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The role of pre-sleep cognitions in adolescent sleep-onset problems

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Abstract

Study Objectives: To examine the relationship between pre-sleep cognitions and sleep-onset difficulties in an adolescent sample.

Methods: Participants were 385 students (59% male) from grades 9 to 11, between 13 and 18 yrs old (*M*=15.6, *SD*=1.0), from 8 co-educational high schools of varied socio-economic status in metropolitan Adelaide, South Australia. The cross-sectional study used a questionnaire battery including the Sleep Anticipatory Anxiety Questionnaire - Adolescent Version [SAAQ-A], completed during school time, followed by 8 days of sleep diary completion and wearing wrist actigraphy to obtain subjective and objective sleep onset latency [SOL].

Results: Significant relationships were found between somatic arousal (SAAQ-A subscale) and objective SOL, and between sleep-related cognitions (SAAQ-A subscale) and subjective SOL and SOL overestimation (sleep misperception). No relationships were found between subjective SOL and somatic or rehearsal and planning cognitions. Objective SOL was not related to rehearsal and planning, or sleep-related cognition scores, and sleep misperception had no relationship with somatic, and rehearsal and planning cognition scores.

Conclusions: These findings are similar to those in clinical adult populations, but also notably different, for example the lack of association between negative sleep-related pre-sleep cognitions and objective sleep difficulty. This study's results provide a basis for existing relationships between negative pre-sleep cognitions and subjective and objective sleep difficulties in this population to be examined causally in more detail.

Keywords: adolescent, cognitions, cognitive model, insomnia, sleep anticipatory anxiety, Sleep Anticipatory Anxiety Questionnaire.

Sleep patterns change considerably during adolescence (Carskadon, 2011; Crowley, Acebo & Carskadon, 2007; Thorleifsdottir, Björnsson, Benediktsdottir, Gislason & Kristbjarnarson, 2002). Adolescents go to bed later, take longer to fall asleep, and find it more difficult to wake up for school than younger children (Carskadon, 2011; Gradisar, Gardner & Dohnt, 2011; National Sleep Foundation [NSF], 2006; Roane & Taylor, 2008; Warner, Murray & Meyer, 2008). Sleep difficulties often manifest from delays in sleep timing. Notably, adolescents with delayed circadian timing commonly experience problems falling asleep as they attempt to sleep earlier than is biologically permissive (Sharma & Feinsilver, 2009). Approximately 30% of adolescents report difficulties falling asleep (Lazaratou, Dikeos, Anagnostopoulos, Sbokou & Soldatos, 2005; Short, Gradisar, Lack, Wright & Dohnt, 2013), with 16%-25% reporting sleep onset latencies (SOL) longer than 30 min each night (NSF, 2006; Short et al, 2013). Repeated difficulty falling asleep can cause an association between bedtime, the bed/bedroom, and the inability to sleep (Bootzin, 1972; Bootzin & Nicassio, 1978; Morin, 1993). Each time an individual goes to bed and cannot fall asleep this association is reinforced until it potentially develops into conditioned insomnia, where previous stimuli for sleep (i.e., bedtime/bedroom) are now associated with sleeplessness (American Sleep Disorders Association [ASDA], 1997; Bootzin; Bootzin & Nicassio; Morin).

Models of insomnia emphasise the role of repetitive negative thinking in causing sleep onset difficulties (Espie, 2002; Harvey, 2002). Although few studies have looked at pre-sleep negative cognitions in adolescents, catastrophising thought patterns prior to sleep are not uncommon in this population (Danielsson, Harvey, MacDonald, Jansson-Fröjmark, & Linton, 2013; Hiller, Lovato, Gradisar, Oliver, & Slater, 2014; Noone et al., 2014). For example, a study of young adolescent girls (11-

12 yrs) found 21% reported catastrophising prior to sleep (Noone et al.), while 87% of adolescents (11-19 yrs) diagnosed with a sleep disorder reported pre-sleep catastrophising (Hiller et al., 2014). In both studies, the most common catastrophising themes were the consequences of poor sleep on school performance and school relationships (e.g., ability to function academically, being embarrassed in front of friends) (Hiller et al.; Noone et al.). Of the young adolescents who reported catastrophising, more than 50% catastrophised about the consequences of poor sleep on mood and tiredness (Noone et al.). Such negative cognitive activity is positively associated with self-reported sleep problems in younger (M=12.5 yrs; Kliewer & Lepore, 2015) and older adolescents (16-18 yrs; Danielsson et al., 2013; Hiller et al., 2014). Similar relationships also exist among children (Gregory, Willis, Wiggs & Harvey, 2008) and adults (Wicklow & Espie, 2000).

Models of insomnia propose that negative cognitions not only impact sleep itself, but also perception of the sleep obtained (i.e., the difference between subjectively and objectively measured sleep). Discrepancies between objective and subjective sleep are known as sleep misperception (Harvey, 2002). Sleep misperception can have a substantial impact on the lives of adults with insomnia, who commonly report significantly shorter total sleep time and longer sleep onset latencies than that objectively recorded (Harvey & Tang, 2012). There is also preliminary evidence indicating that adolescents with a sleep disorder also experience sleep misperception (Richardson, Gradisar & Barbero, 2016).

To build upon emerging evidence for the presence of, and link between, pre-sleep repetitive negative thinking and sleep onset difficulties in adolescents, our study will; (i) measure whether pre-sleep cognitions are related to subjective (sleep diary) and objective (wrist actigraphy) measures of sleep disturbance in adolescents (such as

long SOL, as evidenced in adults; Wicklow & Espie, 2003), and (ii) measure whether non-clinical adolescents' pre-sleep cognitions are related to sleep misperception (similar to Harvey's insomnia model, 2002). Similar to previous findings in adults (Wicklow & Espie) and adolescents (Hiller, et al., 2014), we expect that different types of pre-sleep cognitions will relate with varied strengths to measures of sleep. We anticipate that higher levels of sleep-related cognitions and rehearsal and planning cognitions (measured by SAAQ-A subscales) will be related to longer sleep diary SOL, longer actigraphy SOL and also greater sleep misperception in the form of SOL overestimation (Hiller, et al.; Wicklow & Espie). We also anticipate that somatic pre-sleep cognitions will have a weak positive relationship to diary SOL, actigraphy SOL, and SOL misperception similar to previous results (Hiller, et al.; Wicklow & Espie).

Methods

Participants

385 adolescents (*M*=15.6 yrs, *SD*=1.0, 59% male) from 8 schools in the Adelaide metropolitan area (response rate = 82%) participated in the study. Schools were selected from a stratified sample based on socio-economic status, with one school randomly selected from each octile. Students were recruited from grades 9 (34%), 10 (34%), and 11 (33%). Informed consent was obtained from parents and students, and no exclusion criteria were applied to obtain a representative sample. This study was granted ethics approval by the Flinders University Social and Behavioural Research Ethics Committee and the Department of Education and Children's Services Ethics Committee.

Measures

Pre-Sleep Cognitions

The Sleep Anticipatory Anxiety Questionnaire - Adolescent Version (SAAQ-A; see Appendix) was used to measure pre-sleep cognitions, and has been previously used with adolescents diagnosed with a sleep disorder (Hiller et al., 2014). The original SAAQ consists of 10 items, and is divided into two subscales: the 5-item *somatic* cognitions scale (e.g., *"When I try to fall asleep at night my muscles are tense"*), and the 5-item *sleep-related* cognitions scale (e.g., *"When I try to fall asleep at night I worry that I won't get enough sleep"*; Bootzin, Shoham & Kuo, 1994). The adolescent version (SAAQ-A) included an additional 5-item subscale called the *rehearsal-and-planning* cognitions scale (e.g., *"When I try to fall asleep at night I worry about my school work"*, and, *"I can't stop thinking about what I have to do tomorrow").*

Each item was scored on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree).* Higher scores indicated greater endorsement of negative pre-sleep cognitions (*range*: 15 – 60). In the current study, the internal consistency of the 15-item SAAQ-A (α = .89) was comparable to that of the original 10-item SAAQ (α = .86). The subscales of the SAAQ-A also showed acceptable reliability (α range = .78 - .83).

Subjective Difficulty Falling Asleep

A sleep diary was used to provide a subjective measure of sleep onset latency (SOL) over an 8-day period. Adolescents were asked to estimate each morning how many minutes they took to fall asleep the previous night, which was then averaged across the 8 nights. Sleep diaries have been found to be reliable and valid in assessing

sleep patterns (Short, Arora, Gradisar, Taheri & Carskadon, 2017); and are correlated with objective measures of sleep, such as actigraphy (Wolfson et al., 2003).

A dichotomous variable measuring perceived difficulty falling asleep was also included, from the School Sleep Habits Survey (Wolfson et al., 2003; Short et al., 2013). The item asked students, *"Do you have difficulty falling asleep?"*, with response options *yes* or *no*. This item was included to reflect adolescents' overall perception of whether they have a sleep onset difficulty, which can differ from lengthy reports of SOL (Gradisar, Gardner & Dohnt, 2011), and is an important factor in the diagnosis of sleep problems (Harvey & Tang, 2012).

Objective Difficulty Falling Asleep

Wrist actigraphy monitors (MicroMini-Motionlogger Actiwatch, AMI Inc., Ardsley, NY, USA) were worn over the same 8-day period as the sleep diary to obtain an objective measure of sleep onset latency. Data were digitised in 1 minute epochs using zero-crossing mode with a sensitivity of 0.05 g and a bandwidth of 2-3 Hz. Analysis was conducted with Action W2 software (AMI) using the Sadeh algorithm which has been validated for use with adolescents (Sadeh, Sharkey & Carskadon, 1994). SOL was defined as the difference in minutes between sleep diary bedtime and actigraphy sleep onset time. Sleep onset time was defined as the first of 3 consecutive epochs of sleep (Acebo et al., 1999).

Sleep Misperception

Sleep misperception was operationalised as the discrepancy between subjective and objective SOL. Mean subjective and objective SOL were calculated using a minimum of 5 nights of data, SOL discrepancy was then determined by

subtracting mean objective SOL (actigraphy) from the mean subjective SOL (sleep diary), as per Harvey and Tang (2012). Hence, positive scores reflected an over-estimation of SOL (i.e., the adolescent erroneously perceives they take longer to fall asleep), and negative scores reflected an under-estimation of SOL (i.e., the adolescent erroneously perceives they take a shorter amount of time to fall asleep).

Procedure

After school principal approval, researchers provided a brief session describing the research study to classes of adolescents. To reduce sampling bias, the study was described as investigating general health and well-being. After informed written consent was obtained from adolescents and their parents, each student completed a questionnaire battery during class time, including the modified School Sleep Habits Survey. Participants then received a sleep diary and actigraphy monitor and were instructed on how to use them over the following 8 consecutive days and nights. At the end of the 8 days, researchers clarified with students any major discrepancies in bedtimes between the sleep diaries and sleep onset (e.g., rare occurrence of actigraphy sleep onset occurring >30 mins prior to sleep diary reported bedtime). Students then received an AUD$40 gift voucher reimbursement. Data were collected between 2008 and 2010, during school terms (and outside daylight savings time), and at least 2 weeks after school holiday breaks (Warner et al., 2008).

Statistical Analyses

Age, gender and depressed mood (measured using the Center for Epidemiological Studies – Depression Scale; Radloff, 1977) were entered as covariates in analyses, as they are associated with sleep-onset difficulties (e.g.,

Harvey, 2011; Carskadon, Acebo, & Jenni, 2004; Voderholzer, Al-Shajlawi, Weske, Feige, & Riemann, 2003). Correlation and regression analyses were used to examine whether pre-sleep cognitions (SAAQ-A) significantly predicted either difficulty falling asleep (SOL) or sleep misperception (over-estimators vs under-estimators). Significance was set at $p < .05$. All variables were screened for missing data, outliers and skewness (Tabachnick & Fidell, 2007). SAAQ-A total and subscale scores were normally distributed, however, SOL scores (actigraphy and sleep diary) were positively skewed, and square-root transformations were used to achieve normality (Tabachnick & Fidell).

Results

Preliminary Analyses

Average sleep diary SOL was 17.4 min (*SD* = 13.6), while average objective SOL was 41.4 min (*SD* = 23.1). A paired samples t-test confirmed that subjective estimates of SOL were significantly shorter than objective estimates, t (254) = 32.67, $p < .001$, Cohen's $d = 2.83$. The mean total SAAQ-A score was 17.3 *(SD* = 7.5; range 0 - 45).

Frequency analyses showed that approximately 32% of adolescents reported difficulty falling asleep in the School Sleep Habits Survey, while sleep diary data indicated that 14.3% of adolescents reported taking >30 min to fall asleep (Lichstein, Durrence, Taylor, Bush, & Riedel, 2003), whereas 66.7% met similar criteria when using objective actigraphy data. Sleep misperception was also investigated using frequency analyses in participants with valid subjective and objective SOL data (N = 255). We found 87.5% of the adolescents underestimated the time it took them to fall asleep. Mean sleep misperception was an underestimation of 23.5 min (*SD* = 24.7).

Are Pre-sleep Cognitions Related to Sleep Onset Latency?

Sleep diary SOL had a significant small-to-medium correlation with the SAAQ-A *sleep-related* cognitions subscale, however no significant correlations were found between sleep diary SOL and the SAAQ-A *somatic* or *rehearsal and planning* subscales (see Table 1). Comparatively, actigraphy SOL had a significant small correlation with the SAAQ-A *somatic* subscale. No significant correlations were found between actigraphy SOL and the *sleep-related* cognitions subscale, or *rehearsal and planning* cognitions subscale (see Table 1).

<<<<<<<<<insert Table 1 here>>>>>>>>>

Hierarchical regressions were used to further test the relationships between sleep diary SOL and sleep-related cognitions, and objective SOL and the somatic subscale.

In the first regression, subjective diary SOL was entered as the dependant variable, age, sex, and depressed mood were entered in the first step, and the sleep-related worries subscale was entered in the second step. Age, gender, and depressed mood did not significantly contribute to the model, F (3, 121) = .52, p = .67, and accounted for 1.3% of variance. Sleep-related cognitions did contribute significantly, accounting for 4.9% of variance in subjective diary SOL, F (1, 120) = 6.27, p = .014.

In the second regression, objective SOL was entered as the dependent variable with the somatic subscale entered in the second step. Age, gender, and depressed mood contributed significantly to the model, F (3, 243) = 5.79, p = .001, and accounted for 6.6% of variance. Somatic cognitions also contributed significantly to

the model, F (1, 242) = 4.08, p = .05, accounting for 1.5% of variance in objective actigraphy SOL.

Do Adolescents Who Misperceive Sleep Onset Latency Have More Repetitive Negative Thinking?

Independent samples t-tests were used to analyse the difference in reported pre-sleep cognitions between adolescents who over- and underestimated their SOL. There were no significant differences in somatic cognitions, t(251) = .36, p = .72, Cohen's d = 0.07, or rehearsal and planning cognitions, t(201) = 1.52, p = .13, Cohen's d = 0.32, on the SAAQ-A. However, adolescents who overestimated their SOL had significantly higher levels of negative sleep-related cognitions, t(248) = 2.81, p = .005, Cohen's d = 0.56, than those who underestimated their SOL. Of note, an independent samples t-test showed that the adolescents who overestimated their SOL also reported more severe difficulty falling asleep in the modified Sleep Habits Survey, t(35.1) = 3.43, p = .002, Cohen's d = 0.72, than adolescents who underestimated their SOL.

Discussion

The focus of the present study was to investigate the role of pre-sleep cognitions on adolescents' sleep onset latency and sleep misperception. Sleep-onset problems were common, with 32% of adolescents reporting difficulty falling asleep. This percentage of ~1 in every 3 adolescents is higher than that found in previous studies, which ranged from 7.1 to 26.5% (Gradisar, Gardner, & Dohnt, 2011). When examining sleep diaries, 14.3% of the adolescents took >30 min to fall asleep, compared to a larger 66.7% who took > 30 min to fall asleep according to actigraphy

data. These sleep diary data are in line with previous studies (e.g., National Sleep Foundation, 2006), yet few data exist for actigraphy-measured sleep latency in adolescents. Differences between objective and subjective measures of SOL (i.e. actigraphy and sleep diary data) were significant and approximately 88% of adolescents underestimated their sleep onset latency.

Relationship between Somatic Cognitions and Falling Asleep

The study's first aim was partially supported. Although pre-sleep rehearsal and planning cognitions, and sleep-related cognitions did not significantly predict objective SOL, experiencing somatic symptoms did. Specifically, adolescents who reported more *somatic* cognitions (e.g., "*When I try to fall asleep at night I become short of breath"*; Bootzin et al. 1994*)* had longer actigraphy measured SOL than those with lower scores. This indicates that adolescents with a longer objective SOL are more aware of somatic symptoms in bed at night. It is possible that this increased awareness of somatic symptoms reported in the SAAQ-A, such as tense muscles, rapid heartbeat, feeling 'shaky' and/or short of breath, is due to a genuine increase in physiological arousal which consequentially leads to difficulty falling asleep. A similar correlation was identified by Wicklow and Espie (2000) linking somatic cognitions and adults' objective SOL, however their study also found objective SOL was related to rehearsal and planning and sleep-related cognitions - findings which were not replicated by this study.

Relationship between Sleep-Related Cognitions and Difficulty Falling Asleep

Sleep-related cognitions were significantly related to subjective sleep onset latency. Specifically, longer sleep diary SOL was related to higher scores of *sleep-*

related pre-sleep cognitions on the SAAQ-A sleep subscale (e.g. *"When I try to fall asleep at night I worry that I won't be able to function the next day if I don't sleep"*), but not to rehearsal and planning or somatic cognitions. This was contradictory to the findings of Wicklow and Espie (2000), where adults with insomnia had negative pre-sleep cognitions that were related to objective but *not* subjective SOL. However, similar results to the present study have been found in studies with children and adolescents. Gregory and colleagues (2009) found children's cognitions *were* related to subjective SOL, and Hiller and colleagues (2014) found catastrophising to be indirectly related to subjective SOL through increased anxiety in a clinical sample of adolescents with Delayed Sleep Phase Disorder. Worth noting is that objective SOL was not measured in either of these paediatric studies.

The SAAQ-A items which comprise the sleep-related cognitions subscale are concerned with worry about obtaining sleep itself (i.e., *"I won't be able to fall asleep", "I won't get enough sleep")* and the consequences of poor sleep (i.e. *"I won't be able function the next day if I don't sleep", "I will be tired and irritable the next day if I don't sleep"*). Similar themes about the consequences of poor sleep on the academic and social aspects of school have been identified as adolescents' most common pre-sleep catastrophising themes in previous research (Hiller, et al. 2014; Noone et al., 2014). Indeed, Noone and colleagues (2014) found that the second most common catastrophising theme was concern over the impact of poor sleep on mood and tiredness. It is possible that this pre-occupation with the consequences of poor sleep, and in particular, worrying about falling asleep, could lead to a longer estimation of sleep onset latency due to adolescents' hyperawareness that they are not yet asleep.

Notably, in partial support of our second aim, analysis of sleep misperception identified that although most adolescents underestimated their SOL, the adolescents

who *overestimated* their SOL reported more sleep-related cognitions than those who underestimated. Furthermore, the adolescents who overestimated their SOL also reported that they had more severe difficulty falling asleep than those who underestimated. The interrelationship between sleep-related cognitions, longer subjective SOL, reported difficulty falling asleep, and overestimation of SOL indicates that although experiencing more sleep-related cognitions is associated with reporting longer subjective SOL, this SOL estimation appears inaccurate. The relationship between high levels of sleep-related cognitions and longer subjective SOLs is similar to that found by Hiller et al. (2014). The high levels of sleep-related cognitions in adolescents who overestimated their SOL are reminiscent of previous studies which found that adults with insomnia had much more sleep-related worries than normal or poor sleepers (Jansson-Fröjmark, Harvey, Norell-Clarke & Linton, 2012; Norell-Clarke, Jansson-Fröjmark, Tillfors, Harvey & Linton, 2014). It is also of note that the importance of addressing the role of sleep-related cognitions has been identified in adolescent-targeted interventions for sleep problems (Harvey, 2016).

These results suggest that cognitions do not relate to young people's objective sleep measures as they do adults', but instead relate to adolescents' subjective sleep measures and sleep misperception. It is possible that adolescents who continually experience repeated negative pre-sleep cognitions in addition to subjective sleep disturbance and sleep misperception will transition from this perceived sleep difficulty to a genuine sleep deficit.

Strengths, Limitations and Future Research

One of the notable strengths of this study is the use of multiple measures to assess sleep onset latency (i.e., subjectively [sleep-diary] and objectively [actigraphy]),

thereby allowing comparison between adolescents' perception of SOL and objective SOL. Furthermore, the scope of the study allowed us to collect sleep diary and actigraphy SOL data from a large sample, thus ensuring better representation of the cohort and accuracy of the data. It is important to note that our data were cross-sectional, and longitudinal replication is required to ascertain causality of the relationships between pre-sleep cognitions, somatic arousal and sleep onset latency. Indeed, postulation about how the results of this school-based sample may indicate a precursor to objective sleep difficulty requires appropriate replication using clinical samples. Replication on this level would allow testing of the causality of insomnia models (Espie, 2002; Harvey, 2002), and closer analysis of the processes involved in the development of insomnia, and assessment of factors associated with susceptibility to insomnia.

Differing opinions exist within the literature regarding the accuracy of actigraphy for measuring sleep onset (Ancoli-Israel, Cole, Alessi, Chambers, Moorcroft, & Pollak, 2003). The large number of adolescents defined as having clinical sleep onset difficulties in the present study suggests that actigraphy SOL may be overestimated. Alternately, is it possible that the criterion for clinical SOL in adolescents (i.e., SOL>30 min; Lichstein et al., 2003) may need to be adjusted for objective measures of SOL. It is recommended that future research consider the use of polysomnography to measure objective SOL in those adolescents who overestimate their SOL with actigraphy to address this concern.

Conclusion

In the study's large sample of adolescents, evidence was found for an association between negative pre-sleep cognitions and sleep difficulty. A positive

relationship existed between somatic arousal and actigraphic sleep onset latency, and higher levels of sleep-related cognitions were found to be related to longer subjective SOL and SOL overestimation. There exist large similarities between these results and those found previously in clinical samples of adolescents and adults (Harvey, 2016; Hiller, et al. 2002; Jansson-Fröjmark, et al. 2012; Norell-Clarke, et al. 2014; Wicklow & Espie, 2000), yet in our sample negative pre-sleep sleep-related cognitions were not associated with objective sleep onset difficulty. Our findings provide a starting point for future longitudinal research to determine the causality between negative pre-sleep cognitions and sleep difficulty and sleep misperception: and due to the partial concurrence of our results with those of insomnia populations, we believe adolescents are ideal candidates for the further assessment of insomnia development and insomnia prevention techniques.

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Sleep Anticipatory Anxiety Questionnaire – Adolescent Version

Circle the one phrase for each item that best represents the extent to which you agree with the item.

When I try to fall asleep at night:

1. My muscles are tense
Strongly Disagree Disagree Agree Strongly Agree

2. My heart is beating rapidly
Strongly Disagree Disagree Agree Strongly Agree

3. I feel "shaky"/trembling
Strongly Disagree Disagree Agree Strongly Agree

4. I become short of breath
Strongly Disagree Disagree Agree Strongly Agree

5. I become aware of my body (feeling itches, sweat, pain, nausea)
Strongly Disagree Disagree Agree Strongly Agree

6. I can't stop my mind racing
Strongly Disagree Disagree Agree Strongly Agree

7. I worry that I won't be able to fall asleep
Strongly Disagree Disagree Agree Strongly Agree

8. I worry that I won't get enough sleep
Strongly Disagree Disagree Agree Strongly Agree

9. I worry that I won't be able to function the next day if I don't sleep
Strongly Disagree Disagree Agree Strongly Agree

10. I worry that I will be tired and irritable the next day if I don't sleep
Strongly Disagree Disagree Agree Strongly Agree

11. I worry about my school work
Strongly Disagree Disagree Agree Strongly Agree

12. I can't stop thinking about what I have to do tomorrow
Strongly Disagree Disagree Agree Strongly Agree

13. I can't stop thinking about what happened during the day
Strongly Disagree Disagree Agree Strongly Agree

14. I worry about my relationship (e.g., with my boyfriend/girlfriend/parents)
Strongly Disagree Disagree Agree Strongly Agree

15. I worry about my friendships

Strongly Disagree Disagree Agree Strongly Agree

Scoring key: strongly disagree (1), disagree (2), agree (3), strongly agree (4)

Table 1

Correlations between Subjective and Objective Sleep Onset Latency, and SAAQ-A Subscale r Scores

SAAQ-A Scores	M (*SD*)	Diary SOL (*p)*	Actigraphy SOL
Somatic Cognitions	3.8 (*2.7*)	.15 (.09)	**.13* (.04)**
Sleep Cognitions	6.2 (*3.4*)	**.21* (.02)**	.07 (.30)
Rehearsal & Planning Cognitions	7.3 (*3.0*)	-.03 (.77)	.03 (.65)

Note. SOL = Sleep Onset Latency, M = Mean, SD = Standard Deviation.
Somatic, Sleep and Rehearsal & Planning Cognitions subscales range 0-15.
Degrees of freedom ranged from 79 – 255.
* $p < .05$

- Negative pre-sleep cognitions are related to subjective difficulty falling asleep
- Somatic arousal mediates pre-sleep cognitions and subjective sleep difficulty
- Adolescents experience sleep misperception without ‘real’ sleep deficit