



# Toddler Sleep Disruption and the Trajectory of Self-Regulation Development

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## INTRODUCTION

Dahl (1996) has proposed that sleep plays a critical role in the development and maintenance of the ability to regulate attention and arousal. Poor quality of nightly sleep in 2<sup>nd</sup> graders was associated with poor performance on tests of neurobehavioral functioning (Sadeh et al., 2002), suggesting there is a link between sleep and attention regulation. Furthermore, children who experience disrupted sleep have been shown to have greater difficulty in regulating negative emotions (Staples et al., 2005). Regulation of attention and emotion begin to emerge in toddlerhood and continue to develop beyond the preschool ages. This study presents a novel approach to understanding the rate of growth in regulatory skills. Specifically, we asked if sleep disruption affects the developmental trajectory of self-regulation.

## METHODS

- ☞ Participants
  - 16 mother-child dyads (13 girls, 3 boys) with complete data from a larger sample ( $N_{36} = 25$ ;  $N_{42} = 33$ )
  - Two assessments when children were 36 and 42 months
- ☞ Measures
  - Activity monitor worn 6 nights
  - Daily sleep diary
  - Self-regulation battery
- ☞ Variables
  - Sleep Disruption
    - Variability of bedtime (actigraph)
    - Variability of amount of nightly sleep (actigraph)
    - Lateness of bedtime (diary)
  - Self-regulation composite from the larger sample created similar to Kochanska, et al. (2000) from the following tasks:
 

|                     |                 |
|---------------------|-----------------|
| Bird and Alligator  | Draw a Circle   |
| Fruit Stroop        | Follow the Path |
| Sustained Attention | Candy Delay     |
| Stop-Go             | Gift Delay      |
| Walk-a-Line         |                 |

## RESULTS

|                                   | 1     | 2     | 3     | 4     |
|-----------------------------------|-------|-------|-------|-------|
| 1. Variability of bedtime         |       | .40†  | -.07  | .65** |
| 2. Variability of amount of sleep | .60** |       | .26   | .82** |
| 3. Lateness of bedtime            | .02   | .14   |       | .58** |
| 4. Sleep disruption               | .76** | .82** | .54** |       |

Note. Correlations for 36 months above the diagonal and 42 months are below the diagonal.  
\*  $p < .05$ , \*\*  $p < .01$

|                         | 1 | 2   | 3    | 4     |
|-------------------------|---|-----|------|-------|
| 1. 36m Sleep disruption |   | .48 | -.08 | -.54* |
| 2. 42m Sleep disruption |   |     | .14  | -.18  |
| 3. 36m Self-regulation  |   |     |      | .63*  |
| 4. 42m Self-regulation  |   |     |      |       |

Note. \*  $p < .05$ , \*\*  $p < .01$

| Laboratory Task                    | 36 months |      | 42 months |  |
|------------------------------------|-----------|------|-----------|--|
|                                    |           |      |           |  |
| Bird & Alligator: Alligator trials | .12       | .31  |           |  |
| Bird & Alligator: Bird trials      | .17       | .35  |           |  |
| Candy Delay                        | .17       | .11  |           |  |
| Draw a Circle                      | .48       | .34  |           |  |
| Follow the Path                    | .57       | .30  |           |  |
| Fruit Stroop                       | .52       | .07  |           |  |
| Gift Delay                         | .16       | -.03 |           |  |
| Stop-Go                            | -.08      | .30  |           |  |
| Sustained Attention                | .05       | .26  |           |  |
| Walk-a-Line                        | .57       | .36  |           |  |

Note. Cronbach's alpha 36 mos. = .58 and 42 mos. = .54

Multiple regression tested the relation between self-regulation and sleep disruption from 36 to 42 months. Model 1 (blue): Sleep disruption at 36 months and sleep disruption at 42 months were simultaneously entered into the equation resulting in an overall significant model [ $R^2 = .71$ ;  $F(3, 12) = 9.60$ ,  $p < .01$ ]. Model 2 (purple): The alternative, that self-regulation predicts sleep disruption, was not significant [ $R^2 = .57$ ;  $F(3, 12) = 1.89$ ,  $p > .05$ ].

In addition, multiple regression tested the relation between sleep disruption and the growth (defined as a difference score) in self-regulation from 36 to 42 months. Sleep disruption at 36 ( $\beta = -.62$ ,  $SE = .14$ ) but not 42 months ( $\beta = -.06$ ,  $SE = .13$ ) predicted slower growth in self-regulation at 42 months [ $R^2 = .42$ ;  $F(2, 13) = 4.74$ ,  $p < .05$ ]. The alternative, that self-regulation predicts growth in sleep disruption, was not significant [ $R^2 = .26$ ;  $F(2, 13) = 2.27$ ,  $p > .05$ ].

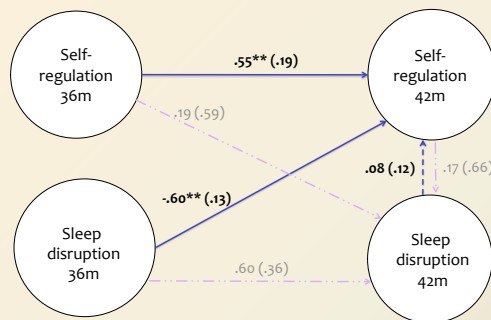


Figure. Summary of two linear regression analyses. Values are standardized beta weights with standard error in parentheses. Values in bold are for model 1, which was significant overall.  
\*  $p < .05$ , \*\*  $p < .01$

## DISCUSSION

The findings suggest sleep disruption in this age range influences the development of self-regulation but not vice versa. Thus, sleep may be an underlying causal factor in children's developing capacity to regulate their behavior. In addition, the stability of sleep disruption from 36 to 42 months ( $r = .48$ ,  $p = .06$ ) suggests that some children experience chronic sleep disruption, which may have a greater impact the development of self-regulation compared to more transitory sleep disturbances.

As part of our continuing research, we are investigating whether sleep disruption impacts more than children's momentary performance, and whether it forecasts a slower rate of regulatory skill acquisition during the preschool period.

We are working to replicate and extend these findings to a larger, more representative sample of families. Furthermore, we are examining the roles of family environment and child temperament in the development of self-regulation.

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- Staples, A. D., Bates, J. E., Goodnight, J. A., & Novosad, C. (April 2005). Toddler Negative Emotion as an Interactive Function of Sleep Disruption and Temperament. Presented at the biennial Society for Research in Child Development Conference, Atlanta, GA.

## FOR FURTHER INFORMATION

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