Spring 3-5-2019

Sleep-Wake Problems and Daytime Sleepiness as Predictors of Emotion Regulation Strategies: A Longitudinal Study in Early Adolescence

Megan Toney
University of Nebraska - Lincoln

Sleep-Wake Problems and Daytime Sleepiness as Predictors of Emotion Regulation Strategies: A Longitudinal Study in Early Adolescence

Megan M. Toney

Supervisor: Timothy D. Nelson, Ph.D.

Department of Psychology

University of Nebraska-Lincoln

Abstract

Objective: Research has analyzed the association between poor sleep and emotion regulation abilities, yet most studies have focused on adult samples which may not generalize to youth. The present study examines how sleep problems and daytime sleepiness in early adolescence were associated with specific forms of emotion regulation later in adolescence.

Methods: A group of 109 children from a larger longitudinal study on cognitive development completed questionnaires at two separate timepoints. Cognitive tasks and survey-based measures were completed at the first point of data collection (M_{age} = 11.90, *SD* = .91, range = 10-14). Approximately 10 months later, additional surveys were emailed to participants (M_{age} = 12.73, *SD* = .899, range = 12-15).

Results: Controlling for daytime sleepiness at the more recent time point and demographic variables, sleep-wake problems at the first time point and daytime sleepiness at both time points were considered as predictors of later cognitive reappraisal and expressive suppression, respectively, in multiple regression models. Greater sleep-wake problems uniquely predicted decreased use of cognitive reappraisal and increased use of expressive suppression. However, daytime sleepiness did not significantly predict either regulation strategy.

Conclusions: The findings from the current study build on the growing body of research demonstrating that poor sleep in adolescence can have negative impacts on health outcomes, especially with the ability to regulate emotions. These results have important implications for sleep intervention earlier in development, with the aim to improve emotion regulation abilities later in adolescence.

Sleep-Wake Problems and Daytime Sleepiness as Predictors of Emotion Regulation Strategies: A Longitudinal Study in Early Adolescence

Sleep problems in youth can have adverse effects in a number of areas, including academic and psychosocial functioning. For example, Perfect et al. (2014) found that youth reporting sleep problems, including insufficient sleep, inconsistent sleep patterns, daytime sleepiness, insomnia symptoms, and sleep-disordered breathing, together predicted lower grades, a perception of struggling in school, and negative attitudes towards education. Moreover, sleep problems in youth tend to correlate with the development of psychiatric disorders (e.g., anxiety, depression, and attention deficit/hyperactivity disorder; Siversten et al., 2015) and difficulties with regulating emotions and behaviors (Reddy et al., 2017). These negative outcomes are especially concerning given the prevalence of sleep problems among youth. More than two-thirds of U.S. high school students do not meet the recommendation for 8 to 10 hours of sleep per night for adolescents (Wheaton et al., 2016). In addition, Meijer and Wittenboer (2001) found that 15 percent of children report sleep problems, 43 percent struggle with getting up in the morning, and 25 percent do not feel rested at school. The current study adds to the literature on the negative outcomes associated with sleep problems by examining how sleep problems and daytime sleepiness predict emotion regulation abilities later in adolescence.

The Process Model of Emotion Regulation

According to Gross et al. (2015), emotion regulation is defined as the use of different strategies to alter the trajectory of an emotion in a way that ultimately changes the end state. Before discussing emotion regulation strategies, it is important to differentiate emotions from other affective states (i.e., moods and stress responses). A distinguishing characteristic of emotions is that they involve a *behavioral* response to certain events, and these behavioral responses can be either beneficial or adverse based on context. A change in facial expression and body language constitutes a more recognizable emotional response, whereas physiological

responses (heart rate, respiration, skin conductance, etc.) may not be as superficially noticeable. According to Walting et al. (2017), mood is a more adaptive system that adjusts to reward and punishment cues. Positive moods are associated with benefits like lowered risk for stroke and better mental health, whereas negative moods are correlated with health problems, such as worse immune functioning and more psychiatric diagnoses. Since emotions unfold over variable amounts of time, Gross et al.'s (2015) *Process Model of Emotion Regulation* captures the dynamics of emotional responses on a continuum, and it does so through a situation-attention-appraisal-response sequence. Each stage within this sequence is subject to regulation by the five families of emotion regulation strategies. The first four regulation strategies aim to modify the emotional impact before an emotion is experienced: situation selection is the act of choosing one situation from other possible situations to prevent certain emotions; situation modification is where an individual directly alters an external situation to make a "new" situation; attentional deployment is where one decides to direct his or her attention; and cognitive change is choosing which emotional meaning to attach to a situation. The last regulation strategy, response modulation, refers to adjusting the response after an emotion is developed such as using alcohol or using deep breathing exercises (Gross et al., 2015). Most research on emotion regulation mostly focuses on harmful emotional responses, such as those that are problematic in duration or expressed in an inappropriate context.

The Process Model of Emotion Regulation can be used to understand the association between the five families of emotion regulation strategies (situation selection, situation modification, attentional deployment, cognitive change, and response modulation) and emotional outcomes. The present research study focuses on forms of *cognitive change* and *response modulation* as emotion regulation strategies. These two strategies tend to substantially differ in their outcomes, possibly because cognitive change occurs early in the emotion-generative

process and is associated with more beneficial outcomes, whereas response modulation occurs at a later timepoint and is generally considered a less adaptive strategy (Gross and John, 2004).

Cognitive reappraisal, a more specific form of *cognitive change* in the process model of emotion regulation, is how people change their interpretation of a situation to alter the emotional impact (i.e., viewing a negative experience in a positive light) and is generally considered an effective, adaptive strategy. Webb et al. (2012) conducted a meta-analysis of over 300 studies to identify which emotion regulation strategies are most effective. Reappraisal was found to be one of the best strategies for regulating emotions, with small-to-medium effect sizes, whereas strategies that involved attentional deployment and response modulation had negligent to small effect sizes. Augustine and Hemenover (2009) also conducted a meta-analysis on emotion regulation strategies by examining 34 studies and similarly found that reappraisal is an effective means for regulating emotions by creating the largest hedonic shift. Likewise, Strauss et al. (2016) used eye tracking and pupil dilation to evaluate patterns of visual attention when analyzing the amount of effort behind cognitive control processes, finding that reappraisal and distraction are effective methods at reducing negative emotional experiences. Yet, cognitive reappraisal was shown to be a more cognitively demanding strategy, as it showed a greater increase in participant pupil size, which is associated with higher emotional arousal and increase in effortful cognitive processes. Similarly, Dhaka and Kashyap (2017) found support for the idea that cognitive reappraisal strategies effectively downregulate self-reported negative affect in comparison to no regulation strategies being implemented. Participants were instructed to regulate their responses to picture and film stimuli using the instructed regulation strategy and then provide an emotional state rating, and their results ranked reappraisal as the most effective.

Expressive suppression, a more specific form of *response modulation* in the process model of emotion regulation, describes efforts to inhibit the expression of emotions. Findings from prior research studies point to conflicting results on expression suppression in which a

greater ability to suppress emotions is correlated with either a more negative or positive affect depending on the individual's capability to self-regulate. Geisler and Schröder-Abé (2015) analyzed the emotion regulation among couples throughout a dispute, finding that higher expressive suppression was correlated with more negative affect in those with low self-regulatory strength, whereas those with high self-regulatory strength benefitted from emotional suppression and were associated with more beneficial interpersonal behavior, underscoring the social functioning aspect of expressive suppression. These individuals had greater conflict resolution the more they tried to suppress their emotions, possibly due to a larger capacity to regulate other aspects of behavior. To further explain the conflicting results on expressive suppression, Bonnano et al. (2004) found empirical evidence for the idea that successful adaptation is associated with the ability to either enhance or suppress emotional expression. This finding supports the flexibility hypothesis in which individuals flexibly regulated their emotional expression based on situational context. It was found that the distressed participants of this study who possessed the abilities to enhance and suppress their emotional expression (i.e., expressive flexibility) showed a reduction in distress in the second measurement. The use of either strategy had a reduction effect because those who were equipped to use both could do so flexibly based on the demand of the situation.

Although the majority of research examining the effectiveness of cognitive reappraisal and expressive suppression have been conducted with adults, most of these findings are consistent with the pattern of results found in studies with adolescents. Yet, expressive suppression in adolescence tends to be associated with more depressive symptoms (Gross and John, 2003), whereas adult findings show support for associations with both negative and positive affect depending on the individual's self-regulation ability. For instance, Boyes et al. (2014) found that in adolescents (12 to 18 years of age), cognitive reappraisal was negatively associated with psychological distress, whereas expressive suppression was positively associated

with psychological distress. In a similar study with adolescents, Flouri and Mavroveli (2011) found that cognitive reappraisal moderated the impact of increased stress on problematic behaviors, serving as a protective factor, whereas expressive suppression was associated with more problematic behaviors in general. In addition, an adolescent longitudinal study conducted by Larsen et al. (2012) found that depressive symptoms were associated with increased use of expressive suppression, but the reciprocal relationship was not supported. Taken together, research suggests that emotion regulation is an adaptive, effective strategy among both youth and adults. In contrast, studies examining the effectiveness of expressive suppression have produced mixed findings in adults but suggest that this strategy is less adaptive among adolescents.

The Importance of the Association Between Sleep and Emotion Regulation in Adolescence

Research examining how poor sleep is associated with emotion regulation abilities has been widely conducted. However, much of this work has been done with adult samples, which may not generalize to youth. This is a major limitation that warrants further research because many mental health issues begin to emerge in late childhood and early adolescence, and poor sleep tends to accompany the emergence of psychopathology. For example, a laboratory study conducted by Forbes et al. (2009) found that adolescents with an anxiety disorder experienced more sleep problems in comparison to adolescents without anxiety. Specifically, adolescents with anxiety experienced heightened stress throughout the night, contributing to a longer sleep latency, more awakenings, and reduced deep sleep. Moreover, in their conclusion to a comprehensive overview on sleep and childhood psychiatric disorders, Alfano and Gamble (2009) argue not only that psychiatric disorders such as anxiety and ADHD can heighten sleep problems, but also that the reciprocal relationship can occur, whereby disturbed sleep can exacerbate existing mental health problems. This bidirectional link between poor sleep and the emergence of psychopathology is one rationale that warrants further research on emotion regulation in late childhood and early adolescence.

Additionally, late childhood and early adolescence is a time when even typically developing youth are more susceptible to emotional difficulties, which makes strong emotion regulation abilities especially important. Heller and Casey (2016) maintain the importance of this period in terms of how adolescents experience emotions, particularly regarding the roles of emotional reactivity and emotion regulation. Throughout the ups and downs of adolescence, some teens may experience heightened emotions, and these dynamic changes of emotional processes are associated with risk for psychopathology. For instance, a longitudinal study conducted by Larson et al. (2002) found that emotional instability was greatest during early adolescence, with emotional changes slowing during late adolescence. As emotional stability tends to increase with age, late adolescent emotional states become more difficult to change. Work by Steinberg (2005) calls attention to the potential disjunctions between the developing brain, behavioral, and cognitive systems. Specifically, adolescence is a sensitive period for the reorganization of these regulatory systems, during which time emotion regulation abilities may be impaired. Together, heightened emotional reactivity coupled with increases in negative emotion make early adolescence a critical period of emotional development, and thus, regulating emotions is an important skill for youth to develop.

Another reason why sleep may be especially critical for adolescents' emotion regulation abilities relates to brain development, since sleep aids in the development of the neural regions responsible for regulating emotions. The prefrontal-subcortical circuits of the adolescent brain, which are responsible for managing emotions, undergo rapid development during adolescence (Giedd, 2004; McRae et al., 2012). The adolescent brain matures by increasing its connectivity among different components of the brain and becoming more specialized. With large changes in networking during this time, this developmental period is sensitive to emotional reactivity and the emergence of lifelong psychopathology, likely due to maturational changes in emotion regulation that may be negatively impacted by poor sleep. In support of this theory, Giedd (2015)

noted differences in the maturation rates of the brain networks that may place adolescents at risk for psychiatric disorders. The limbic system, which drives emotions, heightens during puberty, whereas the prefrontal cortex, which is important for impulse control and sound judgement, does not mature until the 20s. This discordance puts adolescents in a situation in which they lack strong regulatory abilities to cope with elevated levels of emotional reactivity.

Despite the importance of the association between sleep and emotion regulation in adolescence, research in this area is still limited, though some preliminary findings have emerged. After analyzing fifty adolescents throughout a 3-week sleep manipulation study, Baum et al. (2014) found that after a few days of diminished sleep, adolescents experienced decreased mood and worsened emotion regulation capabilities. The participants also rated themselves as more anxious, hostile, confused, and fatigued, and parents reported their children were more irritable and less able to properly regulate emotions. Likewise, Short et al. (2013) found that poor sleep quality in adolescents was associated with depressed feelings and diminished daytime alertness, which tend to accompany each other. Those who reported a decreased alertness throughout the day experienced a higher level of depressive symptoms. These findings show that sleep may be an important factor for regulating emotions in adolescence, justifying the need for further analysis on the implications of poor sleep and emotion regulation abilities.

Study Aims and Hypotheses

The present study aims to advance the sleep and emotion regulation literature by examining how sleep problems and daytime sleepiness in early adolescence are associated with specific forms of emotion regulation (i.e., cognitive reappraisal and expressive suppression) later in adolescence. Cognitive reappraisal is generally considered an adaptive emotion regulation strategy as it has been shown to be more effective in down-regulating negative emotions relative to other strategies (Reddy et al., 2017). Based on prior research, in a model with both sleep-wake problems and daytime sleepiness, it was expected that both would uniquely predict decreased

cognitive reappraisal abilities one year later in early adolescence. However, due to limited research on expressive suppression and sleep among adolescents, it was unclear how daytime sleepiness and sleep-wake problems would be associated with expressive suppression. Expressive suppression is generally considered a more maladaptive form of emotion regulation in that it is related to increased problematic behavior, such as hyperactivity and conduct problems (Flouri and Mavroveli, 2011), and more social consequences, such as lower social support and less closeness to others (Srivastava et al., 2009). Additionally, it may be an easier strategy to deploy while one is sleepy because it requires less cognitive control. As such, increased daytime sleepiness and sleep-wake problems were tentatively expected to predict increased expressive suppression.

Method

Participants

Participants included 109 children enrolled in a larger longitudinal study beginning in preschool on cognitive development (42.2% boys, 57.8% girls). At the first point of data collection during early adolescence, participants' average age was 11.90 years (*SD* = .91, range = 10-14). The next measurement was collected approximately one year later when participants' average age was 12.73 years (*SD* = .899, range = 12-15). The average length between time points was 10 months. The ethnic breakdown consisted of primarily White participants (*N* = 88; 80.7%) followed by multiracial (*N* = 10; 9.1%), Hispanic (*N* = 8; 7.3%), African American (*N* = 2; 1.8%), and Asian American (*N* = 1; 0.9%). Participants were initially recruited in preschool as a part of a larger longitudinal study using flyers posted throughout Lincoln, Nebraska. Only those without any developmental, behavioral, or language disorders at the time of initial recruitment were eligible because this study aims to scrutinize normative cognitive development. Those who developed behavioral disorders following the initial recruitment process were eligible to continue.

Procedures

For the current study, data was collected at two separate timepoints. During the initial laboratory visit, a parent or legal guardian provided written consent for themselves and their adolescent to participate in this phase of the study, in which children (N = 189) completed cognitive tasks as well as survey-based measures of health behaviors and other psychological variables (including emotion regulation and sleep variables; see Measures). Approximately one year later, participants were emailed a link to additional surveys about their health and behavior, which they were asked to complete online. A total of 109 participants completed data collection at both timepoints and were included in the current analyses. All procedures from the present study were approved by the University of Nebraska-Lincoln's Institutional Review Board, and participants and their parents were compensated at both time points with gift cards.

Measures

Demographics. Participant demographic information included child race/ethnicity, age, sex, and maternal education measured on a continuous scale from 1 to 8 (where 1 = less than a high school education and 8 = a doctoral or medical degree).

Sleep-Wake Problems. Sleep-wake problems were measured at the first point of data collection using the Sleep/Wake Problems Behavior Scale from the Sleep Habits Survey (SWP; Wolfson & Carskadon, 1998). This 10-item scale assesses problems with falling asleep and waking up from sleep. Using a 5-point scale that ranges from *never* to *every day/night*, youth rated the frequency with which they experience each item experienced during the second timepoint data collection. Sleep-wake problems in previous studies have demonstrated that this scale is reliable and valid and is considered an "Approaching Well-Established" measurement for sleep problems (Lewandowski, Tolvier-Sokol, & Palermo, 2011). The internal consistency was adequate (α = .77) in the present sample.

Daytime Sleepiness. The Epworth Sleepiness Scale-Revised for Children (ESS; Moore et al., 2009) is an 8-item scale that measures daytime sleepiness, and it was administered at both timepoints. Participants rated their likelihood of falling asleep during daytime activities, such as watching television, using a scale from zero to three (*would never doze or sleep* to *high chance of dozing or sleeping*). Daytime sleepiness in previous studies has demonstrated that this scale is reliable and valid and is considered an "Approaching Well-Established" measure (Lewandowski et al., 2011). The internal consistency was adequate during late childhood ($\alpha = .73$) and in early adolescence ($\alpha = .74$) in the present sample.

Emotion Regulation. The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), which was administered at the second point of data collection later during adolescence, is a 10-item scale that measures emotion-regulatory strategies. It asks individuals to assess how they behave when attempting to change their emotions, and each question measures a specific regulation strategy. The reappraisal subscale is comprised of six items (e.g., "I control my emotions by changing the way I think about the situation I'm in"); internal consistency in the current sample was good ($\alpha = .85$). The suppression subscale is comprised of four items (e.g., "I keep my emotions to myself"); reliability in the current sample was adequate ($\alpha = .74$). Responses on both subscales range from one to seven (*strongly disagree* to *strongly agree*), and each scale includes at least one item related to regulating negative emotion and another to regulating positive emotion.

Analysis Plan

First, bivariate statistical analyses were conducted for all variables. Next, controlling for current sleep-wake problems, separate multiple regression models with sleep-wake problems and daytime sleepiness measured in early adolescence as unique predictors of later cognitive reappraisal and expressive suppression, respectively, were conducted. Age at both time points and daytime sleepiness at the most recent time point were included in both models as covariates.

Results

Preliminary Analyses

Assumptions of normality were met for all variables, and intercorrelations between study variables did not exceed .70, so there were no problems with multicollinearity. Descriptive statistics for all predictors and outcome variables are provided in Tables 1 and 2. At the bivariate level, greater sleep-wake problems and greater daytime sleepiness were both associated with decreased use of cognitive reappraisal. Greater sleep-wake problems were associated with increased use of expressive suppression, yet daytime sleepiness was not significantly associated with expressive suppression. Because maternal education and gender were not significantly correlated with use of either emotion regulation strategy, they were not included as covariates in the final models.

Cognitive Reappraisal

The regression results for daytime sleepiness and sleep-wake problems predicting later use of cognitive reappraisal are presented in Table 4. Controlling for daytime sleepiness at the more recent time point and demographic variables, regression results accounted for significant variance in cognitive reappraisal abilities, F (5, 103) = 4.655, R^2 = .184, $p < .01$. Sleep-wake problems negatively predicted use of cognitive reappraisal, β = -.217, p = .049. However, daytime sleepiness did not emerge as a significant predictor, β = -.145, p = .195.

Expressive Suppression

The regression results for daytime sleepiness and sleep-wake problems predicting later use of expressive suppression abilities are presented in Table 5. Controlling for current daytime sleepiness and demographic variables, the overall model was not significant, F(5, 103) = 1.352, R^2 = .062, p = .249. However, greater sleep-wake problems significantly predicted increased expressive suppression (β = .257, p = .030).

Discussion

Adding to the small but growing literature regarding sleep problems and emotion regulation abilities in youth (Reddy et al., 2017), the present study examined whether sleep-wake problems and daytime sleepiness in early adolescence significantly predicted cognitive reappraisal and expressive suppression later in adolescence. Controlling for maternal education, age at both time points, gender, and daytime sleepiness at the most recent time point, it was found that greater sleep-wake problems uniquely predicted decreased use of cognitive reappraisal as an emotion regulation strategy; daytime sleepiness from the earlier timepoint was not a significant unique predictor. The reverse pattern was found for expressive suppression, in which greater sleep-wake problems uniquely predicted increased use of this strategy. Controlling for demographic covariates, greater sleep-wake problems uniquely predicted *increased* use of expressive suppression. However, the overall model was nonsignificant, yet this contradiction may be related to insufficient power. These findings build on the growing body of research on why sleep is important for adolescent health, specifically with regards to their ability to effectively regulate their emotions.

Results were generally consistent with the stated hypotheses for cognitive reappraisal, with greater sleep-wake problems (but not greater daytime sleepiness) predicting decreased use of cognitive reappraisal. Prior research has demonstrated this strategy to be more cognitively demanding in comparison to other emotion regulation strategies (Strauss et al., 2016), so it follows that disrupted sleep might impede use of a more complex emotion regulation strategy. Given that limited prior research has been conducted to examine the association between sleep and expressive suppression and among adolescents, hypotheses for the model predicting expressive suppression were cautious. Because expressive suppression tends to be a less cognitively demanding strategy that is associated with more problematic behavior (Flouri and Mavroveli, 2011), it seemed possible that youth who experience sleep problems or daytime

sleepiness would use expressive suppression, which may be easier to employ in the absence of optimal sleep, to manage emotions. Consistent with this prediction, the current study found that greater sleep-wake problems (but not daytime sleepiness) predicted increased use of expressive suppression, suggesting that suboptimal sleep is associated with greater use of a maladaptive effective emotion regulation strategy.

Intervention Implications

Unique in its longitudinal design, this study suggests that sleep problems early in adolescence may impact emotion regulation outcomes later in development, which has important implications for intervention, especially because research has shown that sleep problems are common in children and adolescents (Paavonen et al., 2016). For example, approximately 40% of youth encounter sleep problems that can interfere with their ability to effectively regulate emotions (Alfano & Gamble, 2009). Similarly, O'Brien and Mindell (2005) found that more sleep problems have negative consequences on adolescent health including negative moods, behavior problems, and risk-taking behaviors.

To treat sleep problems in children and adolescents, interventions have been used in a wide variety of approaches such as preventive parent education in which caregivers are encouraged to maintain positive sleep habits (Taylor and Roane, 2010) as well as a mindfulness-based multi-component, in-school group intervention (Bei et al., 2013). To evaluate the effectiveness of a sleep intervention, Paavonen et al. (2016) conducted a study with adolescents and found that the intervention did improve average sleep duration, decreased week-weekend irregularity, and improved sleep quality. However, not all adolescents benefited from this group-based intervention. Improved interventions can be tailored through parental involvement, in which parents are taught why positive sleep habits are not only important for their child's physical health, but also for regulating negative emotions.

Limitations and Future Directions

Findings from the current study should be considered in light of the following limitations. Although daytime sleepiness was measured at both time points, sleep-wake problems were only measured in early adolescence. Additional research with consistent, repeated measures of sleep is needed to understand the unique effect of past sleep problems on emotion regulation abilities. Age variability is another limitation to consider as children were a range of different ages at each timepoint. Thus, the present study can only recommend intervention strategies and cannot guide specific ages to intervene. Additionally, measures of daytime sleepiness and sleep-wake problems were self-report, which are not as accurate as other objective measures, such as actigraphy. Similarly, emotion regulation tasks could have provided more objective information. Finally, the duration between time points was relatively short. Future research should consider using multiple timepoints with a wider timespan to better target interventions.

Conclusion

The present study underscores the importance of addressing sleep problems to improve adolescents' use of adaptive emotion regulation strategies later in development. Even though research using a wider timespan with additional timepoints, along with consistent, objective measurements of key study variables, is recommended to build on the current results, the study's unique longitudinal design makes it an important contribution to research on sleep and emotion regulation.

References

Alfano, C. & Gamble, A. (2009). The Role of Sleep in Childhood Psychiatric Disorders. *Child Youth Care Forum*, 38(6), 327-340.

Augustine, A. & Hemenover, S. (2009). On the relative effectiveness of affect regulation strategies: A meta-analysis. *Cognition and Emotion,* 23(6), 1181-1220.

Baum, K., Desai, A., Field, J., Miller, L., Rausch, J., & Beebe, D. (2014). Sleep restriction worsens mood and emotion regulation in adolescents. *Journal of Child Psychology and Psychiatry,* 55(2), 180-190.

Bei, B., Bryne, M., Ivens, C., Waloszek, J., Woods, M., Dudgeon, P., Murray, G., Nicholas, C., Trinder, J., & Allen, N. (2013). Pilot study of a mindfulness-based, multi-component, in-school group sleep intervention in adolescent girls. *Early Intervention in Psychiatry*, 7, 213-220.

Bonnano, G., Papa, A., Lalande, K., Westphal, M., & Coifman, K. (2004). The Importance of Being Flexible: The Ability to Both Enhance and Suppress Emotional Expression Predicts Long-Term Adjustment. *American Psychological Society*, 15(7), 482-487.

Boyes, M., Hasking, P., & Martin, G. (2014). Adverse Life Experience and Psychological Distress in Adolescence: Moderating and Mediating Effects of Emotion Regulation and Rumination. *Stress and Health*, 32, 402-410.

Dhaka, S. & Kashyap, N. (2017). Explicit Emotion Regulation: Comparing Emotion Inducing Stimuli. *Psychological Thought*, 10(2), 303-314.

Forbes, E., Bertocci, M., Gregory, A., Ryan, N., Axelson, D., Birmaher, B., & Ronald, Dahl (2008). Objective Sleep in Pediatric Anxiety Disorders and Major Depressive Disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 47(2), 148-155.

Flouri, E. & Mavroveli, S. (2011). Adverse Life Events and Emotional and Behavioral Problems in Adolescence: The Role of Coping and Emotion Regulation. *Stress and Health,* 29, 360-368.

Giedd, J. (2015). The amazing teen brain. *Scientific American*, 312(6), 32-37.

Geisler, F. & Schro¨der-Abe, M. (2015). Is emotion suppression beneficial or harmful? It depends on self-regulatory strength. *Motivation and Emotion*, 39(4), 553-564.

Gross, J. (2015). Emotion Regulation: Current Status and Future Prospects. *Psychological Inquiry*, 26, 1-26.

Gross, J. & John, O. (2003). Individual Differences in Two Emotion Regulation Processes: Implications for Affect, Relationships, and Well-Being. *Journal of Personality and Social Psychology*, 85(2), 348-362.

Heller, A. & Casey, B. (2016). The neurodynamic of emotion: delineating typical and atypical emotional processes during adolescence. *Developmental Science*, 19(1), 3-18.

Larsen, J., English, T., & Scholte, R. (2012). Social Coping by Masking? Parental Support and Peer Victimization as Mediators of the Relationship Between Depressive Symptoms and Expressive Suppression in Adolescents. *J Youth Adolescence*, 41, 1628-1642.

Larson, R., Moneta, G., Richards, M., & Wilson, S. (2002). Continuity, Stability, and Change in Daily Emotional Experience across Adolescence. *Child Development*, 73(4), 1151-1165.

Lewandowski, A. S., Toliver-Sokol, M. & Palermo, M. (2011) Evidence-based review of subjective pediatric sleep measures. *Journal of Pediatric Psychology,* 36, 780–793.

McRae, K., Gross, J., Weber, J., Robertson, E., Sokol-Hessner, P., Ray, R., Gabrieli, J., & Kevin, O. (2012). The development of emotion regulation: an fMRI study of cognitive reappraisal in children, adolescents and young adults. *Social Cognitive and Affective Neuroscience*, 7, 11-22.

Meijer, M., Habekothe, R., & Van Den Wittenboer, G. (2001). Mental health, parental rules and sleep in pre-adolescents. *Journal of Sleep Research*, 10(4), 297-302.

Moore, M., Kirchner, L., Drotar, D, Johnson, N., Rosen, C., Ancoli-Israel, S., & Redline, S. (2009). Relationships among sleepiness, sleep time, and psychological functioning in adolescents, *Journal of Pediatric Psychology*, 34(10), 1175-1183.

O'Brien, E. & Mindell, J. (2005). Sleep and Risk-Taking Behavior in Adolescents. *Behavioral Sleep Medicine*, 3(3), 113-133.

Paavonen, E., Huurre, T., Tilli, M., Kiviruusu, O., & Partonen, T. (2016). Brief Behavioral Sleep Intervention for Adolescents: An Effectiveness Study. *Behavioral Sleep Medicine*, 14, 351-366.

Perfect, M., Levine-Donnerstein, D., Archbold, K., & Goodwin, J. (2014). The Contribution of Sleep Problems to Academic and Psychosocial Functioning. *Psychology in the Schools*, 51(3), 273-295.

Reddy, R., Palmer, C., Jackson, C., Farris, S, & Alfano, C. (2017). Impact of sleep restriction versus idealized sleep on emotional experience, reactivity and regulation in healthy adolescents. *Journal of Sleep Research*, 26, 516-525.

Short, M., Gradisar, M., Lack, L., & Wright, H. (2013). The impact of sleep on adolescent depressed mood, alertness, and academic performance. *Journal of Adolescence*, 36, 1025-2033.

Siversten, B., Harvey, A., Reichborn-Kjennerud, T., Torgersen, L., Ysstom, E., & Hysing, M. (2015). Later Emotional and Behavioral Problems Associated with Sleep Problems in Toddlers: A Longitudinal Study. *JAMA Pediatrics*, 169(6), 575-582.

Srivastava, S., Tamir, M., McGonigal, K., & John, O. (2009). The Social Costs of Emotional Suppression: A Prospective Study of the Transition to College. *Journal of Personality and Social Psychology,* 96(4), 883-897.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *TRENDS in Cognitive Sciences*, 9(2), 69-74.

Strauss, G., Ossenfort, K., & Whearty, K. (2016). Reappraisal and Distraction Emotion Regulation Strategies Are Associated with Distinct Patterns of Visual Attention and Differing Levels of Cognitive Demand. *PLoS ONE*, 11(11), 1-18.

Taylor, D. & Roane, B. (2010). Treatment of Insomnia in Adults and Children: A Practice-Friendly Review of Research. *Journal of Clinical Psychology*, 66(11), 1137-1147.

Walting J., Pawlik, B., Scott, K., Booth, S., & Short, M. (2017). Sleep Loss and Affective Functioning: More Than Just Mood. *Behavioral Sleep Medicine*, 15, 394-409.

Webb, T., Miles, E., & Sheeran, P. (2012). Dealing with Feeling: A Meta-Analysis of the Effectiveness of Strategies Derived from the Process Model of Emotion Regulation. *Psychological Bulletin*, 138(4), 775-808.

Wheaton, A., Chapman, D., & Croft, J. (2017). School Start Times, Sleep, Behavioral, Health, and Academic Outcomes: A Review of the Literature. *Journal of School Health*, 86(5), 363-381.

Table 1. *Summary of Univariate Statistics for Demographic Information*

Variable	***Univariate Summary***	
Age (Time 1)	*M* = 11.90 (11-14)	*SD* = .910
Age (Time 2)	*M* = 12.73 (12-15)	*SD* = .899
Child's Gender	Male	46 (42.2%)
	Female	63 (57.8%)
Child's Ethnicity	White	88 (80.7%)
	Multiracial	10 (9.1%)
	Hispanic	8 (7.3%)
	African American	2 (1.8%)
	Asian American	1 (0.9%)
Mother's Education	Less than high school	2 (1.8%)
	High school or equivalent	5 (4.6%)
	Vocational or Technical	15 (13.8%)
	Some college	22 (20.2%)
	Associate's	3 (2.8%)
	Bachelor's	41 (37.6%)
	Master's	17 (15.6%)
	Doctoral or Professional	4 (3.7%)

Table 2. *Descriptive Statistics for Study Variables*

	***M* (*SD*)**	**Range**
Sleep-Wake Problems	19.93 (6.577)	10 - 37
Daytime Sleepiness (Time 1)	5.86 (3.643)	0 - 14
Daytime Sleepiness (Time 2)	5.84 (3.422)	0-16
Emotion Regulation Questionnaire – Cognitive Reappraisal	27.70 (7.082)	6 - 42
Emotion Regulation Questionnaire – Expressive Suppression	14.16 (5.110)	4 - 25

Note. $N = 109$.

Table 3. *Pearson Correlations Between Study Variables*

Variables	Sleep-Wake Problems	Cognitive Reappraisal	Expressive Suppression	Child's Age	Child's Gender	Mother's Education
Daytime Sleepiness	.553**	-.303**	.094	-.031	-.068	-.136
Sleep-Wake Problems		-.352**	.228*	.087	-.044	-.121
Cognitive Reappraisal			-.162	-.144	.003	.044
Expressive Suppression				-.033	-.061	.101
Child's Age					.120	-.042
Child's Gender						-.144

Note. *$p < .05$; **$p < .01$; ***p<.001. $N = 109$.

Table 4.

Summary of Regression Results for Daytime Sleepiness and Sleep-Wake Problems Predicting Cognitive Reappraisal

Variable	***B***	**SE B**	***β***	***R²***
Daytime Sleepiness (Time 1)	-.281	.216	-.145	.184
Sleep-Wake Problems	-.234	.117	-.217*	
Daytime Sleepiness (Time 2)	.299	.198	-.145	
Age (Time 1)	-1.935	1.665	-.250	
Age (Time 2)	.654	1.680	.083	

Note. *$p < .05$, $N = 109$.

Table 5.

Summary of Regression Results for Daytime Sleepiness and Sleep-Wake Problems Predicting Expressive Suppression

Variable	***B***	**SE B**	***β***	***R²***
Daytime Sleepiness (Time 1)	-.056	.167	-.040	.062
Sleep-Wake Problems	.199	.091	.257*	
Daytime Sleepiness (Time 2)	-.026	.153	-.017	
Age (Time 1)	.879	1.288	.157	
Age (Time 2)	-1.145	1.301	-.201	

Note. *$p < .05$, $N = 109$.