Han and Waldfogel (2007) found that parents who worked night shifts were more likely to be home with their young teens after school, and parents who worked rotating shifts were more likely to miss important school events.

Time with parents seems to matter as well. More than a decade of annual surveys of teens by the National Center on Addiction and Substance Abuse (CASA) have shown that one of the simplest and most effective ways for parents to be engaged in their children's lives is by frequently having dinner together as a family. Fiese and Schwartz (2008) concluded that responsive, well-organized, and well-regulated mealtimes are related to positive child outcomes, such as better grades and an excellent or good parent-child relationship. More than two-thirds of respondents in the CASA study (2006), however, reported that the reason that their family did not have dinner together five or more times a week was because one or both parents worked late, were too busy, or had schedules that conflicted with the child's

schedules. Nonstandard shifts, especially evening or night shifts, would obviously impact the ability to have family meals.

After-School Activities

The way that children spend their time after school matters to their development (Lauer et al., 2006; Pierce, Bolt, & Vandell, 2010). Through after-school activities, children develop social skills, improve their academic performance, and establish strong relationships with caring adults (Durlak & Weissberg, 2007; Shernoff & Vandell, 2007). A variety of positive outcomes have been associated with participation in organized after-school activities. For example, participation in club activities and sports during middle childhood has been linked to higher academic performance, self-esteem, and social competence (Mahoney et al., 2006), as well as to better health and a lower likelihood of obesity (Krebs, Jacobson, & American Academy of Pediatrics, 2003). Smolensky and Gootman (2003) concluded that children who regularly attended high-quality after-school programs were more likely to be engaged in school and attentive in class, and less likely to exhibit antisocial and problem behaviors than low-income children who attended no such programs. Research has shown that children are more likely to engage in problem behaviors if they spend time unsupervised, either on their own or with peers (Mahoney et al., 2006; Smolensky & Gootman, 2003). Unsupervised time with peers was especially problematic when the peers engaged in negative behaviors, when parental monitoring was low, or when the parent-child relationship was poor (Osgood, Wilson, O'Malley, Bachman, & Johnson, 1996). Parental shift work during evening hours may exacerbate these problems. Thus, the links between parental shift work and child outcomes may be neutral or beneficial if children are enrolled in quality after-school activities. Similarly, the links between parental shift work and child outcomes may prove to be negative if children are unsupervised and/or are involved in activities that are not educationally or physically enriching.

The Present Study

The theoretical perspectives and empirical results discussed above indicate that parental shift work may be related to child well-being, but that the associations will likely depend on a number of factors. We therefore hypothesize three possible associations. Parental nonstandard work may have (a) negative association with child cognitive outcomes if it degrades the quality of the parent-child relationship or the home environment, or increases unsupervised after-school hours; (b) positive associations if it improves relationships and home environments, or increases attendance at educationally/physically enriching after-school programs; or (c) neutral associations if it creates both negative and positive associations with the mediating factors.

Using a longitudinal dataset that spans the first 14 years of a child's life, this paper builds upon and extends the existing research on work and family balance, with particular attention to the relationships between parental work schedules and parent-child relationships, the home environment, and after-school activities. We examine how these links, in turn, are related to child cognitive outcomes. We acknowledge that the links between parental work schedules and child well-being may vary in different contexts and we therefore include both parents' work schedules (in two-parent families). By examining both the mothers' and the fathers' work schedules and connecting them with children's cognitive outcomes, we provide new insights into an important but understudied aspect of work-life balance.

METHOD

Data

This study uses data from the National Longitudinal Survey of Youth (NLSY). The NLSY follows a nationally representative sample of 12,686 young men and women who were 14 to 22 years old when the survey was initiated in 1979, collecting data annually until 1994 and every other year thereafter. This analysis used the NLSY for parental characteristics and employment information. Beginning in 1986, a separate biennial Child Supplement (NLSY-CS) was administered to collect data on the children of the women in the NLSY. In 1988, the Child Supplement was expanded to survey children ages 10–14 on a variety of measures regarding their behavior and feelings, such as how close they are to their mother and father. We used NLSY-CS for child self-report information as well as child assessment outcomes.

The sample for the present study consists of 7,105 children who have been followed for a 13 to 14 year period and who have valid test score data in those years. Because of the way the NLSY-CS is structured (e.g., no child assessment until 1986 and biennially afterwards) and in order to utilize the longitudinal parental employment and family characteristics information on children since birth, the sample consists of six cohorts of children: those born in 1982/83, 1984/85, 1986/87, 1988/89, 1990/91, and 1992/93, who were followed from birth to age 13 or 14 (1996, 1998, 2000, 2002, 2004, and 2006, respectively). Because children were only assessed every other year, children born in a different year were assessed at an age that has a one-year difference. For example, children who were born in 1982 would be 6 years old at the first assessment period in 1988; in contrast, children born in 1983 would be 5 years old at the first assessment period in 1988. For this reason and to use the largest longitudinal sample sizes possible, children born in 1982 and 1983 are categorized together as the first cohort of the sample, and the other five cohorts of children are similarly grouped. With this structure, we were able to follow individual children over five assessment points to determine which groups of children, given their parents' work schedules, had faster or slower cognitive growth over time. Of the children included in the sample, 55% are non-Hispanic White, 26% are non-Hispanic Black, and 19% are Hispanic. About half are males.

Outcome Measures

We measured cognitive outcomes by examining the reading and math scores on the Peabody Individual Achievement Tests (PIAT) given to children age five and older. PIAT standardized scores ($M: 100$, $SD: 15$) are among the most widely used assessments of cognitive achievement, having demonstrably high test-retest reliability and concurrent validity (Baker, Keck, Mott, & Quinlan, 1993). These tests were administered by the NLSY every sampling period to children ages 5 to 14. The Reading Recognition Assessment of the PIAT (PIAT-RR) measures word recognition and pronunciation, and the Mathematics Assessment Test (PIAT-M) measures mathematical ability as commonly taught in U.S. schools.

Parental Work Status/Schedules

The main independent variable of interest is parental work schedules, for which the NLSY collects very detailed data through an interview with women (annually until 1994, biennially thereafter). Following the definitions used by the NLSY, a mother's work schedule was coded as "standard" if work begins at 6 a.m. or later and ends by 6 p.m. The schedule was coded as "fixed evenings" if the job begins at 2 p.m. or later and ends by 9 p.m., "fixed nights" if the job begins at 9 p.m. or later and ends by 6 a.m., and "variable hours" if the respondent had another type of schedule outside of standard hours (e.g., the shift changes periodically either by the employer or by employees themselves). (For simplicity,

“evenings” and “nights” are used hereafter to refer to “fixed evenings” or “fixed nights,” respectively.) Women who were not working at any type of job at the time of the interview were identified as “not working.”

Given the complex and potentially cumulative relationships between parental work schedules, parent-child relationships, the home environment, after-school activities, and children’s outcomes, a simple measure of parental work schedules may not be sufficient to disentangle them. Similarly, a variable that indicates simply whether a parent had worked nonstandard shifts by the child’s assessment age may not capture the experience of children whose parent(s) worked nonstandard shifts for a long time, or the differential effects of different types of shift work. Therefore, we created three work schedule variables to more fully capture children’s experiences with parents working nonstandard hours. These three variables represent the number of years a mother had worked evening, night, or variable shifts between the child’s birth and each of the five assessment ages. Thus, each of these three variables is the sum of the years a woman had been working such a shift with a minimum of 0 and a maximum of 13 or 14 years by the assessment point when the child was 13 or 14 years old. For two-parent families, data on fathers’ work schedules were also provided by mothers since 1981 and were created in a similar fashion. We refer to the mother’s husband or cohabiting male partner as the father (since he is living in the home and likely has a parental role) but note that he may not be the biological father of the child. We also experimented with further dividing the “variable shifts” category into two subgroups—“rotating or split” shifts and “varied” hours for years where this information was available. In these detailed analyses, no significant results were found for rotating/split shift variables.

Parent-Child Relationships, the Home Environment, and After-School Activities

From 1988 onwards, the NLSY-CS collected self-administered surveys from children aged 10 and older on various dimensions of their daily life, along with information gathered from their mothers (but not from fathers). We used this information to operationalize variables identified in the literature as potential mediators in linking parental shift work with children’s cognitive outcomes, including parent-child relationships (proxied by time spent together, maternal and paternal closeness, whether or not the mother and/or the father misses important events, and maternal and paternal knowledge of children’s whereabouts), the home environment (measured by the HOME scale and frequency of eating meals together), and after-school activities.

Time spent together—This construct ($\alpha = 0.75$) was measured using eight questions that asked the children to report whether they went to church, the movies, dinners, shopping, or outings with their parents in the month preceding the survey, or whether they had done things, worked on schoolwork together, or played a game or sport together with their parents in the week preceding the survey. A variable was created to record the number of different activities the child had done with their parents (values range from 0 to 8).

Maternal/paternal closeness—Two variables were used to proxy the child’s closeness with the mother ($\alpha = 0.65$) or father ($\alpha = 0.73$). The first was the child’s report of how close he/she felt toward the parent: *not very close (1), fairly close (2), quite close (3), and extremely close (4)*. The second was the child’s report of how well he/she shared ideas and talked about important things with the parent: *not very well (1), fairly well (2), quite well (3), and extremely well (4)*.

Parent missed important events—Children were asked if his/her mother missed a lot of important events (yes/no). Similarly, children were asked if their father or step-father missed important events a lot. We examined each of these variables separately.

Parental knowledge of children's whereabouts—The NLSY-CS asks children how often the mother knows who the child is with when not at home; responses included *all the time* (4), *most of the time* (3), *some of the time* (2), and *rarely* (1). A parallel question is asked about the father's knowledge of children's whereabouts. We examined each of these variables separately.

Home environment—This variable was the standardized score on the short form of the Home Observation and the Measurement of the Environment scale (HOME-SF), a frequently used measure of the home environment that has been found to have excellent reliability and validity overall (Menaghan & Parcel, 1991) and within the NLSY for children over age 3 (Mott, 2004). As part of the NLSY-CS, through maternal report and interviewer observations of the home, this variable includes information such as the number of books the child has, the availability of newspapers to the family, how often children were taken to museums or theaters, if the mother conversed with the child without scolding, if the mother's voice conveyed positive feeling about the child, whether the interior of the home was clean and well-lit, and whether the exterior of the home was safe.

Frequency of eating meals together—This question was only asked of two-parent families, and it measured the frequency of eating meals together with both parents during a week as reported by mothers, which ranged from *never* (coded 0) to *more than once a day* (coded 5).

After-school activities—This is a series of six dummy variables identifying whether the child participated in various after-school activities. Following the methodology used in Mahoney et al. (2006), activities were grouped into the following categories: organized activities (e.g., team sports, religious activities), educational activities (e.g., doing homework, being tutored), household chores (e.g., meal preparation, washing dishes), hanging out, playing games, or working for pay.

Other Parental and Family Characteristics

To reduce potential omitted variables bias, an extensive set of child, parental, and family characteristics that has been shown in prior research to be associated with family process and child cognitive outcomes were controlled for in the models. Unless otherwise noted, each of the following characteristics were measured at the time of child assessment: whether the child is a boy; child's race/ethnicity; whether the child has any siblings; mother's age, educational level, and marital status at the child's birth; family's income the year before the birth; number of years the child has lived in a single-mother family; and number of years the child's family has received welfare.

We also include controls for parental occupation and work hours. Controlling for occupation is important because employees who work nonstandard hours are more likely to be in sales or service jobs than those with standard hours. Also, these variables account for the fact that women in professional or managerial jobs tend to report working nonstandard shifts voluntarily, whereas those in other types of jobs tend to report working nonstandard shifts involuntarily (Garey, 1999; Han, 2008); similarly, other studies have shown the importance of mother's job characteristics on child cognitive stimulation (Menaghan & Parcel, 1995). Mother's occupation at her current or most recent job was collected at each interview year. Following Presser (2003), we created variables to control for the number of years respondents worked at three types of occupations: cashier and service jobs, sales positions, and professional or managerial jobs.

Controlling for work hours is important because empirical studies have found that individuals working part time are more likely to work nonstandard hours than those working full time (Presser, 2003), and partners appear to arrange their work hours around each other's shifts (Han, 2008; Han & Waldfogel, 2007). Therefore, variables were created to control for the average weekly hours that mothers (and fathers) had worked by the time of their child's assessment age.

Of course, even with these extensive controls, the possibility remains that parents or families differ in other ways that cannot be controlled for in the data and that might bias the results. Hence, we caution against placing a causal interpretation on our results.

Analytic Approach

Rates of missing data were generally less than 5% for demographic variables, and were higher for child's behaviors and feelings during their early adolescent years (age 10–14) but generally below 16%. STATA imputation commands, assuming MAR (missing at random), impute multiple-imputation datasets (i.e., *ice* in STATA) and adjust coefficients and standard errors for the variability between imputations according to the combination rules (i.e., *mim* in STATA; Rubin, 1987). Specifically, the multiple estimation method used in STATA is an iterative MCMC method to impute missing values, and the estimates from the EM algorithm as starting values for the MCMC procedure were used (Royston, Carlin & White, 2009). Results using multiple-imputation data are similar to those using non-imputed data with dummy variables indicating the missing values.

Multilevel growth-curve modeling was used to estimate the associations between parental work schedules and children's cognitive trajectories, with longitudinal data involving five assessment points. Analyses were estimated with Level 1 as age (i.e., within-individual effects) and Level 2 as individuals (i.e., between-individual effects). Such growth-curve models are able to compare the rate of growth of each group to see which have faster or slower cognitive growth paces over time.

As recommended in the growth curve literature (Singer & Willett, 2003, pp. 75–137), we conducted a sequence of statistical models to systematically evaluate whether there were differences in cognitive trajectories based on parental work schedules. We first examined the unconditional means model to assess the amount of outcome variation that exists at each level. Second, we evaluated the unconditional growth model to assess the extent to which within-person variation is systematically associated with time. Next, we added parental shift work variables, followed by adding family characteristics, and by further adding mediators (as described above) to the analysis. For simplicity, we present the results from the unconditional growth model with both mother's and father's work status variables (Model 1), the models adding demographic variables to the model (Model 2), and the models further adding mediators to the model (Model 3).

All continuous variables were centered at their grand mean values except the dummy variables (e.g., Black, Hispanic) so that the reference child represents a realistic scenario (Singer & Willett, 2003, pp. 113–116). In addition, the variable "time" was centered so that the initial status refers to ages 5/6. In all analyses, children whose parent(s) worked only fixed standard daytime hours were the reference group. Only linear slope model was conducted. To evaluate the model fit, three goodness-of-fit indices were used: the deviance statistic ($-2 \log$ -likelihood), AIC (Akaike Information Criterion), and BIC (Bayesian Information Criterion).

Additionally, to formally test variables for mediation, we followed the MacArthur approach (Kraemer, Kiernan, Essex, & Kupfer, 2008), which is similar to Baron and Kenny (1986)

but stricter. We first conducted a set of individual regression analyses to evaluate if parental work schedules were significantly associated with each of the examined mediators, controlling for child and family characteristics (as the first criteria to have mediation). Second, we re-ran the growth-curve analysis for Model 3 by including main effects of parental shift work and individual mediators along with the interaction terms of each type of parental shift work with each mediator in the model. The MacArthur approach finds the existence of a mediation effect if a) the coefficient for parental work schedules to the concerned mediator is significant in the first step, and b) either the estimates for the main effect of work schedules are reduced or the interaction terms or the main effects of mediators are significantly different from 0 in the second step.

RESULTS

Descriptive Statistics

Table 1 presents the descriptive statistics for demographic and parental work status variables by children's assessment age (for brevity, we presented information by age 6, 10, and 14) and by mother's shift work status (only standard shift vs. ever worked a nonstandard shift). Mothers who had ever worked evening, night, or variable shifts were considered as "ever working nonstandard shift." Nonstandard shifts were quite prevalent in this sample. Nearly half of mothers had worked nonstandard hours by the time their children were 6 years old, and more than two thirds had done so by the time their children were age 14, with an average duration of about 4.6 years by that time. Nearly one half of spouses had ever worked nonstandard shifts (not shown in the table), with a mean of 2 years by the time the child was age 13 or 14. As indicated in the table, the raw data suggest that mothers who had ever worked nonstandard shifts tended to have lower family incomes, were less likely to be married, were younger and less-educated, and spent more years as single mothers and more years receiving welfare. They also were less likely to be in professional/managerial jobs but more likely to be in service occupations.

These differences in family characteristics possibly indicate a selection story if there are any meaningful differences in children's cognitive trajectories by mothers' shift work status. Indeed, a great heterogeneity existed even among mothers working nonstandard shifts. In results not shown, we found that mothers who had ever worked variable shifts tended to be more advantaged than mothers who had ever worked either evening or night shifts in a number of sociodemographic characteristics. In addition, the spouses of mothers who had ever worked variable shifts tended to have worked more years at standard or variable shifts but fewer evening shifts and to have worked more hours per week on average during the child's first 13 or 14 years.

With respect to mediators (results not shown), children reported that they had done an average of four things together with their parents during the preceding month. About 63% and 43% of the children reported they felt extremely close to their mothers and fathers, respectively. About 40% and 26% of the children reported they shared ideas and talked about important things extremely well with their mothers and fathers, respectively. Ten percent of children reported that their mothers missed important events a lot compared to about one quarter of fathers. About 80% of children reported that their mothers knew most or all of the time who they were with when not at home compared to about 55% of fathers. Approximately 50% of mothers reported that their children ate dinner with both parents five or more times a week. A fair share of children reported attending organized activities (30%), educational activities (40%), doing household chores (31%), hanging out (40%), playing games (5%), or working for pay after school (13%).

The raw data (Table 2) also indicate that different types of nonstandard shifts are differentially correlated with parent-child relationships, the home environment, and after-school activities. For example, the number of years mothers worked evening hours was positively correlated with mother's knowledge of the child's whereabouts, doing household chores, hanging out, and working for pay after school, but negatively correlated with the frequency of having meals together and paternal closeness. At the same time, the number of years mothers worked night hours was negatively correlated with the frequency of having meals together and positively correlated with the mother missing important events. Note that most of the mediators have small to moderate correlations with each other (correlation coefficients range from about .20 to .40). Of course, a large sample size may result in statistical significance for correlations of small magnitude, and we are cautious not to overemphasize these relations.

Growth-Curve Analysis

Table 3 presents the estimates from the growth-curve models with controls for number of years worked at different nonstandard shifts by the assessment age. The left three columns present results on reading and the right three columns on math, with Models 1–3 as described above. The variance components from the unconditional means model (not shown) indicated that approximately 60% (66%) of the variation in reading (math) was attributable to differences between children with the remaining variation attributable to differences within children themselves. The within-person variance declined by 0.27 between unconditional means and unconditional growth models, indicating that 27% of the reading variation was associated with time. The comparison on math indicates that 13% of the variation was associated with time.

Results on Readings

As shown in Model 1 of Table 3, children's PIAT reading scores were nonzero between ages 5/6 and 13/14 ($b = 104.34, p < .001$) with a significantly negative slope ($b = -0.21, p < .05$), indicating a decrease in reading scores from ages 5/6 to ages 13/14. Children whose mothers worked more years at evening or night shifts had significantly lower reading scores compared to children whose mothers never worked such shifts. In contrast, children whose mothers or fathers worked more years at variable shifts had significantly higher reading scores; however, children whose mothers worked more years at variable shifts also had a significantly slower growth curve compared to those whose mothers never worked at variable shifts. When we added child and family characteristics into the analysis (Model 2), the results did not change much except that the negative significance for children whose mothers worked more years at evening shifts and the positive significance for children whose fathers worked variable shifts disappeared, but the estimate for paternal night shifts became significantly positive. Thus, child and family characteristics might account for these significant estimates for children whose mothers worked evening shifts and for children whose fathers worked variable shifts. The within-person variance component was similar to that of Model 1. For the Level-2 components, however, the variation in individual initial status declined by 22%, while the variation in the rate of change did not differ.

After further adding mediators to the model (Model 3), the only observable changes between Model 2 and Model 3 were that the estimate for paternal night shifts and the rate of change for children whose mothers worked variable shifts were no longer significant. These changes thus serve as an indication that parent-child relationships, the home environment, and after-school activities might explain the significance of paternal night shifts and the rate of change for children whose mothers worked variable shifts. In particular, children's reading scores may suffer if the child perceives that the mother misses the child's important events a lot, if

the mother does not know her child's whereabouts, if the home environment is of poorer quality, or if the child does household chores or plays games during after-school hours.

In our mediation test model (not shown), both the main effect of maternal knowledge ($b = 1.63, p < .001$) and the interaction terms with maternal evening shift ($b = 0.31, p < .05$) were significantly positively associated with children's reading scores. In addition, both the main effect of eating together ($b = 0.29, p < .01$) and the interaction terms with maternal night shift ($b = 0.13, p < .05$) were significantly positively associated with children's reading scores. When we regressed eating together on the set of maternal shift work variables in addition to socio-demographic covariates, we found that maternal night shift was significantly negatively associated with the frequency of families eating dinner together.

The associated variance components indicate that, compared to Model 2, the variations in Level-2 initial status declined, and the within-person variance remained stable as expected. Taken together, parental shift work status, child and family characteristics, and mediators explained 23% of the variation in between-person initial status and 3% of the variation in between-person rates of change. For each successive model, the decrease in the deviance statistic was significant at $p < .001$, indicating that Model 3 provided the best fit of all the models. The comparisons between models using the AIC and BIC were similar (the model with the smaller value is preferable).

Results on Math

The right three columns of Table 3 present results on math. Model 1 shows that children's math scores were nonzero between ages 5/6 and 13/14 ($b = 99.20, p < .001$) with a significantly positive slope ($b = 0.54, p < .001$), indicating an increase in math scores from ages 5/6 to ages 13/14. Children whose mothers or fathers worked more years at variable shifts had significantly higher math scores compared to children whose parents never worked such shifts; however, children whose mothers worked evening, night, or variable shifts all had significantly slower growth curves compared to those whose mothers only worked standard hours.

When we added child and family characteristics into the analysis (Model 2), the significant positive coefficient remained for children whose mothers worked variable shifts, but disappeared for those whose fathers worked variable shifts. Children whose mothers worked evening shifts and children whose fathers worked night shifts had significantly higher math scores than children whose parents worked day shifts; however, children whose mothers worked variable shifts no longer had a significantly different growth rate. Thus, child and family characteristics might account for some of the associations between parental shift work and child math outcomes. The within-person variance component was similar to that presented in Model 1. For the Level-2 components, the variation in individual initial status declined by 24%, whereas the variation in the rate of change did not differ.

After further adding parent-child relationships, the home environment, and after-school activities to the model (Model 3), only the coefficients for children whose fathers worked evening or night shifts remained statistically significant, whereas the significantly slower growth curves for children whose mothers worked evening or night shifts remain. Paternal night shifts were associated with higher math scores whereas paternal evening shifts were associated with lower math scores. In particular, children's math scores might suffer with poorer home environment, if the mother misses the child's important events a lot, if the mother does not know child's whereabouts, or if the child does household chores or plays games during after-school hours.

In our mediation test model (not shown), the main effect of maternal knowledge of child's whereabouts was significantly positively associated with children's math outcomes ($b = 2.38, p < .001$). The interaction effects suggest that maternal knowledge is important when mothers work evening shifts—maternal evening shift was associated with significantly higher maternal knowledge, and that in turn was significantly associated with higher children's math scores ($b = 0.31, p < .05$). In addition, although the main effect of after-school household chores was not significant, the interaction term of maternal night shift with after-school household chores was significantly negative ($b = -0.40, p < .05$), suggesting that maternal night shifts were associated with more after-school household chores, and that was in turn significantly associated with lower math scores.

The associated variance components indicate that, compared to Model 2, the variations in Level-2 initial status declined, whereas the within-person variance remained stable as expected. Taken together, parental shift work status, child and family characteristics, and mediators explained 27% of the variation in between-person initial status and 5% of the variation in between-person rates of change. For each successive model, the decrease in the deviance statistic was significant at $p < .001$, indicating that Model 3 provided the best fit of all the models. The comparisons between models using the AIC and BIC were similar.

Figures 1 and 2 present children's reading and math trajectories using results from Model 3 of Table 3 by mother's shift work status for number of years working at a) only standard shift, b) ever evening shift, c) ever night shift, and d) ever variable shift. Figures 1 and 2 show that children whose mothers worked variable shifts had the highest level of reading and math scores, followed by children whose mothers worked only standard shifts. In contrast, children whose mothers worked either evening or night shifts tended to have similar performance and trajectories in reading, lower than those of children whose mothers worked either only standard or ever variable shifts. Although children whose mothers worked either evening or night shifts had similar math score levels as those whose mothers worked only standard shifts, the former had slower growth curves than the latter, and by age 14, the former group of children had observably lower math scores.

DISCUSSION

Building upon an extensive literature on work-family balance and shift work, we evaluated whether or not children's reading and math initial scores and trajectories might differ by parents' shift work status. Given that children's daily experiences revolve around the availability of parental time, evening and night shifts might present a challenge for both parents and children, and such challenges may have implications for children's learning experiences and their cognitive trajectories. We found that having a mother who worked more years at a night shift might be related to lower reading *scores*, whereas having a father who worked more years at evening shifts might be related to lower math *scores*, and having a mother who worked more years at evening or night shifts might be related to slower math *trajectories*. In comparison, having a mother who worked more years at variable shifts was associated with significantly higher reading scores, and having a father who worked more years at night shifts was associated with significantly higher math scores. We note these results are small in magnitude.

Although we were limited by the availability of the data on mediators which were only available from the time children were age 10 and older, in addition to the fact that the growth-curve analysis and mediation tests cannot establish causality, our results shed light on the experiences these children may have due to their parents' shift work status and how these experiences might be related to their cognitive trajectories. The mediation tests revealed that the reasons that maternal evening and night shifts may put children on a

different cognitive trajectory by either lowering children's average reading scores or by such children having a flatter math growth curve than their peers may have to do with maternal knowledge, eating meals together, and/or children doing household chores during after-school hours. Maternal knowledge of child's whereabouts was positively associated with reading and math outcomes, whereas after-school household chores were negatively related to math outcomes. Our mediation tests suggest that families eating meals together less frequently might help explain some of the relationship between maternal evening and night shifts and children's cognitive trajectories, whereas doing more household chores during after-school hours might explain the association between maternal night shift and children's lower math scores. These two sets of results highlight realities often faced by families juggling work and family demands, and also are consistent with Gennetian and colleagues' finding (2002) that increased household chores due to maternal employment may reduce time spent on homework. Our results on eating meals together are consistent with previous studies showing the importance of family meals in promoting children's positive well-being (Fiese & Schwartz, 2008). In contrast, higher maternal knowledge about children's whereabouts seemed to be able to lessen or neutralize the negative association between maternal evening and night shifts and children's academic outcomes. Extensive research has shown that a good quality parent-child relationship promotes children's willingness to volunteer information about their daily lives and whereabouts to parents (Stattin & Kerr, 2010).

We did not find any significant mediators that explain the relationship between fathers' shift work and children's cognitive trajectories, although we did find that fathers working evening shifts was significantly associated with a higher likelihood of fathers missing important events. In addition, we found that fathers working night shifts was significantly positively associated with maternal knowledge of children's whereabouts. These results may stem from the limited information collected from fathers on their perspectives on the home environment or the time they spend with children. Large national datasets frequently have these limitations (with the exception of the ECLS-B), and we hope they will be addressed in future data gathering efforts.

Together with the finding of negative associations of maternal evening shifts in two-parent families, these findings about fathers' shift work warrant further investigation regarding the availability of fathers, the dynamics of fathers taking on household responsibilities during evening hours when their wives work, and the potential for "tag-team" parenting to maximize the time children spend with at least one of the parents. Indeed, one recent study found that parents in the Netherlands used nonstandard schedules so they could tag-team parent, which allowed fathers to spend more time with their children (Mills & Täht, 2010). It is likely that fathers' fixed night shifts coincide with mothers being at home during the evening/night hours (exemplified by higher maternal knowledge) and this may help explain the more positive outcomes for children. It is also likely that fixed night shifts are often accompanied by higher wages and/or more likely to be full-time positions with benefits (e.g., in the manufacturing sector) than other nonstandard shifts and higher wages and benefits may translate into better children's well-being due to positive income effects. We nonetheless did not find any significant association between joint parental schedules and children's cognitive trajectories when we examined the co-occurrence of parental shift work.

Our mediators were collected when children were aged 10 to 14, a period when young people begin establishing the developmental path of autonomy. Thus, our results may reflect a complex interplay between children trying to obtain autonomy yet in need of parental supervision and monitoring and how parental shift work may allow this developmental process easier or more difficult for both parents and children to negotiate a quality parent-child relationship. One recent study has found that parental shift work during these years had

important influence on adolescent-parent relationships and thus in turn on adolescent well-being (Han, Miller, & Waldfogel, 2010).

This study, of course, is not without caveats. The work schedule data was not collected on a monthly basis and was not available for weekends. Thus, the measures used here might undercount the occurrence of nonstandard schedules that occurred on weekends or between data collection points. To the extent that these undercounts occurred, the associations between nonstandard schedules and children's academic outcomes would be underestimated in this analysis.

The evidence provided in this paper has implications for future research. First, the association between parental evening and night shifts and children's cognitive outcomes may prompt further research on what factors pose special risks and promote protective contexts for children (e.g., parental role strain or the quality of the time parents spend with children). Research examining the spillover and crossover effects of job-related stress would be helpful in this regard. A noteworthy finding is that parents who work variable shifts (possibly signifying greater control over or flexibility in their work schedules) tend to have better knowledge of children's whereabouts, an important protective factor in children's developmental trajectories. At the same time, the heterogeneity of the parents working nonstandard shifts highlights the need for finer-grained analyses of the ways that economic factors (e.g., family income) and social factors (e.g., parental stress) intersect in shaping both families as a whole and children in particular. Finally, we note that we are asking a research question that involves the complex interplay between several aspects of a family's life. For many parents, a nonstandard shift is a requirement of the job rather than something chosen for work-family balance. Our examination of how parental shift work is related to the parent-child relationship, the home environment, and after-school activities attempts to capture real-life daily experiences, and we acknowledge that our quantitative data may barely touch on the challenges and difficulties experienced by families. We therefore call for the use of multi-method approaches to better understand the everyday experiences of today's families and how these experiences shape children's well-being.

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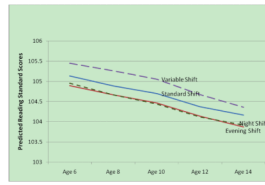


Figure 1.
Predicted PIAT Reading by Mother's Shift Work Status

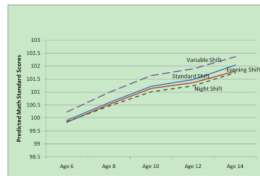


Figure 2.
Predicted PIAT Math by Mother’s Shift Work Status

Table 1

Descriptive Statistics for Analyzed Variables by Child's Assessment Age

	By age 6		By age 10		By age 14	
	Only standard shift	Ever non- standard shift	Only standard shift	Ever non- standard shift	Only standard shift	Ever non- standard shift
Sample Size (N)	1,578	3,946	1,028	4,592	765	4,893
PIAT Reading Standard Score at assessment point	105.2 (13.5)	103.96 (13.23)**	105.83 (14.80)	103.67 (15.57)***	106.40 (16.09)	103.76 (16.30)**
PIAT Math Standard Score at assessment point	100.41 (14.07)	99.08 (13.67)**	103.63 (14.11)	101.16 (14.82)***	101.95 (15.22)	100.67 (14.70)
Boy (%)	50.60%	50.90%	48.60%	51.10%	48.40%	51.00%
Black (%)	22.90%	26.20%	22.30%	26.10%	22.10%	26.10%
Hispanic (%)	18.40%	18.70%	16.50%	18.90%	17.40%	18.80%
Mother's age at birth	26.67 (4.32)	25.39 (4.21)	27.08 (4.20)	25.44 (4.23)	27.10 (4.32)	25.50 (4.23)
Mother's education at birth	12.63 (2.41)	12.21 (2.41)***	12.75 (2.43)	12.23 (2.40)***	12.80 (2.40)	12.24 (2.41)***
Mother married at birth (%)	49.20%	37.00%***	52.70%	37.40%***	52.50%	37.90%***
With older siblings (%)	39.90%	37.90%	40.90%	37.90%	39.80%	38.40%
Family income the year before birth (\$2006 dollars)	54,090 (82,817)	49,132 (85,983)***	55,039 (80,259)	49,001 (86,227)***	55,764 (83,991)	48,765 (84,130)***
Number of years living in a single-mother family by assessment point	0.6 (1.32)	0.64 (1.34)	0.83 (1.69)	0.99 (1.92)*	0.90 (1.87)	1.15 (2.16)**
Years living in welfare-reliant family by assessment point	0.04 (0.28)	0.25 (0.86)***	0.04 (0.27)	0.39 (1.25)***	0.05 (0.29)	0.47 (1.45)***
Years of standard shift work—mother	5.49 (0.5)	2.23 (1.56)***	9.50 (0.50)	4.22 (2.67)***	13.50 (0.50)	6.06 (3.76)***
Years of nonstandard shift work—mother	na	2.45 (1.44)	na	3.53 (2.38)	na	4.59 (3.27)
Years of mother not working	1.03 (1.80)	0.47 (0.98)	1.67 (2.97)	0.84 (1.65)	2.19 (4.00)	1.18 (2.28)
Mother's average work hours per week by assessment point	37.20 (12.02)	36.67 (14.49)	36.64 (12.29)	36.84 (14.13)	36.28 (12.46)	36.83 (13.87)
Years in professional/managerial occupations—mother	0.45 (1.02)	0.19 (0.68)***	1.44 (2.14)	0.6 (1.37)***	2.67 (3.25)	1.22 (2.14)***
Years in sales occupations—mother	0.07 (0.3)	0.05 (0.30)**	0.16 (0.68)	0.13 (0.55)*	0.27 (1.05)	0.24 (0.80)
Years in cashier/service jobs—mother	0.09 (0.51)	0.15 (0.59)***	0.20 (0.93)	0.4 (1.09)***	0.28 (1.13)	0.73 (1.60)***
Years of standard shift work—father	3.68 (1.67)	2.78 (1.6)***	5.33 (2.81)	4.2 (2.67)***	7.22 (3.88)	5.68 (3.71)***
Years of nonstandard shift work—father	0.59 (1.07)	1.07 (1.47)	1.72 (2.66)	1.55 (2.09)	2.29 (3.64)	1.95 (2.74)*

	By age 6		By age 10		By age 14	
	Only standard shift	Ever non- standard shift	Only standard shift	Ever non- standard shift	Only standard shift	Ever non- standard shift
Years of father not working	0.92 (1.45)	1.06 (1.46)	1.42 (2.21)	1.64 (2.16)	1.92 (2.95)	2.13 (2.83)
Father's average work hours per week by assessment point	38.69 (11.78)	38.03 (12.30)	38.76 (11.60)	38.36 (11.82)	38.25 (11.57)	38.58 (11.70)

Note. Asterisks represent the statistical test (chi-square for dummy variables and t-test for continuous variables) between children whose mothers worked only standard shifts and those whose mothers had ever worked nonstandard shifts by the assessment age. The sample size for fathers at each assessment point was 5,525 at ages 5/6, 5,246 at ages 9/10, and 4,550 at ages 13/14.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Correlates of Parental Nonstandard Shift Work with Mediators

	Mother's Evening Shift	Mother's Night Shift	Mother's Varied Shift	Father's Evening Shift	Father's Night Shift	Father's Varied Shift
Quality of home environment	-				+	+
Frequency of eating together	-	-			+	
Time spent together						
Mom likely to miss important events		+		+		-
Mom knowledge of child's whereabouts	+	+		+		+
Maternal closeness		+	+	+	-	
Dad likely to miss important events			-	-		-
Dad knowledge of child's whereabouts		+	+	+		+
Paternal closeness	-	+				
Time spent watching TV			-			-
Time in organized after-school activities		+	+			+
Time in educational after-school activities		+	+		+	+
Time in play-related after-school activities			-			-
Time in household-related after-school activities	+			+		+
Time in hang-out after-school activities	+					+
Time in work-related after-school activities	+					+

Note. Listed correlations were significant at least at 5% level.

Table 3

Reading and Math Trajectories from Age 5 to Age 14

	Reading			Math		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<i>Fixed Effect</i>						
Intercept	104.34 (0.24)***	108.64 (0.36)***	105.21 (1.04)***	99.20 (0.24)***	102.65 (0.34)***	101.00 (1.04)***
# of years mothers working evening shift	-0.31 (0.16)*	-0.16 (0.15)	-0.21 (0.15)	0.22 (0.16)	0.39 (0.15)**	0.28 (0.15)
# of years mothers working night shift	-0.47 (0.18)**	-0.34 (0.17)*	-0.35 (0.17)*	0.13 (0.18)	0.30 (0.17)	0.19 (0.17)
# of years mothers working variable shift	0.45 (0.11)***	0.31 (0.11)**	0.30 (0.11)**	0.52 (0.12)***	0.30 (0.11)**	0.18 (0.11)
# of years fathers working evening shift	-0.38 (0.23)	-0.37 (0.21)	-0.26 (0.20)	-0.33 (0.22)	-0.29 (0.20)	-0.39 (0.19)*
# of years fathers working night shift	0.45 (0.24)	0.58 (0.22)**	0.20 (0.15)	0.37 (0.23)	0.51 (0.21)*	0.45 (0.20)*
# of years fathers working variable shift	0.52 (0.17)**	0.12 (0.15)	0.10 (0.15)	0.50 (0.16)**	0.10 (0.15)	0.12 (0.14)
Home environment			0.004 (0.001)***			0.01 (0.001)***
Mom misses important events a lot			-0.93 (0.42)*			-0.88 (0.45)*
Mom knows child's whereabouts			0.76 (0.34)*			0.75 (0.36)*
Participated in educational activities after school			1.14 (0.46)*			1.08 (0.48)*
Doing household chores after school			ns			-0.66 (0.30)*
Playing games/videos after school			-0.86 (0.37)*			ns
<i>Rate of Change</i>						
Intercept	-0.21 (0.08)*	-0.19 (0.09)*	-0.14 (0.12)	0.54 (0.08)***	0.54 (0.08)***	0.26 (0.12)*
# of years mothers working evening shift	0.01 (0.05)	-0.01 (0.04)	0.01 (0.04)	-0.11 (0.04)*	-0.13 (0.04)**	-0.09 (0.04)*
# of years mothers working night shift	0.04 (0.05)	0.02 (0.05)	0.04 (0.05)	-0.13 (0.05)**	-0.15 (0.05)**	-0.12 (0.05)*
# of years mothers working variable shift	-0.08 (0.03)**	-0.06 (0.03)*	-0.05 (0.03)	-0.08 (0.03)**	-0.06 (0.03)	-0.03 (0.03)
# of years fathers working evening shift	0.08 (0.06)	0.07 (0.06)	0.06 (0.06)	0.05 (0.06)	0.04 (0.06)	0.06 (0.06)
# of years fathers working night shift	-0.06 (0.07)	-0.09 (0.07)	-0.08 (0.07)	0.03 (0.06)	0.01 (0.06)	0.03 (0.06)
# of years fathers working variable shift	-0.03 (0.05)	0.01 (0.05)	0.01 (0.04)	-0.05 (0.04)	-0.01 (0.04)	-0.02 (0.04)
Controls for demographic characteristics	No	Yes	Yes	No	Yes	Yes
Controls for mediators	No	No	Yes	No	No	Yes

	Reading			Math		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
<i>Variance Components</i>						
Level 1 – Within individual	53.56 (0.73)***	53.67 (0.74)***	53.74 (0.74)***	68.78 (0.92)***	69.04 (0.93)***	68.95 (0.93)***
Level2 – Between individual						
Initial status	117.83 (3.15)***	92.36 (2.68)***	90.43 (2.66)***	107.05 (3.14)***	81.47 (2.68)***	78.18 (2.63)***
Rate of change	8.84 (0.36)***	8.68 (0.35)***	8.58 (0.35)***	4.58 (0.31)***	4.44 (0.31)***	4.32 (0.30)***
<i>Model Fit Statistics</i>						
Deviance (= -2log-likelihood)	159691.3	158506.1	158369.5	161910.0	160430.7	160165.43
AIC	159719.3	158560.1	158505.5	161938.0	160484.7	160299.4
BIC	159830.6	158774.8	159046.3	162049.4	160699.6	160832.5
R ²	0.0040	0.1484	0.1636	0.0052	0.1795	0.2013

Note. Numbers represent unstandardized coefficients with standard errors in parentheses. Demographic characteristics include child's gender, race/ethnicity, and having siblings; mother's age, marital status, and education at birth; family income the year before birth; number of years receiving welfare; number of years living in single-mother families; mothers' average weekly work hours; number of years mothers had worked at professional, sales, or service-sector jobs; and number of years mothers/fathers not working.

* $p < .05$,

** $p < .01$,

*** $p < .001$.