Recharge: A preliminary evaluation of an emotion regulation enhanced, CBT-i intervention for insomnia in early adolescence

# Abstract

*Background:* Insomnia disorder in adolescence is prevalent, persistent and associated with adverse outcomes, including reduced quality of life. Cognitive Behavioural Therapy for insomnia (CBT-i) has shown promise as an effective treatment for adolescents. Recent research has highlighted the role of emotion regulation in insomnia, suggesting that the inclusion of emotion regulation techniques may enhance CBT-i. *Aims:* To evaluate the feasibility and preliminary effectiveness of a CBT-i treatment program for insomnia in early adolescence, augmented with emotion regulation strategies, using a case-series design. *Method:* Three participants (*M* = 11. 67 years) completed the program that consisted of seven weekly individual therapy sessions and parental participation. Participants monitored their sleep daily during the intervention. Insomnia diagnostic status and severity, use of emotion regulation strategies and quality of life were assessed at baseline, post-intervention and at 6-week follow-up. *Results:* At post-treatment, none of the participants met criteria for insomnia and all reported statistically reliable reductions in symptoms. Improvements were maintained at follow-up for two participants. Sleep onset latency was reduced and improvements in quality of life were evident. However, there were no changes in the use of emotion regulation strategies following treatment. Adolescents and parents reported high program satisfaction. *Conclusions:* This preliminary evaluation provides support for the effectiveness of the CBT-i program tested. However, given that emotion regulation did not change and yet improvements in sleep were evident, the usefulness of augmenting the program with emotion regulation strategies requires further evaluation. ~~of the program~~ ~~using a randomized controlled trial and comparison with CBT-i alone.~~

 *Keywords: insomnia, adolescence, sleep, emotion regulation, CBT*

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Insomnia is characterised by difficulty falling asleep, staying asleep or waking too early, and is accompanied by significant daytime impairment (American Psychiatric Association, 2013). During adolescence, changes in the sleep-wake cycle associated with developmental maturation interact with changing psychosocial and environmental factors to create a period of development that is highly vulnerable to sleep problems, including insomnia (Carskadon, 2011). Indeed, insomnia is the most prevalent sleep disorder experienced by adolescents, with reported prevalence estimates between four and 23.8% (Hysing, Pallesen, Stormark, Lundervold, & Sivertsen, 2013; Johnson, Roth, Schultz, & Breslau, 2006; Ohayon, Roberts, Zulley, Smirne, & Priest, 2000), and is often chronic (Roberts, Roberts, & Duong, 2008; Roth et al., 2006), persisting into adulthood (Dregan & Armstrong, 2010).

 Adolescent insomnia is associated with numerous adverse outcomes such as poor overall quality of life (Roeser, Eichholz, Schwerdtle, Schlarb, & Kübler, 2012), conduct problems, drug use (Bauducco, Flink, Jansson-Fröjmark, & Linton, 2016; Tynjala, Kannas, & Valimaa, 1993), irritability, anxiety and negative emotionality (Baum et al., 2014; Talbot, McGlinchey, Kaplan, Dahl, & Harvey, 2010), overweight problems and stress (Noland, Price, Dake, & Telljohann, 2009), fatigue (Roberts, Roberts, & Chen, 2001), and poor school performance (Dewald, Meijer, Oort, Kerkhof, & Bögels, 2010). Of particular concern is the finding that insomnia predicts the development of depression in young people (Lovato & Gradisar, 2014), and is an independent predictor of adolescent suicide risk (Goldstein, Bridge, & Brent, 2008; McCall et al., 2010; Pigeon, Pinquart, & Conner, 2012). Given the myriad of problematic consequences associated with adolescent insomnia, targeting the disorder earlier and more effectively is critical.

Cognitive Behavioural Therapy for insomnia (CBT-i) has been systematically evaluated and found to be efficacious for the treatment of adult insomnia (van Straten et al., 2017), and is recommended as the first line treatment by the American College of Physicians (Qaseem, Kansagara, Forciea, Cooke, Denberg, 2016), ~~and~~ the Australasian Sleep Association (Ree, Junge, & Huntington, 2017), the European Sleep Research Society (Reimann et al., 2017), and the emerging European CBT-I Academy (Riemann & Espie, 2018). The use of CBT-i in the treatment of adolescent sleep problems has gained greater attention from researchers in the past decade, although few studies have evaluated its efficacy with clinical insomnia disorder. ~~Schlarb et al. (2011) evaluated a group-based CBT-i program for adolescents aged 11 to 16 years with insomnia disorder that included hypnotherapy techniques. Results showed significant reductions in sleep onset latency (SOL) and improvements in sleep efficiency (SE) and total sleep time (TST). Similarly, Roeser et al. (2016), found improvements at post-intervention and 12-month follow-up in SOL, number of times waking after sleep onset and the degree to which the young person felt ‘rested’ post-intervention.~~

 ~~Clarke et al. (2015) conducted a pilot trial whereby 41 adolescents aged 12 – 20 years with comorbid insomnia disorder and major depression completed either a CBT depression (CBT-D) treatment augmented with CBT-i or a CBT-D treatment with sleep hygiene strategies only (control condition). Results showed a significant increase in TST for the CBT-i condition compared to the CBT-D plus sleep hygiene condition, but no effects for self-reported sleep diary data, insomnia severity or depression outcomes.~~

 ~~de Bruin et al. (2015) conducted a randomised controlled trial (RCT) employing waitlist control, CBT-i internet therapy and CBT-i group therapy conditions for 86 adolescents aged 12 to 19 years with insomnia disorder. Both conditions demonstrated significant improvements in SE and SOL at post-intervention compared to the waitlist control, with moderate to large effect sizes that were maintained at two-month follow-up.~~

A recent, systematic review and meta-analysis examining nine adolescent cognitive-behavioural sleep intervention trials, including four RCTs, concluded that CBT-i is effective for adolescent sleep problems (Blake, Sheeber, Youssef, Raniti, & Allen, 2017), demonstrating significant reductions in sleep onset latency (SOL), sleep efficiency (SE), total sleep time (TST), and wake after sleep onset (WASO). However, research on CBT-i for adolescents lacks breadth and lags behind that of adults. For instance, CBT-i augmented with other strategies has not been adequately tested in adolescent populations and it is unclear whether CBT-i improves other areas of functioning such as school or emotional functioning (Gradisar & Richardson, 2015).

Another area in which adolescent sleep research lags behind that of adults is in the area of emotion regulation. Adolescence is a turbulent period of high emotionality (Arnett, 1999; Larson, Moneta, Richards, & Wilson, 2002), and presents numerous challenges to developing emotional regulatory systems by way of hormonal changes, increasing independence, and academic stress, as well as increasingly complex social environments (Somerville, Jones, & Casey, 2010). Emotion regulation refers to the processes used to change or maintain the intensity and expression of an emotional experience (Gross, 2015), and while some emotion regulation strategies such as cognitive reappraisal, can be adaptive, others, such as expressive suppression, can be maladaptive (Gross & John, 2003).

Recently, researchers have focused on the role of emotion regulation in the development and maintenance of insomnia in adults (Baglioni, Spiegelhalder, Lombardo, & Riemann, 2010; Cerolini, Ballesio, & Lombardo, 2015), with emotion dysregulation being a feature in current models of the disorder (Espie, Broomfield, MacMahon, Macphee, & Taylor, 2006; Harvey, 2002). In their review of the literature on emotion regulation and insomnia, Cerolini et al. (2015) suggest a complex cyclical relationship between emotion regulation and sleep, whereby sleep problems impair an individual’s capacity to regulate emotions, which in turn increases negative emotional states and impairs the sleep cycle. Indeed, lack of sleep has been associated with increased experience of negative emotion and decreased feeling of positive emotion, as well as changes in the way that emotions are recognised, expressed and regulated (Kahn, Sheppes, & Sadeh, 2013; van der Helm & Walker, 2009). Poor use of emotion regulation strategies has been associated with sleep problems, particularly increased SOL, in both adults (Jansson-Fröjmark, Norell-Clarke, & Linton, 2016; Mauss, Troy, & LeBourgeois, 2013) and adolescent populations (Baum et al., 2014; Palmer, Oosterhoff, Bower, Kaplow, & Alfano, 2017), and the experience of negative emotions at sleep time has been linked with problems falling asleep (Schmidt & Van der Linden, 2013; Vandekerckhove et al., 2011). Given the association between emotion regulation and sleep problems, Cerolini et al. (2015) suggest that the inclusion of emotion regulation strategies may enhance the effectiveness of insomnia interventions. However to date, few studies have examined the usefulness of incorporating emotion regulation strategies into CBT-i interventions in either adult or adolescent populations. ~~Despite theoretical interest, few studies even with adults have incorporated emotion regulation strategies into insomnia treatment protocols (Cerolini et al., 2015), and~~ ~~none~~ ~~even fewer to our knowledge~~ ~~have evaluated the effectiveness of emotion regulation strategies, nor of incorporating these into existing CBT-i interventions, with adolescent populations.~~

Two emotion regulation strategies that have preliminary support as effective techniques included in sleep interventions include mindfulness techniques (Ong, Shapiro, & Manber, 2009; Wong, Ree, & Lee, 2016) and the Pennebaker writing technique (Harvey & Farrell, 2003; Mooney, Espie, & Broomfield, 2009). Mindfulness techniques are hypothesised to be useful in the treatment of insomnia, as the techniques aim to reduce cognitive, emotional and physiological arousal (Bei et al., 2013; Blake et al., 2016). In fact, research indicates that mindfulness-based therapies, when combined with CBT-I, improve sleep in adults with sleep problems (Ong, Shapiro, & Manber, 2009; Wong, Ree, & Lee, 2016). Similarly, three studies have ~~however,~~ used mindfulness components in conjunction with CBT-i, within interventions for adolescents with sub-clinical sleep and anxiety problems (Bei et al., 2013; Blake et al., 2016) and sleep and substance use problems (Bootzin & Stevens, 2005), with promising results. However, to date, there have been no studies examining the effectiveness of adding mindfulness techniques to CBT-i interventions with adolescents suffering from clinical levels of insomnia specifically.

~~Furthermore, there is preliminary evidence in the adult literature for~~ The use of the Pennebaker writing technique (Pennebaker, 1997) also has preliminary evidence in improving ~~the~~ adult sleep ~~literature.~~ when used ~~in sleep interventions~~ (Harvey & Farrell, 2003; Mooney et al., 2009). This technique involves ~~for whereby~~ individuals writing down emotionally valent thoughts, worries and feelings in order to promote the cognitive processing of emotional stimuli and reduce the inhibition of emotional experiences (Pennebaker, 1997). The Pennebaker technique has not yet been used in treatments for adolescent sleep problems. However, a meta-analysis of 24 studies with youth aged 10 to 18 years, found a small positive effect (*g* = 0.107) of expressive writing interventions on improving internalising problems and social adjustment (Travagin, Margola, & Revenson, 2015), providing some support for its potential usefulness with adolescent sleep interventions.

The aim of the current study was to conduct a feasibility and preliminary case series evaluation of a CBT-i treatment protocol for clinical-level insomnia in early adolescence augmented with emotion regulation techniques (the Pennebaker technique and mindfulness strategies). The intervention was intended for younger adolescents (aged 11 to 14 years) as (a) existing research has shown that the median age of onset for adolescent insomnia is 11 years, (Johnson et al., 2006) and; (b) this age-group demonstrates less developed emotion regulation strategies and therefore may particularly benefit from techniques specifically targeting them (McRae et al., 2012; Silvers et al., 2012). It was hypothesised that the treatment program would lead to clinically significant improvements in Insomnia Disorder, emotion regulation, and quality of life ratings for adolescent participants at post-intervention and 6-week follow-up.

# Method

## Participants

Participants were recruited through advertisements in school newsletters, and were required to be between 11 and 14 years of age, and have a primary diagnosis of insomnia disorder as determined by a semi-structured clinical interview. Comorbid anxiety diagnoses and depression were permissible (according to the Anxiety Disorders Interview Schedule - Child and Parent Versions; ADIS-C/P; Silverman & Albano, 1996) as long as insomnia disorder was primary, and depression severity was below 5 according to the ADIS-C/P. Potential participants were excluded if they had an intellectual disability, a developmental disorder, were receiving psychological assistance for sleep or other psychological problems, or had a major medical condition. Seven families contacted the researcher and completed the telephone screening interview (see below). Two youth were excluded as they were outside the age range required, one was excluded for receiving treatment for depression, and another family declined further participation. As a result, three female youth, aged 11 to 13 years (*M* = 11.67), participated in the pilot program.

“Alice” was a 13 year old female presenting with difficulties initiating sleep every night, and experiencing daytime sleepiness almost every day, for approximately two years prior to treatment. She met diagnostic criteria for insomnia disorder according to the insomnia diagnostic clinical interview (see below), did not meet clinical diagnostic criteria for any anxiety or other psychological disorder according to the ADIS-C/P, and fell within the normal range on the anxiety (*t* = 39) and depression (*t* = 48) subscales of the Revised Child Anxiety Depression Scale (RCADS - Short Version; Ebesutani et al., 2012). She had previously participated in group treatment for generalised anxiety disorder at 11 years of age, with improvements reported following participation. She had not previously received assistance for insomnia. Alice completed the program with her mother. She lived with her mother and a grandparent.

“Candice” was an 11 year old female presenting with difficulty initiating sleep approximately five nights per week, the onset of which was six months prior to participating in the study. She reported unhelpful beliefs about sleep that also affected her during the day, such as predicting a bad night’s sleep and having a “funny feeling” that she would not be able to sleep. She met diagnostic criteria for insomnia disorder according to the insomnia diagnostic clinical interview (see below). Although Candice reported some symptoms of generalised anxiety disorder and specific phobia, they were not at a clinical level according to the ADIS-C/P. Her scores fell within the normal range on the anxiety (*t* = 57) and depression (*t* = 43) subscales of the RCADS. Candice had not previously seen a psychologist, she lived with both parents and a younger sister, and she completed the program with her mother.

“Sally” was an 11 year old female presenting with difficulty initiating sleep that was occurring nightly for approximately three years prior to participating in the study. Sally reported that she was unable to fall asleep because she was thinking about many different things. Sally often woke up feeling tired and reported feeling tired throughout the day. Sally’s parents were concerned that she was getting less sleep than recommended for her age. Sally met diagnostic criteria for insomnia according to the insomnia diagnostic clinical interview (see below). Although Sally reported some generalised anxiety symptoms, they were not at a clinical level according to the ADIS-C/P. Her scores fell within the normal range on the anxiety (*t* = 44) and depression (*t* = 50) subscales of the RCADS. Sally lived with both parents and one sibling, she participated in treatment with her father, and she had no prior history of treatment for insomnia or other psychological difficulties.

## Measures

Screening Interview. A telephone screening interview was conducted with the parent to assess for program eligibility. Within the screener, existing psychological and physical health diagnoses were assessed, as was insomnia severity using the Insomnia Severity Index (ISI; Bastien, Vallières, & Morin, 2001). Participants were required to score nine or greater on the ISI to progress into the assessment phase of the study.

Diagnostic Assessment for Insomnia. Diagnosis of insomnia was assessed at pre-treatment, post-treatment and follow-up using a semi-structured clinical interview devised by the authors according to the DSM-5 criteria for insomnia disorder (American Psychiatric Association, 2013). It included screening checks for other sleep-wake disorders of parasomnia, narcolepsy, breathing-related sleep wake disorders, circadian rhythm sleep-wake disorders and restless leg syndrome as well as other medical or psychological conditions, in accordance with DSM-5 exclusion criteria.

Anxiety Disorders Interview Schedule: Child and Parent Versions (ADIS-C/P; Silverman & Albano, 1996). Participants were screened at the pre-treatment assessment for other psychological problems using the ADIS-C/P interview, which was administered to the adolescent and their parent separately following the insomnia diagnostic clinical interview. In line with recommendations of the ADIS-C/P manual, a combined clinician severity rating (CSR) for each diagnosis was given based on youth and parent report. Each disorder was assigned a clinician severity rating (0 = absent; to 8 = very severely disturbing or disabling), with scores of four and above considered a clinical diagnosis. The ADIS-C/P has been shown to have strong concurrent validity (Wood, Piacentini, Bergman, McCracken, & Barrios, 2002) and excellent test-retest reliability (Silverman, Saavedra, & Pina, 2001)

Revised Child Anxiety and Depression Scale – Short Version (RCADS; Ebesutani et al., 2012). The RCADS is a 25-item youth-report scale assessing anxiety (15 items) and depression (10 items) symptoms, and was used at pre-treatment assessment to screen for anxiety and depression. Scores for each subscale are summed to produce subscale scores that may range from 0 to 45 for anxiety, and 0 to 30 for depression. The scale has excellent reliability (a = .80 for depression subscale and a = 0.91 for the anxiety subscale), and good concurrent and discriminant validity.

Insomnia Severity Index (ISI; Bastien et al., 2001). The 7-item ISI was used to measure severity of insomnia symptoms. Respondents are required to rate, on a 5-point Likert scale, their level of problem severity for each item. Items are summed to produce a total score that may range from 0 to 28, with higher scores indicative of more severe insomnia symptoms. The scale has been validated for adolescents (Chung, Kan, & Yeung, 2011), with scores of ≥ 9 being considered the clinical cut-off for insomnia in an adolescent population. The ISI has been found to have adequate internal consistency (Bastien et al., 2001) and test-retest reliability (Chung et al., 2011).

Sleep Diary.Participants completed a daily sleep diary for the baseline period and duration of the intervention. The sleep diary was adapted from the Consensus Sleep Diary – Core (Carney et al., 2012), that is written at a 3rd grade reading level, with the instructions comprehensible by children at a 6th grade level. Key data of interest to this study were sleep onset latency (the time it takes to fall asleep; SOL) and total sleep time (TST).

Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA; Gullone & Taffe, 2012). The ERQ-CA is a 10 item, youth-report questionnaire measuring Cognitive Reappraisal (CR; 6 items) and Expressive Suppression (ES; 4 items). Respondents are required to rate on a 5-point Likert scale, the degree to which they agreed with each item. Items for each subscale are summed to produce subscale scores that may range from 6 to 30 (CR scale) and 4 to 20 (ES scale), with higher scores indicating greater cognitive reappraisal and expressive suppression respectively. The ERQ-CA demonstrates strong psychometrics, with good internal consistency (*a* = .83) for girls aged 10 to 18 years old, and an independent two-factor structure (Gullone & Taffe, 2012).

Pediatric Quality of Life Inventory (PedsQL 4.0; Varni, Seid, & Kurtin, 2001). The 23-item PedsQL 4.0 is a youth-rated measure of health-related quality of life across four dimensions; physical functioning (8 items), emotional functioning (5 items), social functioning (5 items) and school functioning (5 items), which assess the degree to which each item has been a problem in the last month on a 5-point Likert scale. Items are reversed scored and transformed to a 0 to 100 scale, where higher scores are indicative of better quality of life. Scale scores are computed by summing the items and dividing by the number of items answered for each subscale. The scale has been shown to have strong internal consistency across both parent and child reports for the total scale and subscales. It has also shown good discriminant validity between healthy children and paediatric patients (Varni et al., 2001).

Adolescent and Parent Program Satisfaction Measure. Parents and youth rated their agreement with two items relating to a) overall treatment satisfaction and b) the degree to which they believed the program improved sleep problems on a 5-point Likert scale. Scores for each item could therefore range from 1-5, with higher scores indicating greater treatment satisfaction and greater belief that the program improved their sleep (or the sleep of their child).

## Procedure

The study was approved by the Griffith University Human Research and Ethics Committee. Interested parents took part in a 15-minute telephone screening interview to ascertain broad inclusion and exclusion criteria. Upon being deemed eligible, participants were invited to attend the clinic for a pre-treatment assessment interview (insomnia interview and ADIS-C/P interview), before which both the adolescent and their parent provided informed consent. Interviews were conducted by provisionally registered postgraduate clinical psychology students. Participants were then provided with the sleep diary and completed the pre-treatment self-report measures listed above. Participants completed a two-week baseline sleep monitoring period prior to the commencement of treatment, during which they completed the daily sleep diary (Bastien et al., 2001). Participants continued to monitor their sleep daily for the duration of the intervention. Treatment was conducted by a provisionally registered clinical psychology postgraduate student, and supervised by a clinical psychologist. One-week following completion of the program, a blind and independent provisionally-registered clinical psychology postgraduate student completed the post-intervention insomnia diagnostic clinical interview over the phone with the adolescent and their parent. In addition, adolescents completed the self-report measures again, and both parent and adolescent completed the program satisfaction measure. Outcome assessments (including interviews and questionnaires) were completed again at 6-week follow-up.

## **Intervention**

 *Recharge* is a 7-session treatment program designed specifically for young adolescents with insomnia disorder (Byrne, Sweeney, & Donovan, 2016). The sessions are completed individually and weekly, in a face-to-face format with a therapist. Each session is comprised of a 60-minute adolescent session followed by a 30-minute parent session. Two of the seven parent sessions are also attended by the adolescent to facilitate collaboration and agreement regarding new bedtime routines.

*Recharge* follows a primarily CBT-i framework, consisting of sleep hygiene, stimulus control and relaxation strategies, with the addition of a Pennebaker-like (Pennebaker, 1997) writing task and mindfulness strategies incorporated as part of the bed-time routine from Session two onwards. It also uses cognitive strategies of thought monitoring, cognitive restructuring, coping cards and worry time. The program was adapted from a 10-session group treatment program for adolescents with comorbid anxiety and insomnia disorder (Sweeney, Donovan, Farrell, Bell, & Meltzer, 2015), and is informed by the four core modules of the transdiagnostic treatment protocol developed by Harvey (2016). It also draws on recent research regarding emotion regulation. See Table 1 for a description of the program.

[Insert Table 1 here]

# Results

All three participants completed the treatment program and follow-up assessments. Most sessions were attended weekly with only a few cancellations or breaks in treatment owing to the Christmas period and, for one participant, the death of a grandparent. Sleep diary data are not reported for Sally, due to noncompliance with diary completion and therefore insufficient data.

## Insomnia Diagnostic Status

At post-treatment assessment, none of the participants met criteria for insomnia disorder according to the diagnostic interview. Treatment gains persisted at 6-week follow-up for both Alice and Candice, with neither participant meeting DSM-5 diagnostic criteria for Insomnia Disorder. However, Sally met criteria for insomnia disorder at follow-up, with the exception of the 3-month time qualifier.

## Insomnia Symptom Severity

Clinically significant change on the ISI was determined by a drop from the clinical range on the ISI (i.e., greater than or equal to a score of 9) to the non-clinical range (a score below 9). As is evident from Table 2, clinically significant change was demonstrated on the ISI for all three participants following treatment.

Reliable Change Indices (RCI) were calculated for the participants’ outcome data on the ISI using the formula outlined by Jacobson and Truax (1991), with RCIs greater than 1.96 indicating a statistically reliable change has occurred at the 95% confidence level. As is evident from Table 2, reliable reduction in insomnia symptoms was found for all participants at both post-assessment and at 6-week follow-up.

[Insert Table 2 here]

## Sleep Diary Data

Sleep Onset Latency. As noted above, sleep diary data is only available for Alice and Candice as Sally did not complete sufficient diary monitoring, and there was also no follow-up sleep diary data completed for any participant. As is evident in Figure 1, there is a general downward trend in SOL reported for both participants. Consistent with previous research (de Bruin, Bögels, Oort, & Meijer, 2015; Morin, 2003), a 50% decrease in SOL at post-intervention was considered clinically significant change. According to this criteria, both Alice and Candice experienced a clinically significant reduction in SOL at post-intervention. Furthermore, for Alice, SOL remained below the 30 minute threshold for problematic sleep advocated by the APA (American Psychiatric Association, 2013) from Session 4 onwards. However, despite a decrease in SOL from baseline, Candice reported SOLs above the clinical threshold for the majority of the intervention.

[Insert Figure 1 here]

Total Sleep Time. There were minor increases in TST for both Alice and Candice at post-assessment. Alice’s average TST across baseline was 7 hours and 39 minutes. At session 7, her average TST was 7 hours and 55 minutes. Candice’s average TST at baseline was 8 hours and 22 minutes. At session 7, her average TST was 9 hours and 4 minutes. TST data is presented in Figure 2.

[Insert Figure 2 here]

## Emotion Regulation

Test-retest reliability data required for calculating RCI is not available for the ERQ-CA (Gullone & Taffe, 2012) and therefore RCIs could not be calculated. Therefore, whether a score was considered in the ‘normal’ range was determined by whether it fell within one standard deviation of the mean for adolescents on the particular subscale. Emotion regulation scores for each participant are presented in Table 3, along with female adolescent population mean and standard deviation data (Gullone & Taffe, 2012). As indicated in Table 3, none of the participants showed large changes in either expressive suppression or cognitive reappraisal at either post-intervention or follow-up.

[Insert Table 3 here]

~~Alice’s use of expressive suppression strategies at pre, post and follow-up were within the normal range and there was very little change following the program. However, her use of cognitive reappraisal to change emotional impact was one standard deviation below the mean at pre-assessment, indicating a small deficit in this area. Although very little change (1 point) was evident at post-assessment and 6-week follow-up, her scores at these time points fell within one standard deviation of the mean and were thus within the normal range.~~

~~Candice’s scores on expressive suppression at pre-post and follow-up were within the normal range, with scores showing a very small increase over time. Her use of cognitive reappraisal was also within the normal range at all time points, and showed a 3-point increase from pre-assessment to 6-week follow-up.~~

~~Sally’s use of expressive suppression was just below the normal range at all time points and remained relatively stable over time. Given that suppression is a maladaptive emotion regulation strategy, her low scores indicate good emotion regulation. Similarly, her scores on cognitive reappraisal were in the normal range at all time points and did not change as a function of treatment.~~

## Quality of Life

 The population mean and standard deviations for each of the subscales and the total score of the PedsQL 4.0 are presented in Table 4, along with data obtained from Alice, Candice and Sally. As is evident from Table 4, the only scores to fall one standard deviation below the mean and therefore suggest risk of impairment, are for Candice on the emotional subscale at pre- and post-assessment, and the school subscale at pre-assessment time point. All other scores for all other participants and subscales at all time points were in the normal range.

 Minimal clinically important differences (MCID) for the total score and subscale scores of the PedsQL 4.0 reported by Varni, Burwinkle, Seid, and Skarr (2003) were used to evaluate change due to treatment in the current study. The MCID for each subscale and the total score is listed in Table 4. If changes in scores from pre- to post-assessment and pre- to follow-up assessment are greater than the MCID for that particular subscale, they are starred in Table 4 to indicate a clinically important difference. As can be seen from Table 4, clinically important differences occurred on the emotional subscale, which decreased at post for Alice (though this had improved by follow-up), and improved for Candice and Sally. It should be noted that the decrease in emotional functioning for Alice at post-assessment may be attributable to the coinciding death of a family member. Clinically important improvements were also found on the physical subscale for Alice, and the school subscale and total score for Candice and Sally. There was no MCID for any participant on the social functioning subscale.

[Insert Table 4 here]

## Treatment Satisfaction

Both adolescents and parents were satisfied with the Recharge program (Adolescent average = 4.66, Parent average 4.33) and agreed that the program had helped to improve adolescent sleep (Adolescent average = 4.33, Parent average = 4).

# Discussion

The aim of this study was to evaluate the feasibility and preliminary effectiveness of a CBT-i intervention for adolescent insomnia that was augmented with emotion regulation strategies. It was hypothesised that the intervention would produce improvements in insomnia diagnosis and severity, sleep onset latency (SOL), total sleep time (TST), emotion regulation and quality of life (QOL). The results suggested that all three participants lost their insomnia diagnosis at post-assessment and all showed clinically significant and reliable change in insomnia severity following treatment. Two of the three participants continued to be diagnosis free at 6-week follow-up, with one returning to sub-threshold levels at this time point. SOL also reduced following treatment, and there was a small improvement in total sleep time as well. Finally, improvements in various QOL domains were evident for all three participants, although there was little improvement in emotion regulation for any participant.

Overall, the program was effective in treating insomnia disorder with these young adolescents. Improvements in insomnia diagnosis, symptom severity and SOL reported in this study are consistent with previous research with adolescent insomnia disorder (Clarke et al., 2015; de Bruin et al., 2015; Schlarb, Liddle, & Hautzinger, 2011), and therefore these findings contribute to the existing evidence base for the use of CBT-i with adolescents. However, at 6-week follow-up, one participant reported subclinical insomnia symptoms, potentially highlighting the need for booster sessions, and consistent with the findings of Clarke et al. (2015) who reported loss of sleep improvements by follow-up.

It would seem that the demonstrated improvements in adolescent sleep were not due to improvements in emotion regulation, as in contrast to what was predicted, emotion regulation did not significantly improve over the course of treatment and follow-up. Although it may be the case that the emotion regulation strategies included in the program were ineffective in improving emotion regulation, it should be noted that all three participants reported using adaptive emotion regulation strategies within the normal range at pre-assessment, making it difficult to demonstrate meaningful improvement. Future research should consider replicating this study with young adolescents who have emotion regulation problems prior to treatment. It may be that the inclusion of emotion regulation may indeed increase the efficacy of CBT-i for adolescents, but only for those with emotion regulation difficulties prior to treatment.

Anecdotally, all three participants identified the writing strategy as their preferred night-time wind-down strategy, and qualitatively discussed its benefits for improving SOL. It is possible that favourable effects reported by the participants may be due to general cognitive de-arousal produced by writing about emotionally valent events, as opposed to improving emotion regulation capabilities. Alternatively, consistent with the conclusions of Harvey and Farrell (2003), who evaluated the use of the Pennebaker technique for adult sleep problems, it may be that the ‘write-it-out’ strategy acted as an anchor in the overall stimulus control techniques of the night-time routine, whereby adolescents associated the writing activity as the beginning of their preparation for sleep, and the writing activity in turn prevented the use of maladaptive pre-sleep behaviours.

Despite there being no changes in emotional regulation in this study, there were clinically important improvements in emotional functioning according to the quality of life measure for two participants. The scores also showed clinically meaningful improvement on physical functioning for one participant, and school functioning for two participants. This suggests that CBT-i interventions for insomnia disorder may contribute to improvements in other important areas of daily functioning, and that improving sleep using CBT-i is of benefit to broader areas of adolescents’ lives. These findings contribute to existing literature on the ability of CBT-i for adolescents to impact other areas of functioning; an area that has received limited empirical attention thus far.

 There are several limitations of this study that require acknowledgement. First, the present study included a case series design, which, whilst useful, is not considered the gold standard in terms of treatment evaluation. Future studies should conduct randomised controlled trials to assess the relative efficacy of CBT-i and CBT-i augmented with emotion regulation strategies in the treatment of adolescent insomnia. Second, the use of paper sleep diaries for the duration of the treatment program proved an onerous task for the adolescents, with sufficient diary data only collected for two of the three participants, and follow-up sleep diary data not collected at all. Future studies should include only a period of monitoring at each time point including follow-up, perhaps using a mobile application that may be more attractive to an adolescent population. Finally, the omission of objective actigraphy data is a limitation of this study that should be amended in future research.

Overall, this study has demonstrated the effectiveness of CBT-i for adolescent insomnia, but was unable to demonstrate that including emotion regulation strategies within treatment led to improvements in emotion regulation that may have contributed to treatment efficacy. Given that the three participants in this study had good emotion regulation strategies prior to treatment, ~~and because the adolescents anecdotally reported the usefulness of emotion regulation strategies,~~ ~~further research is required to assess the potential efficacy of including emotion regulation strategies within a CBT-i treatment protocol.~~ future research should first replicate this study with adolescents who have both sleep and emotion regulation problems, before moving on to larger clinical trials.

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# Tables and Figures

Table 1

*Recharge Program Content*

|  |  |  |
| --- | --- | --- |
| Session | Adolescent Session Content | Home task |
| Session 1 – All about Sleep | * Sleep Psychoeducation
	+ Stages of sleep
	+ Regulation of sleep
	+ Consequences of insufficient sleep
* Sleep Circle – formulation of maintaining factors of sleep problems
* Goal Setting
 | * Monitor sleep
* Record 5 Sleep Stats from week 1
 |
| Session 2 – Get Ready to Relax | * Rationale for relaxation
* Relaxation Strategies
	+ Calm breathing
	+ Muscle Relaxation
* Emotion Regulation Strategies
	+ Write it out (Pennebaker)
	+ Be in the moment (mindfulness)
 | * Monitor Sleep
* Practice relaxation techniques
* Practice emotion regulation strategies
 |
| Session 3 – Say Hello to Healthy Sleep | * My Sleep Analysis
* Sleep Hygiene Strategies
* Stimulus Control Strategies
* Identifying my sleep traps
* Creating a sleep schedule and night-time routine (including sleep restriction)
* Sleep Trivia
 | * Monitor Sleep
* Implement new sleep/night-time routine
* Practice emotion regulation strategies
 |
| Session 4 – Mornings and Daytime  | * Morning psychoeducation – sleep inertia, importance of consistent wake time
* Creating a morning routine
* Day time energy levels education and energy generator behavioural experiment
* Sleep Trivia
 | * Monitor Sleep
* Implement morning routine, maintain night-time routine
* Practice emotion regulation strategies
 |
| Session 5 – Recharge Thinking  | * Psychoeducation on thoughts – feelings – behaviour link
* Unhelpful sleep related beliefs and general worries
* Coping Statements
* Worry Time
 | * Monitor Sleep
* Make coping cards
* Implement worry time
* Monitor thoughts
* Practice emotion regulation strategies
 |
| Session 6 – Rewire Your Thoughts | * Psychoeducation – thinking traps (cognitive distortions)
* Spot the thinking trap game
* Reality checking and rewiring your thoughts (cognitive restructuring)
 | * Monitor Sleep
* Apply cognitive restructuring techniques to sleep-related beliefs and worries
* Practice emotion regulation strategies
 |
| Session 7 – Recharge Recap  | * Review of progress
* Review of sleep science psychoeducation
* Review of cognitive and behavioural strategies
* Goal setting for future sleep, maintaining gains (relapse prevention)
 |  |

Table 2

*Scores and Reliable Change Indices on the Insomnia Severity Index*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Pre | Post | RCIPre to Post | FU | RCIPre to Follow-Up |
| Alice | 12 | 5 | 2.35\* | 1 | 3.69\* |
| Candice | 15 | 3 | 4.02\* | 0 | 5.03\* |
| Sally | 16 | 6 | 3.35\* | 8 | 2.68\* |

*Note.* \* = RCI > 1.96, indicating reliable change occurred at 95% confidence.

Table 3

*Outcome data for Emotion Regulation on the ERQ-CA*

|  |  |  |
| --- | --- | --- |
|  | Expressive Suppression(Population *M* = 10.18, *SD* = 2.97) | Cognitive Reappraisal(Population *M* = 21.47, *SD* = 3.81) |
|  | Pre | Post | Follow-up | Pre | Post | Follow-up |
| Alice | 10 | 11 | 10 | 171 | 18 | 18 |
| Candice | 9 | 10 | 11 | 20 | 19 | 24 |
| Sally | 71 | 71 | 61 | 24 | 24 | 24 |

*Note.* 1 = Score fell below one standard deviation of the population mean.

Table 4

*Outcome Data for Quality of Life according to PedsQL 4.0 Subscales and Total Scale*

|  |  |  |  |
| --- | --- | --- | --- |
| Scale | Pre | Post | Follow-Up |
| Physical (MCID = 6.66; population *M* = 86.86; population *SD* = 13.88) |
| Alice | 90.63 | 100\* | 100\* |
| Candice | 96.43 | 100 | 100 |
| Sally | 93.75 | 90.63 | 87.5 |
| Emotional (MCID = 8.94; population *M* = 78.21; population *SD* = 18.64) |
| Alice | 90 | 75\* | 95 |
| Candice | 451 | 551\* | 70\* |
| Sally | 60 | 70\* | 70\* |
| Social (MCID = 8.36; population *M* = 84.04; population *SD* = 17.43) |
| Alice | 100 | 100 | 100 |
| Candice | 95 | 100 | 100 |
| Sally | 80 | 85 | 75 |
| School (MCID = 9.12; population *M* = 79.92; population *SD* = 16.93) |
| Alice | 95 | 90 | 90 |
| Candice | 501 | 80\* | 90\* |
| Sally | 70 | 85\* | 85\* |
| Total (MCID = 4.36; population *M* = 82.87; population *SD* = 13.16) |
| Alice | 93.48 | 92.39 | 96.74 |
| Candice | 73.86 | 85.87\* |  92.39\* |
| Sally | 78.26 | 83.70\* | 80.43 |

*Note.* 1 = Score fell below one standard deviation of the population mean and represents at risk status of impaired health-related quality of life \* = Clinically meaningful change occurred from pre to post, or pre to follow-up, according to Minimal Clinically Important Difference (MCID; Varni et al., 2003).

Figure 1. Result of the Recharge program on sleep onset latency (minutes)

*Figure 2.* Total sleep time (hours)

# Required Sections

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## Ethical Statements

The authors have abided by the Ethical Principles of Psychologists and Code of Conduct as set out by the APA. Ethics approval was required from the Griffith University Human Research Ethics Committee. Griffith University Reference Number*: 2016/719.*

## Conflict of Interest

Luka Byrne, A/Prof Caroline Donovan and Amy Shiels have no conflict of interest with respect to this publication.

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