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## Effects of a Workplace Intervention on Sleep in Employees' Children



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### ABSTRACT

**Purpose:** The implications of sleep patterns for adolescent health are well established, but we know less about larger contextual influences on youth sleep. We focused on parents' workplace experiences as extrafamilial forces that may affect youth sleep.

**Methods:** In a group-randomized trial focused on employee work groups in the information technology division of a Fortune 500 company, we tested whether a workplace intervention improved sleep latency, duration, night-to-night variability in duration, and quality of sleep of employees' offspring, aged 9–17 years. The intervention was aimed at promoting employees' schedule control and supervisor support for personal and family life to decrease employees' work–family conflict and thereby promote the health of employees, their families, and the work organization. Analyses focused on 93 parent–adolescent dyads (57 dyads in the intervention and 46 in the comparison group) that completed baseline and 12-month follow-up home interviews and a series of telephone diary interviews that were conducted on eight consecutive evenings at each wave.

**Results:** Intent-to-treat analyses of the diary interview data revealed main effects of the intervention on youth's sleep latency, night-to-night variability in sleep duration, and sleep quality, but not sleep duration.

**Conclusions:** The intervention focused on parents' work conditions, not on their parenting or parent–child relationships, attesting to the role of larger contextual influences on youth sleep and the importance of parents' work experiences in the health of their children.

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### IMPLICATIONS AND CONTRIBUTION

Sleep is linked to youth health, but we know less about social–ecological influences on sleep patterns. A workplace intervention to reduce employees' work–family conflict had positive effects on regularity of adolescents' nighttime sleep duration, sleep quality, and time to fall asleep, but not sleep duration.

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Adolescence is a period of dramatic physical, cognitive, and socioemotional developmental changes, including in youth sleep patterns. Both psychosocial factors such as youth's increasing involvement in the world beyond home and biological factors such as circadian time, for example, underlie changes in adolescents' preferences for going to bed and getting up at later times [1]. Nonetheless, sleep remains critical for adolescents' health and development [1]. Indeed, accumulating evidence documents the significance of sleep patterns for adolescents' well-being in domains ranging from psychological and social adjustment and health risk behaviors to school performance and obesity [2–9]. U.S. adolescents, however, experience greater sleep deprivation than either children or adults [10]—almost 2 hours less than the recommended average of 9 hours per night [11]. And, national data suggest that sleep deprivation increases across adolescence. [12].

Although research has examined the characteristics and health implications of youth sleep, there remain gaps in the literature about the social contextual determinants of healthful sleep [13]. Prior work highlights demographic factors (e.g., ethnicity, socioeconomic status), but a focus on such status variables does not provide insights about malleable processes and conditions to target for intervention. Some work also shows that family processes such as parental warmth are linked to youth sleep [13]. Correlational research designs, however, limit conclusions about the causal links between the social ecology and youth sleep because unmeasured third variables may explain patterns of association.

We grounded our work in an ecological model, which holds that youth are embedded within a system of nested contexts ranging from more proximal (e.g., family) to distal (e.g., societal institutions) influences [14]. Using a randomized controlled field trial design, we tested whether an experimental intervention, aimed at reducing employees' work–family conflict, improved sleep in employee-parents' adolescent-aged offspring. Sleep was assessed in terms of the duration, night-to-night variability in duration, latency, and quality of youth's sleep.

From an ecological perspective, youth health is influenced by the microsystems of everyday life, such as family and school, but in addition, by contexts in which youth do not directly participate. Such exosystem influences include, for example, their teachers' family lives and their parents' workplace conditions [14]. Consistent with ecological tenets, the work–home resources model [15] posits that parents' work experiences can cross over to negatively affect their children's health by depleting parents' personal resources, such as positive mood and time needed for monitoring and promoting children's healthful daily routines. Parents' work experiences can also enhance family role performance and foster children's well-being when those experiences provide parents with personal resources, such as control over their work schedules, that allow time for parental responsibilities.

As noted, research on social contextual correlates of youth sleep focuses on demographic characteristics, such as family socioeconomic status and parents' marital status. Reviewing this literature, Hale et al. [13] concluded that these status characteristics may mark social/psychological stressors such as financial hardship and family conflict, which serve as the mechanisms linking demographic factors and youth sleep patterns. Research on family dynamics is consistent with this conclusion, showing links between both marital and parent–child conflict and youth sleep [16,17]. By contrast, positive parental involvement,

including parent–child shared time, monitoring, and appropriate limit-setting, may promote healthful sleep [13,17,18].

Prior research also documents associations between parents' work experiences and the same kinds of parenting behaviors that have been linked to youth sleep patterns. For example, parents' job demands were related to less parent–child shared time and warmth but more conflict [19–21], and a negative social climate at work was correlated with negative parent–child interactions [22]. In contrast, employees' schedule flexibility was related to more parent–child shared time and, in turn, greater warmth [21], and employees' positive interactions with supervisors were associated with greater parental warmth [23]. In the United States, limited public policy means that employers are left to develop programs and practices that support working families [24,25]. Although past decades have seen new family-friendly workplace policies, there are few systematic data on the effectiveness of those policies for improving employee health, and we know almost nothing about whether and how family-oriented work policies benefit the physical health of employees' children [26].

This study used data from a field test of the STAR (Support, Transform, Achieve Results) workplace intervention program to examine the role of parents' work experiences in their adolescent-aged offspring's sleep patterns. STAR was designed to reduce employees' work–family conflict by promoting job resources in two domains: supervisor support for employees' personal and family lives and employees' perceived control over their work schedules. Importantly, for the purposes of this study, the intervention did not target parenting practices, although prior findings on the links between supervisor support and parental warmth and schedule control and parental involvement suggested that STAR effects might spillover to affect the same parenting behaviors that have been implicated in youth sleep.

STAR was implemented in the information technology (IT) division of a U.S. Fortune 500 company over a 3-month period and included training sessions for managers to learn about the intervention and strategies to support employees' personal and family lives while maintaining high levels of work performance. The supervisor support training also included a self-paced, computer-based training followed by real-time self-monitoring of managers' supportive behaviors via an iPod Touch (Apple Inc., Cupertino, CA) with an alarm reminder to log support behaviors. In addition, STAR involved 8 hours of work group participatory training sessions (four sessions) for managers and employees. Highly scripted sessions focused on targeted areas for change (e.g., attitudes that more hours spent at the office reflected greater commitment or productivity). The sessions were highly interactive and aimed at identifying new work practices that would focus employees' time and attention on key work results rather than face time. The intervention is described in detail, and program materials are available online [27].

The first analyses of the effects of STAR established that, at the 6-month follow-up, the intervention had predicted positive effects: Employees who were randomly assigned to the intervention reported more schedule control and supervisor support for family and personal life and less conflict between work and family responsibilities than did those in the usual practice (UP) condition. Additional analyses indicated that STAR employees almost doubled their hours of work at home and were more likely to describe their schedules as "variable" at follow-up; they also exhibited more time adequacy for activities with family members and time spent with their children [28]. Their greater

availability may mean that parents are more knowledgeable about their children's activities and are better able to orchestrate family routines that promote healthful sleep patterns in youth.

The current analyses built on this initial evaluation of the intervention to test its effects on the sleep patterns of the adolescent-aged offspring of employee-parents. We measured four domains of youth sleep that have been linked in prior research to youth physical, psychological, and behavioral health: sleep duration (hours of sleep per night), night-to-night variation in sleep duration (to mark consistent sleep routines), sleep onset latency (reflecting difficulty falling asleep), and perceived sleep quality [1,2,10,17]. Based on the tenets of the work–home resources model [15] and our prior research [28], we hypothesized that, by the 12-month follow-up, youth whose parents had participated in STAR would exhibit more positive sleep patterns than youth whose parents were randomly assigned to UP. Findings that healthful sleep may decline across adolescence as youth become more autonomous and involved in activities beyond the home [8] led us to expect that intervention effects might manifest in the form of buffering age-related declines in healthful sleep patterns.

## Methods

The data came from the baseline and 12-month follow-up waves of a group-randomized field experiment designed to test the effects of a workplace intervention on the health and well-being of employees, their families, and their work organization. The research team partnered with a Fortune 500 company, pseudonym TOMO, to recruit study participants from its IT division. After the baseline data collection, teams of employees who worked together and/or reported to the same supervisors ( $N = 56$  teams) were assigned to the intervention or UP condition. Given the differing sizes and functions of the work teams, we used a modified biased coin randomization approach for group randomization [27] to yield a balance across the intervention and UP conditions in job function, team size, and executive (vice president) leader. Importantly, for our purposes here, employee work groups, not the youth who were the focus of these analyses, were the unit of group assignment.

STAR was introduced by the organization's IT executives as a company-sponsored pilot program. Our research team and outside consultants jointly developed the intervention, customizing the materials for the targeted IT work force. Four group facilitators delivered the STAR intervention to supervisors and employees. The evaluation study was introduced separately and not directly linked to STAR, and a separate group of research staff, blind to participants' group assignments, was responsible for data collection.

## Participants

The sample of parent–youth dyads was drawn from the larger sample of employees who participated in workplace interviews. Of the 823 employees who completed workplace interviews, 222 (26.97%) were a parent of a child aged 9–17 years who lived at home for at least 4 days a week and thus eligible for the family component of our study. Of the 147 parent–youth dyads that completed the baseline home interview, 93 completed at least three of the eight daily telephone diary interviews at both baseline and the 12-month follow-up and were the focus of the

present analyses. Tests for differential attrition ( $t$  and chi-squared tests) revealed no differences between those who remained versus those who left the study at 12 months as a function of demographic or work characteristics (i.e., age, gender, income, ethnicity, marital status, number of children in the household, job tenure) or the target intervention variables (i.e., schedule control, family-supportive supervisor behaviors, work-to-family conflict). Eligible ( $N = 222$ ) and participating ( $N = 147$ ) families differed only in income, ethnicity, and youth age (participants had lower salaries, were less likely to be minorities, and youth were older).

At baseline, average annual income of participating families fell in the range of \$80,000–\$90,000, and most parents (80.80%) had a bachelor's degree or more education. In addition, 83.2% of youth had married parents. Most (67.00%) were white, non-Hispanic, with smaller percentages of Asian/Pacific Islander (20.00%), Hispanic (9.60%), black, non-Hispanic (1.60%), and multiracial (1.60%) youth. Parents (47.00% female) averaged 45.05 years of age (standard deviation [SD] = 6.03), 12.73 years employed by the company (SD = 6.45), and 46.45 hours of work per week (SD = 5.94), although all worked daytime shifts. Youth participants (52.78% female) averaged 13.34 years of age (SD = 2.30). There were no differences on any of these measures for youth whose parents were assigned to the STAR ( $n = 57$ ) versus the UP ( $n = 36$ ) conditions, and no differential attrition across groups (Table 1).

## Procedures

Trained interviewers conducted interviews with employees at the worksite and with employees and their children at their homes at baseline and the 12 month follow-up. During the latter, parents provided consent and youth assented to participation. After the home interviews, in eight, consecutive, nightly phone calls averaging 15 minutes, youth reported on their experiences during the 24 hours before the call. The data collection centers' institutional review boards approved the procedures. Families received \$150 for participation at baseline and \$200 for participation at the 12-month follow-up telephone diary assessment.

**Table 1**  
Participant demographic information ( $n = 93$ ), mean (standard deviation) or number (%)

	Intervention ( $N = 57$ )	Usual practice ( $N = 36$ )
Employee measures		
Age (years)	45.58 (6.16)	43.56 (4.71)
Gender (% female)	28 (49.12)	14 (38.89)
Education (% college graduate)	46 (80.70)	28 (77.78)
Marital status (% married/cohabiting)	49 (85.96)	34 (94.44)
Number of children living in household	1.93 (.90)	2.25 (1.20)
Work hours (hours/week)	46.84 (6.10)	45.78 (5.54)
Income (% more than 100,000/year)	41 (77.36)	22 (64.71)
Tenure (years)	13.64 (7.66)	12.32 (5.74)
Diary days completed	7.82 (.47)	7.78 (.48)
Youth measures		
Age	12.93 (1.99)	13.31 (2.40)
Gender (% female)	29 (50.88)	17 (47.22)
Diary days completed	7.86 (.40)	7.88 (.42)

The results of independent samples  $t$  tests and chi-squared tests revealed no significant differences between the intervention and usual practice groups on these measures.

**Table 2**

Means (standard deviations [SDs]) and Pearson Correlations for Sleep Measures [1] at baseline (above diagonal) and 12-month follow-up (below diagonal)

	Baseline	12 months	Duration	Variability	Latency	Quality
	Mean (SD)	Mean (SD)				
Duration	8.99 (1.55)	8.94 (1.74)	<b>.72**</b>	-.27**	.20*	.13
Variability	1.09 (.49)	1.34 (.59)	-.05	<b>.33**</b>	.01	-.17
Latency	1.52 (.83)	1.50 (.87)	.28**	-.14	<b>.64**</b>	-.25*
Quality	3.53 (.62)	3.51 (.55)	-.00	-.02	-.40**	<b>.53**</b>

Stability coefficients (bolded) on diagonal.

Duration measured in hours, variability measured as the within-person standard deviation of the duration scores across days, latency rated on a four-point scale (1 = about 15 minutes; 4 = more than 60 minutes), and quality rated on a four-point scale (1 = very badly; 4 = very well).

\* $p < .05$ ; \*\* $p < .01$ .

## Measures

We adapted items from the Pittsburgh Sleep Quality Index [29] for the diary interviews. During each nightly interview, youth were asked four questions about the prior night: "What time did you go to bed?" "What time did you wake up this morning?" "How long did it take you to fall asleep?" and "How well did you sleep last night?" Bedtime and wakeup time were recorded in military time, and the interval between them was calculated to index sleep duration (hours/day). Night-to-night sleep duration variability was the within-person standard deviation of the duration scores across the diary days, with high scores signifying greater variation [30]. Sleep latency was coded on a four-point ordinal scale (1 = about 15 minutes; 2 = between 15 and 30 minutes; 3 = 30 to 60 minutes, 4 = more than an hour). Youth rated their sleep quality on each call using a four-point ordinal scale (1 = very badly; 4 = very well). More than 90% of youth completed all eight calls, and all completed at least six calls.

## Results

To account for the clustered design (occasions within persons), we conducted mixed effect, multilevel models using SAS Proc Mixed (SAS Institute, Cary, NC). To test intervention effects on the sleep duration, latency and quality dependent measures, the two waves of data (baseline and 12-month follow-up) were stacked (i.e., 16 rows per person, 8 days for each wave). The analysis of sleep variability required only one within-individual measure,

wave. Wave (0 = baseline, 1 = 12-month follow-up) and condition variables (0 = UP, 1 = STAR) were the primary predictors; the estimate obtained for their interaction indicated whether the change in youth sleep outcomes from the baseline to 12-month follow-up differed for the UP versus STAR groups. Given the relatively small sample size, to limit the number of factors, we first tested for links between potential covariates and between covariates and sleep measures, including parent income, ethnicity, and the workplace intervention targets. Given nonsignificant effects, these factors were excluded from the final models. The final models included youth age and gender (0 = female), day in study (0 = Day 1, 7 = Day 8), and the percentage of the eight diary days at each wave that the youth attended school. The latter was an index of the timing of the eight-day diary.

Descriptive data are shown in Table 2 and results in Table 3. Analyses revealed no effects for sleep duration, but predicted effects of the intervention emerged for the other measures: (1) youth whose parents were assigned to the STAR intervention showed no change in sleep duration variability, but youth in the UP group increased in night-to-night variability in sleep duration from the baseline to the 12-month follow-up, effect size = .23; (2) STAR youth exhibited decreases in latency of sleep onset, but youth in the UP group exhibited increases in the time it took them to fall asleep, effect size = .15; and (3) STAR youth exhibited no change in sleep quality, but youth in the UP group exhibited declines, effect size = .13.

## Discussion

Our findings showed that a workplace intervention, designed to reduce employees' work–family conflict through increasing employees' schedule control and supervisor support for work and personal life, had corollary effects on the sleep of employees' adolescent-aged offspring. The results suggest that the intervention served to buffer youth from age-related declines in healthful sleep patterns. Prior research on social contextual factors in youth sleep suggested that markers of family stress are associated with less healthful sleep patterns [9,13]. Correlational designs, however, do not allow for strong inferences about the role of the social context in youth sleep, because unmeasured third variables can account for both social influences and youth health. Using a group-randomized experimental design, this study documented the significance of social contextual influences on youth sleep by demonstrating

**Table 3**

Mixed model results (coefficients and standard errors) of intervention effects on youth sleep duration, variability, latency, and quality [1].

	Sleep duration	Sleep variability	Sleep latency	Sleep quality
Covariates				
Day in study	.01 (.02)	—	-.02 (.01)*	-.01 (.01)
Youth gender	.30 (.15)*	.05 (.08)	.13 (.13)	-.01 (.08)
Youth age	-.27 (.04)**	.07 (.02)**	-.05 (.03)	-.02 (.02)
Wave mean school days	-.103 (.18)***	-.11 (.13)	.35 (.10)***	.07 (.07)
Intervention effect				
Intercept	8.82 (.16)***	.96 (.09)***	1.48 (.13)***	3.69 (.08)***
Wave	-.07 (.12)	.41 (.10)***	.16 (.05)**	-.10 (.04)*
Condition	-.10 (.17)	.21 (.11)	-.01 (.14)	-.22 (.08)**
<b>Wave × condition</b>	<b>-.07 (.15)</b>	<b>-.26 (.13)*</b>	<b>-.27 (.06)***</b>	<b>.15 (.05)**</b>

Sleep duration measured in hours, variability measured as the within-person standard deviation of the duration scores across days, latency rated on a four-point scale (1 = about 15 minutes; 4 = more than an hour), and quality rated on a four-point scale (1 = very badly; 4 = very well).

Intervention effects are bolded. Wave coded as baseline = 0, 12-month follow-up = 1. Condition coded as 0 = usual practice, 1 = Support, Transform, Achieve Results. Youth gender coded as 0 = female, 1 = male.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

that experimentally-induced changes in the exosystem can lead to more healthful sleep in adolescence. Our workgroup random assignment meant that youth, themselves, were not randomly assigned to the intervention, limiting the causal inferences that can be drawn from this study. That group differences in changes over time in youth sleep were evident despite the fact that the workplace intervention targeted neither parenting nor parent-youth relationships, however, attests to the significance of parents' work experiences in youth health.

Taken together, our results have several implications for an understanding of youth sleep and adolescent health, more generally. First, the findings were consistent with the tenets of an ecological model, which holds that youth are embedded within a system of nested contexts and highlights the significance of forces beyond youth's immediate settings in their well-being and development [14]. Our findings document the power of exosystem influences—contexts outside youth's own everyday experiences—to affect youth sleep, and they alert practitioners to take these more distal and sometimes malleable influences into account in efforts to promote youth health and health behaviors. Second, although impediments to healthful sleep may change across adolescence as youth become increasingly autonomous and involved in the world beyond home [13], in this study, exosystem influences emanating from parents' work conditions were evident into late adolescence. Our findings are thus consistent with a body of research on adolescent development that highlights the continued importance of parents and family life across this developmental period [31]. Finally, our results are congruent with a body of correlational research linking parents' work conditions and youth well-being, but which to date, has not focused on youth sleep or health. As noted, the STAR program included no components focused on parenting practices and behaviors, underscoring the potentially powerful effects of parents' work experiences on their children. The significant effects of STAR should also be viewed in the light of mixed findings from tests of youth-oriented psychoeducational interventions for promoting healthful sleep. Although increases in youth knowledge have been documented, program effects on sleep behaviors have been limited [32,33].

An important direction for research on workplace effects is to test whether resources such as schedule control and supervisor support have effects on the sleep patterns of youth whose parents are employed in other kinds of industries. In particular, our findings are limited to employees with relatively high incomes and education and should be replicated in less-advantaged samples. The small sample size precluded tests of moderating factors, including youth age, gender, and seasonality differences in youth sleep, other directions for future research. In addition, our study is limited by its reliance on youth self-reports of their sleep duration and timing. The measure of sleep duration captured time in bed, or sleep opportunity, and thus may have overestimated actual sleep duration. Indeed, average sleep duration in this sample was longer than typically reported, which may also reflect our focus on a relatively advantaged sample of youth. Research on a more socioeconomically diverse group of youth using objective measures such as wrist actigraphy would provide stronger evidence about social contextual effects on youth sleep. Of particular interest is whether interventions like STAR have stronger impacts on youth who are at higher risk for sleep problems.

Another step is to identify the proximal processes through which workplace policies and programs like STAR can affect youth sleep. As noted, our prior research showed that STAR

increased two workplace resources, schedule control and supervisor support and reduced employees' work-family conflict. Furthermore, STAR positively impacted employees' reports of time adequacy and time spent with their children [28]. By providing employees with more control over their work schedules, STAR parents may have been able to align their time at home to fit their children's schedules and needs. Although we did not detect intervention effects on sleep duration, findings that youth whose parents participated in STAR did not show the same increase in night-to-night variation in sleep duration as youth with parents in the UP group are consistent with the idea that parental involvement, which provides opportunities for monitoring and developmentally appropriate limit-setting, can promote regular sleep routines during a developmental period when school, work, and peer activities may otherwise promote their decline. Another mechanism through which STAR may have had its impact is through its documented effects on employees' work–family conflict. Prior research highlights the role of family stressors in youth sleep, including through its effects on youth's emotional security [13,34]. Our findings are consistent with the idea that reducing parents' work-related stress can have positive impacts on their children's sleep, including sleep quality and the time it takes them to fall asleep.

At the most general level, our findings speak to the importance of looking beyond the immediate settings of youth's daily lives for influences in the larger environment that have an impact on their health and health behaviors. As such, the results are consistent with an ecological perspective, which highlights the embeddedness of youth in a larger, multilayered system of interacting influences [14]. From this perspective, interventions that target only individual adolescents may not be effective if changes to behavior and health fail to take into account powerful and potentially competing influences in the larger ecology. An ecological perspective also opens up new opportunities to intervene at points in the system that are most malleable and that may have the broadest impact. Consistent with the work–home model [15], our findings suggest that providing parents with workplace resources that reduce their experiences of work–family conflict may alter the family system in ways that support and promote youth health. At the most general level, the significant effects of the STAR intervention on youth sleep attest to the power of parents' workplace conditions to affect the health of their children.

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