PREFERENCES FOR SLEEP TIP INFORMATION IN YOUNG ADULTS

by

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Preferences for Sleep Tip Information

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Abstract

The health of Canadian university students has been recognized as a public health concern, with sleep identified as one of the three most problematic areas. Of Canadian post-secondary students, 75.6% report obtaining an insufficient amount of sleep. Cognitive behaviour therapy for insomnia (CBT-I) has been found to be highly effective for the treatment of insomnia in the general population, including self-help administration of CBT-I. Due to a dearth of professionals trained in administering CBT-I, this study examined whether a self-help CBT-I program for young adult students would be a feasible method of improving sleep in this population. On quantitative measures, completers of the program (N = 18) demonstrated adequate knowledge acquisition, and they rated the program as acceptable, easy to understand, satisfactory, and useful. According to the qualitative data, completers found the program to be useful, clear, and easy to understand.

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Dedication

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Introduction

Sleep problems are very common, with roughly 30% of individuals reporting that they

experience at least one symptom of insomnia: difficulty falling asleep, difficulty maintaining

sleep during the night, or early morning wakening (Ancoli-Israel & Roth, 1999). In addition, for

approximately 16.5% of the general adult population insomnia will become a chronic condition

(Lichstein, Durrence, Riedel, Taylor, & Bush, 2004). Sleep complaints amongst young adult

students are very prevalent, with 75.6% of Canadian post-secondary students reporting that they

do not get enough sleep (Kwan, Faulkner, Arbour-Nicitopoulos, & Cairney, 2013), and 29.6% of

first year university students endorsing clinically significant levels of daytime sleepiness (Vela-

Bueno et al., 2008). During young adulthood sleep problems, including insomnia, often surface

for the first time (Jensen, 2003: Kang, & Chen, 2009), and there is research indicating that sleep

problems may constitute a risk factor for developing depression or anxiety (Ford & Kamerow,

1989; Neckelmann, Mykletun, & Dahl, 2007; Riemann, & Voderholzer, 2003). Therefore, it is

important to attempt to improve the sleep problems of young adults not simply for relief from the

symptoms associated with insomnia, but also for the preventative effect treating insomnia may

have on depression and anxiety.

Cognitive behavioural therapy for insomnia (CBT-I) has been found to be highly

effective in treating insomnia (Morin et al., 2006); however, there is a dearth of research of

interventions for sleep problems in young adults (Colarusso, 2005). There is a shortage of trained

clinicians to provide CBT-I (Perlis & Smith, 2008); however, there is growing support for the

effectiveness of CBT-I delivered as bibliotherapy (Cheng & Dizon, 2012; Ho et al., 2015; van

Straten & Cuijpers, 2009). Sleep issues have been identified as a public health concern among

Canadian university students (Kwan et al., 2013); this study was designed to address this issue.

In order to aid young adults in combating their sleep problems, this study focused on developing a self-management CBT-I program for young adults. The rationale of the study was based on: 1) the high prevalence of sleep problems with potentially long-lasting effects, in young adults, 2) empirical support for the effectiveness of CBT-I in the general population, as a self-management tool, and in young adults, and 3) the limitations surrounding the availability of CBT-I. What follows is an exploration of the rationale for why an electronically delivered self-management CBT-I program may be a viable option for reaching young adults.

<center>**Literature Review**</center>

Sleep Problems in Young Adults

      The period of young adulthood is a time of transition and increased stress, with heightened academic pressures, significant social changes, and disrupted sleep (Lemma, Gelaye, Berhane, Worku, & Williams, 2012; Vela-Bueno, Fernandez-Mendoza, & Olavarrieta-Bernardino, 2009). In order to accommodate new roles and responsibilities, these young adults will often alter their sleep-wakefulness schedules and these alterations are sometimes incompatible with attaining adequate sleep (Vela-Bueno et al., 2009). Specifically, university students often experience stress in meeting increasing academic demands that negatively impact their sleep habits (Ginsberg & Gapen, 2008). In fact, even university students who are not experiencing insomnia, experience poor quality sleep (Buboltz, Brown, & Soper, 2001). A recent survey of Canadian post-secondary students found that 75.6% of students report not getting enough sleep to feel rested (Kwan et al., 2013). University students experience sleep problems beyond insomnia, with as few as 11% of university students reporting good sleep quality (Buboltz et al., 2001). Many young adults also report excessive sleepiness during the day (Bixler et al., 2005; Vela-Bueno et al., 2009); indeed, in first-year university students, 29.6% endorsed clinically significant levels of daytime sleepiness (Vela-Bueno et al, 2008). These figures are an increase from the 26.7% of university students reporting sleep problems in 1982 (Hicks, Fernandez, & Pellegrini, 2001).

      Reduced sleep quality in university students is associated with emotional issues, such as depression, anger, and tension; challenges with concentration and memory; and a reduction in life satisfaction (Pilcher, Ginter, & Sadowsky, 1997). Students who regularly sleep for fewer than 8 hours may compromise their ability to store and consolidate newly acquired information

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(De Koninck, Lorrain, Christ, Proulx, & Coulombe, 1989; Karni, Tanne, Rubenstein, Askenasy, & Sagi, 1994). The final two hours of the sleep window have been found to be the most important for consolidating new information (Smith & Lapp, 2001). Sleep window refers to the amount of time an individual spends in bed from the time they get into bed until the time they get out of bed, including any time they may spend awake during the night (Kyle et al., 2014).

Therefore, a continued reduction in hours of sleep may negatively impact a student's ability to retain new information, and in turn their academic performance. In addition to problems associated with a reduction in sleep duration, variability in the sleep window was linked to greater variability in academic performance in comparison to mood, stress, amount of social support, hours worked outside of school in a week, and gender (Trockel, Barnes, & Egget, 2000). Variability of sleep schedules may be particularly problematic amongst university students, as many students endorse limiting their sleep during the week, in order to access more study time, and then attempting to make up for this lost sleep by sleeping longer hours on the weekend (Machado, Verella, & Andrade, 1998). This marked difference between their sleep during the week and on the weekend results in a circadian desynchronization during the weekend (Vela-Bueno, 2009). In light of the findings that more university students are experiencing sleep problems than 30 years ago, and these problems are impacting on their daytime functioning, including academic performance, searching for ways to reduce sleep problems for this population is critical. One intervention that has been found to be effective at helping to improve sleep in the general population is CBT-I.

Effectiveness of CBT-I in the General Population

Cognitive behavioural therapy for insomnia (CBT-I) has been established as the front-line treatment for those suffering from insomnia in the general population (Wilson et al., 2010).

CBT-I is a form of psychotherapy and the core components are: stimulus control, sleep restriction, cognitive restructuring, and sleep hygiene (Edinger & Carney, 2014). The objective of CBT-I is to target the factors that may be perpetuating an individual's sleep problems, such as behavioural factors (e.g. unpredictable sleep schedules), psychological factors (e.g. negative beliefs about sleep or lack of sleep), and physiological factors (e.g. hyperarousal; Edinger & Carney, 2014). Studies have found that of patients who complete treatment in CBT-I, 70% endorse improvement in sleep and daytime functioning that continues beyond posttreatment, with moderate to large effect sizes as compared to wait list control groups (Irwin, Cole, & Nicassio, 2006; Morin et al., 2006). CBT-I has been shown to produce medium to large effect sizes for sleep onset latency (SOL) and sleep quality, and small to medium effect sizes for total sleep time (TST), as well as number and duration of awakenings (Morin & Benca, 2012). CBT-I has been found to be as effective as prescription medication in treating insomnia in the short term (Morin, Colecchi, Stone, Sood, & Brink, 1999; Siversten et al., 2006). Additionally, CBT-I has advantages over pharmacotherapy for treating insomnia long-term, as the positive effects of CBT-I treatment have been shown to be more enduring than the effects of pharmacotherapy once these treatments have been withdrawn (Morin, Colecchi, Stone, Sood, & Brink, 1999; Siversten et al., 2006). Additionally, patients often report preferring CBT-I to medication (Vincent & Lionberg, 2001).

Effectiveness of CBT-I as a Self-Management Tool

Although CBT-I has been found to be effective for the vast majority of individuals experiencing insomnia (Morin et al., 2006), access to this highly beneficial treatment is limited by the small number of specialists trained in the delivery of CBT-I (Perlis & Smith, 2008). This lack of availability of clinicians trained in CBT-I, as well as financial constraints that individuals

who could benefit from CBT-I may face (Espie, 2009) may indicate that the availability of self-management CBT-I options could be beneficial. According to Bower and Gilbody (2005), stepped care options, including self-management tools, are considered acceptable by patients, and can lead to significant improvements in health concerns for patients. Stepped care involves utilizing resources in such a way that patients are treated effectively utilizing the most conservative amount of resources required, with the greater amount of resources being saved for the patients who require more intense, expertly led treatments (Bower & Gilbody, 2005). The stepped care model can be imagined as a pyramid, with the highest patient volume occurring at the bottom of the pyramid. At the base level of the pyramid, the treatments that are available are the least resource intensive, and as one progresses up the pyramid, treatments are more intense, utilizing a greater amount of resources, with treatments being more costly and clinicians having more expertise. Patients are referred up the pyramid to more intense treatments as required. At all levels, the treatment must be evidence-based, and, at the base level, the treatment must be beneficial for a large percentage of patients and there should be no risks associated with the treatment (Bower & Gilbody, 2005).

Thus far, there have been two meta-analyses conducted looking at the use of self-help interventions in the treatment of insomnia in the general population (Ho et al., 2015; van Straten & Cuijpers, 2009), and one meta-analysis looking specifically at the use of Internet delivered self-help interventions for insomnia (Cheng & Dizon, 2012). All three of these meta-analyses were focused on studies in adult populations, and the results of these meta-analyses are promising with effect sizes ranging from small to large, depending on the variable being investigated. The meta-analysis conducted by van Straten and Cuijpers (2009) included ten studies that compared CBT-I self-help interventions to wait list or comparison control groups.

Results of this meta-analysis found that self-help interventions for insomnia resulted in effect sizes that ranged from small to moderate, and these effect sizes were, with the exception of one study, not found to be significantly different from effect sizes of face-to-face CBT-I interventions. The overall effect size was found to be 0.36, and effect sizes were larger for interventions where participants could access support regarding verification of intervention details, as well as for interventions that were text only (i.e., did not incorporate learning enhancing elements, such as a video component). However, these findings must be considered cautiously as van Straten and Cujpers (2009) reported that the results may have been overestimated due to publication bias.

The meta-analysis conducted by Ho et al. (2015), included ten new studies, in addition to the ten studies included in the van Stratten and Cuijpers (2009) meta-analysis. At posttreatment, effect sizes of 0.80, 0.66, and 0.55 were found for sleep efficiency (SE), SOL and wake after sleep onset (WASO) respectively, and these results were still present one to three months after posttreatment. Consistent with the finding in the van Stratten and Cuijpers (2009) meta-analysis, larger effect sizes were found in interventions that allowed for telephone consultation with a therapist. According to Ho et al. (2015) the dropout rate at posttreatment was 14.5%; however, this dropout rate is fairly similar to the dropout rate for in person CBT-I of 16.7%. Ho et al. (2015) found no indication that publication bias had influenced the effect sizes of this review.

Finally, a review of Internet delivered CBT-I included six randomized controlled trials (Cheng & Dizon, 2012). Effect sizes varied from very small (effect size of 0.18 for WASO) to moderate (effect size of 0.55 for SOL). Larger effect sizes were found in studies that included more of the core CBT-I strategies. Interventions that included interactive components resulted in higher adherence, which is somewhat at odds with van Stratten and Cuijpers' (2009) finding that

interventions only including text led to larger effect sizes. Adherence rates were quite strong across interventions, with an overall adherence rate of 78% (Cheng & Dizon, 2012).

Although no studies have been located that investigate the use of self-help CBT-I interventions in a young adult population, there is growing support for the use of self-help interventions in this population for mental health concerns other than insomnia (Boydell et al., 2014). For example, CBT based self-help programs for young adults have been shown to be effective in reducing depressive symptoms (Clarke et al., 2009; van der Zanden, Kramer, Gerrits, & Cujpers, 2012) and maladaptive perfectionism (Radhu, Daskalakis, Arpin-Cribbie, Irvine, & Ritvo, 2012). Furthermore, there is support for CBT-I as an intervention in young adult populations.

Effectiveness of CBT-I in Young Adults

Although many individuals transitioning into adulthood experience numerous sleep problems, relatively few studies have examined interventions targeting sleep problems within this population (Colarusso, 2005; Taylor et al., 2014). Of the minimal number of studies that have been conducted, even fewer still have employed CBT-I, considered to be the gold standard for treating insomnia (Wilson et al., 2010). Studies that included short psychoeducation modules delivered electronically or in person regarding sleep hygiene have resulted in increases in participants' knowledge about sleep hygiene (Asano et al., 2015; Brown, Buboltz, & Soper, 2006; Quan, Anderson, & Hodge, 2013; Tsai & Li, 2004). Other results reported post-intervention in these studies include: reduced napping (Brown et al., 2006), more consistent wake up times (Quan et al., 2013) and greater decrease in symptoms of anxiety and depression (Asano et al., 2015). However, these studies did not utilize random assignment, and in one case, the intervention group was comprised of students who chose to sign up for a semester long

course about sleep management (Tsai & Li, 2004).

Recently, there have been studies investigating sleep problems in university students that have included an experimental intervention that parallels the components of CBT-I, including a cognitive component in addition to the educational and behavioural foci of the previously mentioned studies, and these studies led to improvement in university students' sleep quality, SOL, daytime functioning, depressive symptoms, and quality of life (Kloss et al., 2015; Taylor et al., 2014; Trockel, Manber, Chang, Thurston, and Tailor, 2011). Level of engagement in the intervention has also been found to possibly be associated with outcomes. In Trockel et al.'s (2011) study, which compared an email-delivered CBT-I program to an email-delivered program for stress, students who engaged more in the CBT-I program experienced greater improvements in their sleep quality (Trockel et al., 2011). However, it was not possible for Trockel et al. (2011) to analyze this data to verify if this difference was statistically significant, due to a limited number of cases. Of these studies, only the one conducted by Taylor et al. (2014) employed random assignment, assigning participants to either a six-session one-on-one CBT-I intervention or to a wait list control (WLC) group within a university setting. Those in the intervention group endorsed a greater improvement in many measures of sleep quality, and the difference between the two groups was evident three months after posttreatment. The positive outcomes in this study are comparable to the outcomes of studies conducted with adult populations (Taylor et al., 2014).

Self-help CBT-I: A potentially Viable Option to Reach More Young Adults

The health of university students is a public health concern that is not receiving the attention it deserves in Canada (Kwan et al., 2013). Toward this end, campaigns to promote health among Canadian university students have been proposed, specifically in the areas of sleep, physical activity, and healthy eating (Kwan et al., 2013). Further, Espie (2009) has argued that

insomnia is an international health crisis for the general population, and it is pressing to develop and disseminate engaging intervention options of CBT-I. Espie (2009) posits that CBT-I is well suited to be delivered according to a stepped care model, as not all individuals experiencing insomnia require a highly trained clinician in order to benefit from the intervention. Some individuals may be well served by a self-help book, a CBT-I group, or CBT-I delivered electronically. Meta-analyses of CBT-I self-help interventions, such as books, booklets, audio-visual and Internet interventions in the general population yielded small to large effect sizes (Cheng & Dizon, 2012; Ho et al., 2015; van Straten & Cuijpers, 2009). Although the effect sizes are smaller than those resulting from individual or group CBT-I, there is still a benefit to employing CBT-I self-help interventions, on account of the lack of skilled clinicians available to offer CBT-I (Perlis & Smith, 2008), the increasing incidence of sleep problems in young adults (Buboltz et al., 2001), and the fact that not all individuals experiencing sleep problems require treatment by a highly skilled clinician (Espie, 2009).

Disseminating a CBT-I program electronically may be a particularly effective method of reaching young adults. CBT-I has been shown to be effective with young adults (Taylor et al., 2014); however, there are several barriers to the widespread availability of CBT-I in general. Presently, CBT-I is underutilized, as there are not enough clinicians trained to deal with all the insomnia cases that present (Perlis & Smith, 2008). Furthermore, financial and time constraints make it challenging for all individuals with sleep difficulties to seek treatment from a professional (Espie, 2009). Therefore, the availability of a self-help CBT-I program that individuals could employ without support could be a beneficial first step to offer in a stepped care system for individuals experiencing sleep difficulties (Lancee, van den Bout, van Straten, & Spoormaker, 2012). In addition, given that young adults deal with multiple demands on their

time (Buboltz et al., 2001) and changing social roles (Lemma et al., 2012), making an accessible

program (e.g., without the added obstacle of travel time) available to them that they can engage

with when they can fit it into their schedule may be especially beneficial to this population.

Delivery Pacing

Typically, CBT-I is delivered weekly or biweekly when offered face-to-face. Originally,

this study aimed to investigate if tips regarding sleep based on a CBT-I program, when delivered

to young adults within an online program should replicate the scheduling of typical CBT-I

therapy sessions or if there is a benefit to a one-time delivery of the complete program. Due to

difficulty in recruiting a large enough sample size, it was necessary to simplify the study design

so that only one delivery pacing was utilized. In order to understand the potential challenges and

benefits of offering a program in a format that is not delivered face-to-face, considering the

literature regarding courses offered out of the typical classroom setting may be helpful.

Courses that are offered outside of the typical face-to-face classroom setting include

courses offered online, and by email. These courses will be referred to as distance education

(DE) courses. DE courses are very popular on account of the flexibility and freedom these

courses offer, allowing students to manage how they will attend to tasks, and what physical

location they will use while engaging in course work (del Valle & Duffy, 2009). However, this

freedom may actually be partly responsible for the challenges faced by those participating in a

DE course. It has been suggested that when enrolled in a DE course, students may make choices

that interfere with their ability to take full advantage of the learning opportunities involved in the

course (Bonk, Wisher, & Lee, 2004; Kornell & Bjork, 2007, 2008), and this difficulty may be

exacerbated in courses of longer duration (del Valle & Duffy, 2009). Del Valle and Duffy (2009)

describe two challenges of self-management students face when participating in a DE course.

One of the primary concerns is time management, involving the students setting aside time specifically to attend to the course material (del Valle & Duffy, 2009). According to del Valle and Duffy (2009), many students find it challenging to attend lectures, even when there is a specified time, and classroom designated; therefore, the increased freedom inherent in a DE course, which does not involve a specified time and location for learning to happen, may result in less participation by students. A second challenge of self-management for those participating in a DE course involves students attending to the process of learning. Beyond simply attending to the course materials, students will need to, among other things, interact with the course content, reflect on the course material, and complete any tasks contained in the course that will help to solidify learning (del Valle & Duffy, 2009).

Although, there are challenges for students enrolled in DE courses, these types of courses have become very popular in recent years, with roughly 30% of American students enrolled in one online course (Allen & Seaman, 2010). One type of DE course is the learner-paced course, and Weiland (2011) posits the main attraction of self-paced courses is the autonomy such courses offer the student. Students are able to devote more or less time to a course in any given week depending on their schedule, which is parallel to the freedom that individuals are experiencing with their entertainment viewing habits (Weiland, 2011). Weiland (2011) posits that the preference for this degree of control and choice can be seen in the popularity of DE courses. However, according to del Valle and Duffy (2009) there are some students who benefit from the format of a structured-pace course (where all students proceed through the course receiving information and working on learning tasks in tandem). This group of students is made up of three types of students: students who prefer a structure to be created that they can follow, students who prefer working together with other students, or students who are inclined to do less work,

sometimes referred to as minimalist students (del Valle & Duffy, 2009). However, according to del Valle and Duffy (2009) with a learner-paced course the majority of students, roughly 80%, self-manage their learning effectively. In addition, Chiviacowsky and Wulf (2002) found that a large proportion of students regularly make decisions that are supportive of effective learning beyond the context of DE courses.

Findings from metacognition literature (Zimmerman, 1989) have been proposed as explaining the success of self-guided learning, which is applicable to self-paced DE courses (Brydges, Dubrowski, & Regehr, 2010). Metacognition has been defined as an individual's knowledge regarding their cognitive processes (Metcalfe & Kornell, 2005). Researchers in metacognition have found that beginning as early as Grade 3, individuals will consciously choose to not study items they already know and focus their attention on items they have not yet learned (Masur, McIntyre, & Flavell, 1973; Metcalfe & Kornell, 2005). This ability is firmly established in college students (Masur, et al., 1973). There is also support for individuals being capable of approaching learning strategically (Brydges et al., 2010). These strategies include: prioritizing learning more difficult items first when they are not facing time constraints (Metcalfe, 2002); prioritizing learning easier items when time pressure is added to a situation (Kornell & Metcalfe, 2006; Metcalfe & Kornell, 2003; Metcalfe & Kornell, 2005); and prioritizing items of greater value if an element of reward is incorporated into the situation (Ariel, Dunlosky, & Bailey, 2009). Finally, individuals have been found to cease studying when they feel like they are no longer learning new material (Kornell & Metcalfe, 2006; Metcalfe & Kornell, 2005). Furthermore, if individuals are asked to continue practicing the information they are learning after the point when they would opt to cease studying, they do not display a significant increase in learning (Jowett, LeBlanc, Xeroulis, MacRae, & Dubrowski, 2007).

Research of self-guided learning has found self-monitoring to be important for improving unsupervised learning (Schunk, 2001; Zimmerman, 2000). Self-monitoring, such as keeping track of behaviours related to a skill an individual is attempting to learn has resulted in greater improvement in the targeted skills compared to a control group that was not recording their learning related behaviours (Lan, 1996; Zimmerman & Kitsantas, 1996). It has been proposed that self-monitoring leads to an increase in awareness of learning processes in the individual, which in turn leads to a greater increase in targeted outcomes (Brydges et al., 2010). These findings regarding self-monitoring are pertinent to this study, as participants will be asked to track their sleep shortly after waking, daily, for two weeks at the beginning and end of the study.

According to Anderson (2003), neither learner-paced nor structured-pace courses will be able to satisfy all groups of learners, and it is important to investigate the best delivery method for the population one is designing a course for. Since it has been shown that individuals are likely to make decisions that are supportive of effective learning (Chiviacowsky & Wulf, 2002), and that the majority of students self-manage their learning effectively (del Valle & Duffy, 2009), it was originally predicted that individuals in a learner-paced program will find the program to be acceptable. However, due to the smaller sample size it was not possible to test this hypothesis. It is possible that retention of participants in this study was negatively influenced by the length of the study (12 weeks) and the high degree of freedom for the participants to engage with the program as they desire, two elements mentioned by del Valle and Duffy (2009) as often being problematic with online courses. Ultimately, all participants received the modules at one time and were able to organize for themselves how and when they would approach the material.

Treatment Preferences

Empirically supported treatments (ESTs) have been shown to lead to results in better

outcomes and reduced costs (Weersing & Weisz, 2002); however, when developing programs, it

is important to consider what patients consider as acceptable (Sidani & Braden, 1998). Whether

patients find a program or treatment to be acceptable is done by consulting directly with patients

regarding their preferences concerning a particular treatment, and whether the treatment is in-line

with their values (Sidani, Epstein, & Miranda, 2006). According to Sidani, Epstein, Bootzin,

Moritz, and Miranda (2009), acceptability of a treatment is defined as an individual's favourable

regard for a treatment option based on contemplation of all aspects of the intervention. Research

has found that the most common aspects of an intervention that individuals consider important

are: effectiveness and appropriateness of the intervention for dealing with their health issue,

being conducive to their lifestyle, and convenience (Miranda, 2004; Thacher, Morey, &

Craighead, 2005). If a treatment is both evidenced based and acceptable to patients, it is referred

to as adhering to the patient-centered evidenced based approach (PCEB; Coyler & Kamath,

1999). Patients' treatment preferences are considered central to the PCEB (Sidani et al., 2006),

and when they are taken into account, there is an increase in patient satisfaction, an increase in

patient sense of control, and improved clinical outcomes (Harvey, Kazis, & Lee, 1999; Reid

Pointe et al., 2003; Street & Voigt, 1997).

Patient preferences can be investigated with regards to treatment type, delivery modality,

perceived convenience or risks associated (Sidani, Fox, & Epstein, 2015). In order to assess

preferences, the available options must be outlined clearly, in a language that is easily

understood (i.e., able to be understood by someone with a Grade 6 education), and patients must

be directly queried explicitly about their preference (Sidani et al., 2015). According to Sidani et

al. (2015), patients' preferences are shaped by information gathered before presenting to

participate in a study (e.g., from the media, interaction with family, personal history, and friends,

or health care providers) or once they present at the study (i.e. from reading the consent form). In line with the recommendations of Sidani et al. (2015), participants in this study will be asked explicitly regarding their preference of program delivery mode. Although participants were asked what delivery method they would prefer (learner-paced or structured-paced), due to low enrolment in the study, it was not possible to utilize this information in the way originally intended. Information regarding acceptability of treatment was still collected, which according to Sidani and Braden (1998) is of central importance when developing new treatment options.

The Current Study

The current study extended the findings of the previously discussed studies and built on the shortcomings identified in the literature, including the lack of an accessible program for young adults and the increasing number of young adult students affected by sleep difficulties. The lack of available services coupled with the increased need for effective treatment options for sleep problems in young adult students makes it logical, and critical, to investigate the use of a self-management CBT-I program which could become a foundational component in a stepped-care model. This study investigated how to best meet the needs of young adult students with regards to a self-management program for sleep problems. The participants required for this study were young adult students with sleep problems; therefore, this study did not utilize a convenience sample by young adult students in the greater Toronto area (GTA). Please see Appendices A, B, C, and D for documents utilized in recruitment.

The purpose of this study was to acquire knowledge that could lead to the development and availability of a self-management program for CBT-I for young adult students that could be offered directly to this population (e.g., undergraduate students by the university they are attending). At Ryerson University (RU), a psychologist from the Center for Student Development and Counselling (CSDC) reported that the clinic is unable to keep up with the demand for services, and they are hoping to begin offering stepped-care models in the near future (L. Girz, personal communication, September 28, 2015). Thus, it is important to design programs to be cost-effective and straightforward in terms of implementation. A self-management CBT-I program would be simpler to implement if the program could be delivered to students all at once, as this reduces the logistical considerations. Whether a one-time delivery is feasible for a program targeted at young adults must be tested. With this in mind, this study was originally

designed to include two different pacing options for the program, which included eight modules based on CBT-I principles. One group was to receive the modules all at once, and they were to explore the material in a self-directed way (learner-paced). The other group was to receive the same eight modules over the course of as many weeks; therefore, the pacing of the exploration of the material would be automatically controlled (structured-pace). Ultimately, due to not reaching the recruitment target, the design was simplified so that all participants received the modules in the same format (i.e., modules were sent all at once). This still allowed for the collection of information that is critical to exploring whether these young adults found the program to be acceptable when delivered all at once.

When developing a new program, it is helpful to employ a specific evaluation model in order to ensure that development of the program occurs in a systematic fashion. This study used the Kirkpatrick four-level learning evaluation model as a framework in which to evaluate the program, focusing on the first two levels of evaluation: reactions and knowledge acquired (Kirkpatrick, 1959; 1996). According to Kirkpatrick (1959; 1996), it is necessary to evaluate reactions and to verify the amount of learning that has taken place before progressing to the final two levels of evaluation that focus on behaviour, and results respectively. Corresponding to the first level of the Kirkpatrick model (1959; 1996), feedback regarding reactions to the program should be gathered using qualitative and quantitative measures. Furthermore, Kirkpatrick (1995) stresses that qualitative and quantitative information that is gathered should be considered as equally important, and participants should be given an opportunity to express their reactions to the program in response to open ended questions. According to Kirkpatrick's model (1959; 1996), reactions to the program include acceptability and engagement. When participants find a program acceptable or interesting, this may lead them to derive greater benefits from the

program. Furthermore, greater acceptability or interest often leads to increased willingness to engage in a program, and participants who are more engaged in a program often exert greater effort in applying techniques introduced within the program (Kirkpatrick, 1959; 1996). Therefore, quantitative and qualitative data collection techniques were employed to capture participants' general reactions to this program, including acceptability. General reactions and acceptability were captured employing a self-report questionnaire inquiring about benefits, challenges, and overall opinion of participants regarding the program. Corresponding to the second level of the Kirkpatrick model, knowledge acquisition was measured by the amount of knowledge acquired by the participants based on the results of the questionnaire they completed at the termination of the program to verify how much information they recalled regarding the principles of CBT-I included in the program.

Finally, this study investigated outcome measures, as well as potential predictors of several variables. To investigate for whom this program may be best suited, potential predictors (i.e., demographic characteristics, psychological characteristics, and delivery preference) were considered with regards to level of acceptability, level of engagement, and outcome measures. Strictly speaking, null-hypothesis significance testing is not considered appropriate in an acceptability study (Tickle-Degnen, 2013); however, the outcome measures can be analyzed to see what trends can likely be expected in future, more rigorous studies. The results of analyses focused on outcome measures can be helpful in considering the feasibility of further studies investigating the use of electronically delivered CBT-I with a young adult population.

Research Questions and Hypotheses

CBT-I has been found to be highly effective in treating insomnia in adults (Jacobs, Pace-Schott, Stickgold, & Otto, 2004; Morin et al. & 2009), and there is growing support for the use

of CBT-I with young adults, both when employed as a full treatment (Taylor et al., 2014) and psychoeducation interventions that are based on CBT-I (Kloss et al., 2015, Trockel et al., 2011). This study investigated the acceptability of a self-help program based on CBT-I principles delivered electronically to young adults.

Aim 1. Investigate the reactions to the program, using both quantitative and qualitative data analysis.

- Hypothesis 1a: Completers of the program, as defined by those who read at least six of the eight modules, would rate the program as acceptable, as measured on the Therapy Evaluation Questionnaire for CBT-I (TEQ; Edinger, Wohlgemuth, Radtke, Marsh, & Quillian, 2001; see Appendix E). Rating the program as acceptable on the TEQ was defined as a score on the TEQ of 20 or higher, at post-program. In addition, it was hypothesized that the group mean score for completers would be a minimum of 4 out of 7 on quantitative questions querying regarding ease of understanding, satisfaction and usefulness of program. For all these variables, the priori target was set above the midpoint of each measures to ensure that if the group mean did exceed the a priori target that the group, on average, would be endorsing the program as performing above neutral on the variable of interest.

- Hypothesis 1b: Completers would endorse a high level of positive reactions to the program as captured in a qualitative questionnaire designed to probe participants' reactions to the program.

Aim 2. Investigate whether completers demonstrated knowledge acquisition.

- Hypothesis 2: Those who completed the program would demonstrate adequate knowledge acquisition, as measured by the CBT-I Knowledge Questionnaire (CBT-I-KQ; see Appendix F). Adequate knowledge acquisition was defined as answering 50% or more of the questions

on the CBT-I-KQ accurately.

Aim 3. Investigate whether engagement was associated with adherence to the protocol.

- Hypothesis 3: There would be a difference on measures of adherence between those with a low level of engagement versus those with a high level of engagement. Engagement in the program was measured by an aggregate engagement score comprised of the number of modules completed, and score on the CBT-I-KQ. Adherence was measured by into bed variability and out of bed variability from the Consensus Sleep Diary (CSD; see Appendix G; Carney et al., 2012), as well as on a measure of sleep hygiene practices – the Sleep Hygiene Practice subscale (SHP; see Appendix H) of the Sleep Hygiene Awareness and Practice Scale (SHAPS; Lacks & Rotert, 1986).

Aim 4. Investigate potential predictors of acceptability and engagement.

- Hypothesis 4a: Participant characteristics and psychological characteristics would predict acceptability.

- Hypothesis 4b: Participant characteristics and psychological characteristics predict would knowledge acquisition.

Aim 5. Investigate sleep outcomes for feasibility as future outcome measures to study if a similar program is undertaken in the future.

- Hypothesis 5: There would be a significant difference between completers and non-completers on the following measures at pre- and post-program:
  - The Insomnia Index (ISI; Morin, 1993; see Appendix I; utilizing a cutoff score of 10 [Morin et al., 2011]).
  - A measure of cognitions about sleep, the Dysfunctional Beliefs and Attitudes About Sleep (DBAS-16; Morin, Vallieres, & Ivers, 2007; see Appendix J; utilizing a off

score of 3.8 [Carney et al., 2010]).

o Total wake time (TWT) as captured by the CSD (Carney et al., 2012; utilizing a

cutoff of 60 minutes [Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008]).

Methods

Research Design

The study was an acceptability trial with pre-and post-program assessments comparing the perceived acceptability and engagement with an email-delivered program based on CBT-I principles delivered as all eight modules at once (learner-paced). Participation in this study was voluntary, and approval was obtained from RU's Research Ethics Board (REB).

Participants

Two hundred and eighty five individuals expressed interest in participating in this study. All those who expressed interest were sent an email outlining the details of the study (see Appendix K), with the consent form attached (see Appendix L). After receiving this email, 96 individuals proceeded to fill in the screening questionnaire. Of this original 96, 80 individuals were classified as eligible, and 18 individuals were classified as not eligible. The reasons for non-eligibility included: being over 30 years of age ($n = 3$), having a previous diagnosis of either psychotic disorder or bipolar disorder ($n = 3$), working overnight ($n = 5$), not being a student ($n = 3$), not having at least a mild sleep complaint ($n = 5$), and having a score of 4 or higher on the STOP-Bang questionnaire (see Appendix M; $n = 1$), which may indicate the individual has sleep apnea (Chung et al., 2008). Of the 80 individuals who were invited to participate in this study, 58 individuals chose to fill in the pre-program questionnaires. Due to the changes made to the study design, one arm of the study was eliminated, resulting in the elimination of the data from the sole participant who had been randomly assigned to receiving the program modules spread out over 8 weeks. Six participants notified the principal investigator that they wished to withdraw from the study. All participants were sent an initial invitation to each next step of the study, and received two subsequent reminders, if they did not complete what would be the next step for them in the

study. After these two reminders, they were sent two requests to answer two questions regarding their reasons for discontinuing their participation in the study.

Twenty-six participants completed one or both of the post-program steps (i.e., either the post-program questionnaires, or both the post program questionnaires and the post-program sleep logs). Of the 26 participants who completed some element of the post-program measures, 18 were considered to be completers, and eight were considered to be non-completers. In the completer group, the majority of participants ($n = 17$) read all eight modules, and one of the participants read most (i.e., seven) of the modules. In the non-completer group, one read one module, and most ($n = 7$) read no modules. Twenty-five participants discontinued participation in the study (e.g., they completed pre-program questionnaires, but did not complete the pre-program sleep diaries), and are thus non-starters.

Measures

Whenever possible, measures utilized in this study were chosen to adhere to the assessments recommended by a panel of 25 leaders in sleep research (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006).

Screening measures

Demographic *Questionnaire*. Young adults were asked to answer questions regarding demographic variables such as: age; gender; living situation (whether they were living alone, with roommate[s], with a partner, or with their parents); average number of nights per week that they shared their bed with another person or a pet; whether they were a part-time or fulltime student; whether they were employed part-time or fulltime; if they lived in the GTA; how long a commute they had to school or work; whether they were taking any medications for sleep on a regular basis; whether they had a previous or current diagnosis of bipolar disorder or psychotic

disorder; the average amount of time that they spent online per day and whether they owned a smart phone and/or a personal computer; whether they participated in social media sites, and average time spent on these sites per day; and how they categorized their sleep (i.e. good sleeper, fair sleeper, poor sleeper, or severe insomnia); and what their preference was regarding learning new information (i.e., having the information structured for them, or deciding for themselves how to structure their learning; see Appendix N).

STOP-Bang Questionnaire. The STOP-Bang questionnaire (Chung et al., 2008) was employed to screen for obstructive sleep (OSA), and it consists of four yes/no questions and four fill in the blank questions. The name of the questionnaire is a mnemonic based on the eight questions: S, *Do you **S**nore loudly?*; T, *Do you often feel **T**ired, fatigued, or sleep during the daytime?*; O, *Has anyone **O**bserved you stop breathing during your sleep?*; P, *Do you have high blood **P**ressure*?; B, ***B**ody Mass Index (BMI;* screening for those with a BMI over 35); A, ***A**ge* (screening for those who are over 50 years old); N, ***N**eck circumference* (screening for those with a neck circumference over 40 centimeters); and G*, **G**ender (*screening for those of male gender*).* The STOP-Bang has shown specificity and sensitivity greater than 90% in patients who have moderate or severe OSA (Chung et al., 2008). Generally, a cutoff score of 3 or greater on the STOP-Bang is utilized (Chung et al., 2008); however, a more liberal cutoff score of 4 or greater was utilized due to the low risk of sleep apnea in this population. Ultimately, only one non-starter had a score of 3 on the STOP-Bang; none of the completers or non-completers had a score of 3 or above on this measure.

Epworth Sleepiness Scale. The Epworth Sleepiness Scale (ESS; Johns, 1991) is an eight-item measure of daytime sleepiness (see Appendix O). Individuals were asked to indicate how likely they are to nod off during eight scenarios that are more or less likely to induce drowsiness

(e.g., watching television, reading, or travelling as a passenger in a car). The eight scenarios were rated by the individual from 0, *Would never doze* to 3, *High chance of dozing*. Total scores ranged from 0 to 24, with a higher score indicating a greater likelihood of nodding off unintentionally during the day, with scores of 16 and above denoting that those individuals have a high level of daytime sleepiness (Johns, 1991). A systematic review found internal consistency was good, $\alpha = 0.73$-0.86 (Kendzerska, Smith, Brignardello-Petersen, Leung, & Tomlinson, 2014). The Cronbach alpha of the ESS for this study at pre-program was 0.80.

Insomnia Severity Index. The Insomnia Severity Index (ISI; Morin, 1993) contains seven items that measure daytime and nighttime elements of insomnia (Morin, 1993). Individuals rated their perception of their sleep quality in the last month on a 5-point Likert scale ranging from 0 to 4 (Morin, 1993). Total scores range from 0 to 28, and this range was broken down into four levels: 0 to 7 (absence of insomnia), 8 to 14 (sub-threshold insomnia), 15 to 21 (moderate insomnia), and 22 to 28 (severe insomnia; Morin, Belleville, Bélanger, & Ivers, 2011). Elements that are captured on this scale include: level of satisfaction with sleep pattern, amount of emotional disturbance caused by the sleep issues, extent of impairment due to lack of sleep, noticeability of impairment to others, and amount of difficulty falling and staying asleep (Bastien, Valliéres, & Morin, 2001). The ISI has shown strong internal consistency with community and clinical samples, with Cronbach alpha's of 0.90 and 0.91 respectively (Morin et al., 2011). The ISI (Morin, 1993) was used to establish inclusion criteria. Students meeting the inclusion criteria of mild to severe sleep disruption (scoring above a 9 on the ISI), but not meeting any of the exclusion criteria, were invited by email to participate in the study. The ISI was utilized as a screening measure, as well as an outcome measure. The Cronbach alpha's for the ISI were 0.77 at pre-program and 0.68 at post-program.

Process and outcome measures

Therapy Evaluation Questionnaire for CBT-I. The Therapy Evaluation Questionnaire (TEQ; Edinger et al., 2001) was adapted for use with individuals receiving CBT-I from the work of Borkovec and Nau (1972). This 7-item scale assessed participants' evaluation of the acceptability of the treatment, including how logical the treatment is perceived to be by participants, the degree of confidence participants endorse in the treatment they received, how willing they would be to recommend this treatment to a friend, and whether they would be willing to repeat the treatment (Edinger et al., 2001). This scale also includes two questions regarding the therapeutic relationship. These two items were not included in the current study, as the program is being delivered electronically, and it would not be possible for participants to comment on therapeutic relationship. Therefore, the TEQ included five items, and participants' responses were captured on a 7-point Likert scale. Responses could range from 1, *Not at all* to 7, *Very confident/logical/willing*. Total scores can range from 7 to 35 with a higher score indicating a greater degree of endorsement of the perceived acceptability of the program. The TEQ has shown high internal consistency (Cronbach alpha = 0.79) and strong face validity for assessing treatment credibility and perceived competence and warmth of the therapist when employed in CBT-I trials (Edinger et al., 2001). The Cronbach alpha for the TEQ for this study was 0.88 at post-program.

Reactions to the Program Questionnaire. This questionnaire gathered qualitative and quantitative data from participants regarding program content, format, and satisfaction (see Appendix P). The majority of questions were open-ended, allowing participants to share their reactions to the program freely. In addition, several questions asked participants to rate factors on a scale from 1 to 7. Within program content, participants were asked about the ease of

understanding the program and which modules they found most or least useful. On the subject of format, participants were asked on which device they accessed the program and if this was the preferred device to access the program. The questions regarding satisfaction ask about overall satisfaction with the program, the helpfulness of the program, and whether participants would use the program again in the future if faced with the same problem. The final item in this questionnaire asked participants to share any other reactions they had to the program that were not captured in the previous questions.

CBT-I Knowledge Questionnaire. The CBT-I Knowledge Questionnaire (CBT-I-KQ) was based on information contained in the book Goodnight Mind (Carney & Manber, 2013). The purpose of this questionnaire was to gauge the degree to which participants retained the material they read within the modules they received. It was also considered as a measure of engagement, the rationale being that the greater amount of time and effort a participant has spent reading and engaging with the modules they have been sent, the greater the amount of information they will recall. The questions contained in this questionnaire were based strictly on understanding of the material; participants' ability to apply the information contained in the chapters will not be directly assessed. There were 28 multiple-choice questions in total, and each question was worth one point. Therefore, scores could range from 0 to 28, with 28 signifying the greatest amount of knowledge retention and thus engagement with the material. During the study, participants were unobserved when answering these questions, and may have wanted to consult the modules in an attempt to get as many correct answers as possible. Therefore, instructions accompanying the questionnaire explained that the goal was to obtain an accurate measure of how much information participants understood from what they have read without consulting the program material, and that their performances would not be evaluated individually. An example of a

question gauging for knowledge from module one is: *Of the time that one is in bed, what is the optimal percentage of time that should be spent sleeping?* The possible answers to choose from are: a) *over 90%*, b) *roughly 85%*, c) *between 70 and 80%*, and d) *there is no optimal amount, it varies by individual.*

  Consensus Sleep Diary. The Consensus Sleep Diary (CSD; Carney et al., 2012) is completed within an hour of waking, and allows prospective capture of an individual's sleep pattern and perception on a daily basis. The CSD allows individuals to track information regarding nighttime experience that is deemed by a panel of experts to be important when tracking sleep, such as: time the individual got into bed, time of first sleep attempt, the length of time taken to fall asleep, number and cumulative length of middle of the night awakenings, time of final wakening, and time the individual got out of bed. There are also spaces to track daytime activities which can impact on sleep or sleep quality, such as: number and cumulative total of naps, number of alcoholic and caffeinated beverages consumed, the individual's perception of their sleep quality, and any other comments the individual considers pertinent. Created by leading experts in the field of insomnia research, as well as by patients, the CSD is considered the gold standard in insomnia assessment (Carney et al., 2012).

  Sleep diaries are considered to be a reliable and valid method for measuring sleep (Redeker, Pigeon, & Boudreau, 2015), as well as the "standard of practice," in both research and clinical settings, for prospectively capturing self-reported information regarding sleep variables (Buysse et al., 2006). However, there is a paucity of studies focused on the reliability of sleep diaries, which can be attributed to the challenge of investigating the reliability of a diary, as well as the fact that the various indices of which the CSD is comprised cannot be assumed to be interrelated (Maich, Lachowski, & Carney, 2016). One of the few studies investigating the

psychometric properties of the CSD, conducted by Maich et al. (2016), yielded strong support

for the utility and validity of the CSD. The results of this study indicate that the CSD is

significantly correlated with two tools that are considered to have strong psychometric properties

and are used consistently within sleep research: the ISI (Morin, 1993), which measures insomnia

symptoms retrospectively, and actigraphy, which measures sleep objectively. Further, Maich et

al., (2016) found that the CSD can discriminate those with non-problematic sleep from those

with insomnia disorder, and the CSD can detect improvement from pre- to post-treatment that is

clinically significant.

The current study utilized an electronic diary for the collection of information regarding

the sleep of participants. Studies have found that there is no significant difference between sleep

variables as captured by either paper or electronic sleep diaries (Tonetti, Mingozzi, & Matale,

2016). In line with previous studies examining CBT-I that utilized TWT as the primary outcome

measure (Khalsa, 2004; Ong, Shapiro, & Manber, 2008; Siversten et al., 2006; Strom, Pettersson,

& Andersson, 2004), the current study utilized TWT as the primary sleep measure. There were

two other CSD indices analyzed in this study, into bed variability and out of bed variability.

Sleep Hygiene Awareness and Practice Scale. The Sleep Hygiene Awareness and

Practice Scale (SHAPS; Lacks & Rotert, 1986) consists of three subscales, Sleep Hygiene

Awareness (SHA), Caffeine Awareness (CA), and Sleep Hygiene Practices (SHP). The SHA

subscale contains 13 items and measures an individual's understanding of the potential impact of

certain activities on sleep (e.g., taking a nap). Responses are captured on a 7-point Likert scale

ranging from 1, *Very beneficial to sleep* to 7, *Very disruptive to sleep.* At the midpoint of the

scale, a rating of 4 indicates *Neutral to sleep*. Scores on the SHA can range from 13 to 39, with

scores at the higher end of the scale being associated with less awareness regarding sleep

hygiene practices. The CA subscale measures an individual's knowledge of whether certain food, beverages, or over-the-counter medication contain caffeine or not. Total scores are represented as percentages representative of the number of items correctly identified out of 18 items presented within the CA subscale. The SHP subscale consists of 19 items that probe how many nights during any given week an individual participates in activities considered to either increase or decrease the likelihood of sleep. The SHP subscale yields scores ranging from 0 to 133, with lower scores indicating that an individual is engaging is fewer activities that interfere with sleep (Lacks & Rotert, 1986).

Although the SHAPS has been used extensively in research and clinical settings (Kohn & Espie, 2005), the subscales do not exhibit consistently strong psychometric properties (Brown et al., 2006: Kloss et al., 2015). The SHA subscale has exhibited the strongest psychometric properties of the three subscales, with an acceptable internal reliability (Cronbach alpha of .78) and acceptable test-retest reliability ($r = .76$, $p < .001$; Brown et al., 2006). The CA subscale has exhibited the weakest psychometric properties, resulting in the results of this subscale being omitted from studies (Brown et al., 2006; Kloss et al., 2015). The CA scale was found to have poor internal reliability (Cronbach's alpha of .47) and poor test-retest reliability ($r = .50$, $p < .001$; Brown et al., 2006). Brown et al. (2006) found the final subscale, the SHP, to have poor internal reliability (Cronbach's alpha of .55) and acceptable test-retest reliability ($r = .74$, $p < .001$). Brown et al. (2006) stated that the poor internal reliability was likely a result of the questions within the subscale addressing multiple topics; however the stability over time of this subscale led to its retention in their analysis. Kloss et al. (2015) found the SHP subscale to have poor internal reliability (Cronbach's alpha of .42); therefore, this subscale was eliminated from the analysis in their study. For this study, only the SHP subscale was utilized, and the Cronbach

alpha's were 0.61 at pre-program and 0.57 at post-program.

Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form. The Quality of

Life Enjoyment and Satisfaction Questionnaire-Short Form (Q-LES-QSF; Endicott et al., 1993)

is a 16-item self-report questionnaire that measures enjoyment and satisfaction in several areas:

physical health, mood, work, daily functioning and activities, relationships, intimate

relationships, finances, and medication (see Appendix Q). Individuals rated their satisfaction

with the 16 items on a 5-point Likert scale, ranging from 1, *Very poor* to 5, *Very good*. Scores

ranged from 14 to 70 and were converted into percentages, with higher scores or percentages

indicating a higher amount of satisfaction with various aspects of life (Endicott et al., 1993).

High levels have been found for internal consistency, 0.9, and test-retest validity, 0.93

(Stevanovic, 2011). Strong convergent and criterion validity have also been found. With regards

to responsiveness parameters, the Q-LES-QSF demonstrated 80% sensitivity and 100%

specificity (Stevanovic, 2011). The Cronbach alpha for the Q-LES-QSF for this study was 0.85

at pre-program.

Depression Anxiety Stress Scales. The Depression Anxiety Stress Scales (DASS-21;

Lovibond & Lovibond, 1995) is a 21-item self-report questionnaire that is a shortened version of

the original 42-item scale (see Appendix R). It measures the negative emotional states of

depression, anxiety, and stress. Individuals are asked to rank to what extent the scale items refer

to themselves over the past week on a 5-point Likert scale, ranging from 0- *Did not apply to me*

at all to 3- *Applied to me very much, or most of the time*. Cutoff scores are typically used to

interpret these scales, and are based on percentile ranks (Lovibond & Lovibond, 1995). The

classification of scores according to Lovibond and Lovibond (1995) are as follows: 0 to 77

(normal), 78 to 87 (mild), 88 to 95 (moderate), and 96 to 100 (extremely severe). The DASS-21

includes 7 items within each of the subscales (depression, anxiety, and stress), with scores being

doubled in order to compare them to the original classification system (Osman et al., 2012). For

the DASS-21, the three subscales have shown strong concurrent validity, as well as high internal

consistency, with Cronbach alpha's of 0.94, 0.87, and 0.91 respectively across both clinical and

non-clinical samples (Antony, Bieling, Cox, Enns, & Swinson, 1998). For this study, only the

Stress subscale was utilized, and the Cronbach alpha was 0.62 at pre-program.

     ***Self-Efficacy for Sleep Scale*.** The Self-Efficacy for Sleep Scale (SE-S; Lacks, 1987) is a

9-item questionnaire that measures self-efficacy, specifically in the domain on sleep-promoting

behaviours (see Appendix S). Bandura (1989) described self-efficacy as the belief an individual

has regarding their ability to perform a specific task well, as compared to their actual skill in this

area. The SE-S requires respondents to indicate the level of confidence they have with regards to

performing sleep-promoting behaviours (e.g., falling asleep in less than 30 minutes). Responses

are captured on a 5-point Likert scale, ranging from 1, *Not confident* to 5, *Very confident*. Final

scores range from 9 to 45 with higher scores indicating that the individual endorses a greater

level of confidence to perform sleep-promoting behaviour. Excellent internal reliability was

displayed by the SE-S, with Cronbach alpha's ranging from 0.71 to 0.86 (Edinger, Wohlgemuth,

Radtke, Coffman, & Carney, 2007; Rutledge, La Guardia, & Bluestein, 2013), and test-retest

reliability was found to be acceptable (Fichten et al., 2001). The Cronbach alpha for the S-ES for

this study was 0.74 at pre-program.

     ***Dysfunctional Beliefs and Attitudes About Sleep*.** The Dysfunctional Beliefs and

Attitudes About Sleep (DBAS-16; Morin et al., 2007) is a 16-item self-report questionnaire that

is a shortened version of the original 30-item scale. This scale measures negative sleep related

cognitions that are often partly responsible for continued insomnia. Individuals rated their level

of agreement with the 16 statements on an 11-point Likert scale ranging from 0, *Strongly disagree* to 10, *Strongly agree*. There is a 100mm visual analogue scale in the background of each item. There are four factors captured by this scale, 1) perceived repercussions of insomnia, 2) worry or helplessness about insomnia, 3) expectations around sleep, and 4) medication. This scale shows reliability, with good internal consistency (Cronbach alpha's of .77 and .79 for clinical and research samples respectively; Morin et al., 2007). The Cronbach alpha for the DBAS-16 for this study was 0.91 at post-program.

Recruitment

This study screened 96 participants for a final sample size of 26. To be included in the study, participants needed to: 1) report at least mild sleep disruption (i.e., scoring 10 or higher on the ISI), 2) be a student, and 3) be between 18 and 30 years of age. The upper age limit was based on literature that supports the expansion of young adulthood into the late-twenties or early thirties (Settersten & Ray, 2010) as there is a growing trend toward staying in school longer while postponing starting a family or entering the work force (Berlin, Furstenberg, & Waters, 2010). Exclusion criteria consisted of: 1) self-reported signs of sleep apnea on the STOP-Bang, 2) self-reported shift work, and 3) a previous or current, diagnosis of bipolar disorder or psychotic disorder. The exclusion criteria were to ensure that no one participated in the program for whom CBT-I was contraindicated.

The original recruitment target of 60 participants was not met within the time frame of this study; therefore, the study procedures and research questions were adapted and simplified, as previously outlined. Recruiting began in February 2016 after REB approval was obtained from RU, and recruitment terminated in October 2016. Participants were recruited using various techniques: posters on campus on local universities (i.e., RU, University of Toronto, and York

University), Reddit and Facebook postings on various social media pages associated with local universities, tabling in the Student Learning Centre (SLC) at RU, the CSDC at RU, and word of mouth.

Minimal guidance has been published regarding appropriate sample size in an acceptability or feasibility study (Lancaster, 2015). If a sample size is initially set too high, this may lead to difficulty recruiting the optimal number of participants (Lancaster, Dodd, & Williamson, 2004), while a sample size that is too low may lead to inappropriate decisions being made about the design of a future study, on account of inaccurately estimated variance (Julious, 2005). Although the median sample size for pilot, feasibility and acceptability studies is 30 participants (Billingham, Whitehead, & Julius, 2013), according to Rounsaville, Carroll, and Onken (2001) it is acceptable for studies of this type to have 15 to 30 participants. However, when dealing with a sample of this size, it is important to consider that power will be low.

Procedures

Interested individuals contacted the principal investigator via email to an account set up specifically for this study, using the contact information on the poster or social media posting. Interested individuals were sent an email containing a link to a questionnaire housed on the Qualtrics website where they completed the consent form, the demographic questionnaire that queried about exclusion criteria, and a number of self-report measures. The questionnaires completed at the screening stage included: ISI, ESS, STOP-Bang. Those who did not meet the study inclusion criteria were informed by email, thanked for their interest, and given other resources as appropriate (see Appendix T).

Those individuals meeting inclusion criteria were asked to complete the following questionnaires: Q-LES-QSF, DBAS-16, DASS-21, and SHAPS. Following completion of these

initials questionnaires, participants were invited to complete 2 weeks of sleep logs, which involved logging onto the Qualtrics website on a daily basis for 2 weeks to fill in the CSD. After completing 2 weeks of sleep logs, participants were granted access to the eight-module CBT-I program housed on the Qualtrics website based on the book Goodnight Mind (Carney & Manber, 2013).

Goodnight Mind (Carney & Manber, 2013) is an adult self-help CBT-I book for insomnia written by two experts in the field of insomnia research, Drs. Colleen Carney and Rachel Manber. The book contains 10 chapters, packaged as eight modules, and written in language that can easily be understood by individuals who do not have a background in insomnia or sleep research. The book contains information, along with examples, on all aspects of CBT-I treatment: stimulus control, sleep restriction, and cognitive restructuring. The first chapter describes key concepts responsible for the production of sleep (circadian rhythm, the homeostatic system, and the arousal system), as well as information on reducing one's effort to fall asleep and ideas for effectively preparing oneself for a good night's sleep. The second chapter describes ways to increase one's sleep drive, and discusses the logic behind setting and manipulating one's sleep schedule. The first two chapters were combined to create the first module. Chapter three focuses on identifying the best sleep schedule for one's body clock. Chapter four contains information on reducing the amount of mental activity one experiences in bed. The fifth chapter highlights the importance of creating a quiet time to bridge one's active daytime activities and when one attempts to sleep. The sixth chapter describes relaxation techniques to help reduce one's level of arousal. Chapter seven includes strategies for reducing one's level of worrying, specifically worrying that is undertaken in one's bed. Chapter eight explains the difference between the way a good sleeper and a poor sleeper think about sleep, and

contains suggestions on how a poor sleeper can start to think more like a good sleeper. The ninth chapter contains strategies for improving one's sleep through altering daytime behavior, including techniques aimed at worrying less and questioning one's unbeneficial thoughts regarding sleep. The final chapter focuses on the importance of being open and accepting with regards to reducing mental activity in order to improve one's sleep. These final two chapters were combined to create the eighth, and final module.

Participants were asked to keep sleep logs for two weeks post-program, in addition to the two week of sleep logs completed pre-program. At the end of the 8-week program, participants were asked to complete a questionnaire to capture reactions to the program and various self-report measures: TEQ, CBT-I-KQ, ISI, ESS, Q-LES-QSF, DBAS-16, DASS-21, and SHAPS. Finally, after completing the final 2 weeks of sleep logs, participants were debriefed about the study (see Appendix U). They received an explanation of the rationale and design of the study, beyond what was shared in the consent form. Two pertinent articles were also listed on this form that participants could consult if they wished to read further about the empirical support for CBT-I for treating sleep problems in young adults (Kloss et al., 2015; Taylor et al., 2014).

As incentive for participating in this study, participants were granted access to the content of the book Goodnight Mind (Carney & Manber, 2013) for the purposes of improving their self-identified sleep problems. In addition, participants received $10 upon completion of the pre-program measures and sleep logs, and $10 for completion of the post-program measures and sleep logs. There was no financial incentive provided for completing the screening process. Therefore, participants who completed the full study protocol received $20 compensation for their involvement. These incentives are outlined for participants in the consent form that they complete in the initial, screening phase of the study.

Analysis

  Quantitative analysis. All statistical analyses were performed using IBM's Statistical Package for the Social Sciences (SPSS; Version 21.0). Tests of assumptions of normality and homogeneity of variance were conducted, and the appropriate parametric or non-parametric analysis was conducted. An a priori decision was made to remove outliers that were three standard deviations or further from the mean.

  Qualitative analysis. The qualitative analysis was carried out within an inductive, realist approach, utilizing the participants' responses to discover the themes (Braun & Clarke, 2006). This analysis was done considering semantic themes - focusing on what the participants were expressing explicitly. No attempt was made to explore underlying ideas, or assumptions that the participants may have been making (Braun & Clarke, 2006). Qualitative analysis was conducted across questions, as opposed to separately for each individual question allowing for the identification of commonalities throughout the data (Toerien & Wilkinson, 2004).

Results

Demographics

Age and gender. The age of completers ranged from 18 to 29 years of age ($M = 23.17$, $SD = 2.60$, $Mdn = 23.00$, $n = 18$), the age of non-completers ranged from 19 to 26 years of age ($M = 21.38$, $SD = 2.13$, $Mdn = 21.00$, $n = 8$), and the age of non-starters ranged from 18 to 28 ($M = 21.68$, $SD = 3.00$, $Mdn = 21.00$, $n = 25$). A one-way independent ANOVA was conducted that indicated there were no group differences for age, $F(2, 48) = 1.92$, $p = .158$, $\eta^2 = .07$.

The majority of participants were female. For completers, 17 (94.44%) identified as female and one (5.55%) identified as male. For non-completers, six identified as female and two identified as male. For non-starters, 24 identified as female, and one identified as male.

Sleep quality. When asked to rate what kind of a "sleeper" they were, of the completers, nine (50%) rated themselves as being fair sleepers, seven (38.89%) rated themselves as being poor sleepers, and two (11.11%) rated themselves as having severe insomnia. Of the non-completers, four (50%) rated themselves as poor sleepers, three (37.55%) rated themselves as being fair sleepers, and one (12.50%) endorsed having good sleep. Of the non-starters, three (12%) rated themselves as being fair sleepers, 21 (84%) rated themselves as being poor sleepers, and one (4%) endorsed having severe insomnia.

The scores of completers on the ISI at screening ranged from 10 to 24 ($M = 15.67$, $SD = 4.23$, $Mdn = 15.00$). The scores of non-completers on the ISI at screening ranged from 12 to 18 ($M = 14.63$, $SD = 1.92$, $Mdn = 14.00$). The scores of non-starters on the ISI at screening ranged from 10 to 21 ($M = 16.20$, $SD = 3.25$, $Mdn = 16.00$). A one-way independent ANOVA was conducted that indicated that there were no group differences in ISI scores, $F(2, 48) = .629$, $p = .537$, $\eta^2 = .03$.

Technology. With regards to technology, all participants reported owning a smartphone. The amount of time completers reported spending online daily ranged from 3.00 to 16.00 hours ($M = 6.89$, $SD = 3.21$, $Mdn = 6.25$). The amount of time non-completers reported spending online daily ranged from 3.00 to 8.00 hours ($M = 5.56$, $SD = 1.76$, $Mdn = 5.25$). The amount of time non-starters reported spending online daily ranged from 3.50 to 15.00 ($M = 8.06$, $SD = 3.81$, $Mdn = 7.00$). The data was found to have issues with skew, kurtosis, and normality; therefore, it was most appropriate to utilize a non-parametric test to analyze the data. A Kruskal Wallis test was conducted that indicated that there were no group differences in amount of time spent online daily, $H(2) = 2.50$, $p = .286$, r = 0.07.

Of the hours spent online, the amount of time that completers reported spending on social media sites daily ranged from 0.50 to 10.00 hours ($M = 2.83$, $SD = 2.57$, $Mdn = 2.00$). The amount of time that non-completers reported spending on social media sites ranged from 1.00 to 7.00 hours ($M = 2.88$, $SD = 2.01$, $Mdn = 2.00$). The amount of time that non-starters reported spending on social media sites daily ranged from .50 to 15.00 hours ($M = 3.39$, $SD = 3.15$, $Mdn = 3.00$. A Kruskal Wallis test revealed that there were no group differences in amount of time spent on social media sites daily, $H(2) = .237$, $p = .888$, $r = 0.17$.

Completers reported being involved with the following ten different media sites: Facebook ($n = 18$), Instagram ($n = 12$), Pinterest ($n = 7$), LinkedIn ($n = 6$), Twitter ($n = 6$), Snapchat ($n = 4$), Tumblr ($n = 3$), Reddit ($n = 2$), Wordpress (n = 1), and GooglePlus (n = 1). Non-completers reported being involved with six social media sites: Facebook ($n = 7$), Instagram ($n = 3$), Twitter ($n = 3$), Pinterest ($n = 2$), Tumblr ($n = 2$), and LinkedIn ($n = 2$). Non-starters reported being involved with the following social media sites: Facebook ($n = 22$), Twitter ($n = 10$), Instagram ($n = 9$), LinkdIn ($n = 9$), Snapchat ($n = 7$), Pinterest ($n = 6$), Tumblr ($n = 5$),

Whatsapp ($n = 1$), Reddit ($n = 1$), Twitch ($n = 1$), and Rappad ($n = 1$).

Commuting. The amount of time completers reported spending commuting daily ranged from 15.00 to 120.00 minutes ($M = 56.67$, $SD = 24.61$, $Mdn = 60.00$). The amount of time non-completers reported spending commuting daily ranged from 30.00 to 150.00 minutes ($M = 75.71$, $SD = 41.27$, $Mdn = 60.00$). The amount of time non-starters reported spending commuting daily ranged from 15.00 to 90.00 minutes ($M = 44.23$, $SD = 20.56$, $Mdn = 45.00$). A Kruskal Wallis test revealed that there were no group differences in amount of time spent commuting daily, $H(2) = 4.93$, $p = .085$, $r = 0.21$.

Completers reported utilizing the following five different forms of transportation for commuting: Toronto Transit Commission (TTC; $n = 9$), Go Transit ($n = 3$), walking ($n = 1$), Uber ($n = 1$), and bicycle ($n = 1$). Non-completers reported commuting by TTC ($n = 8$) and Go Transit ($n = 1$). Non-starters reported utilizing five modes of transportation: TTC ($n = 17$), Go Transit ($n = 2$), walking ($n = 2$), car ($n = 2$), and MiWay ($n = 1$).

Living arrangements. With respect to living arrangements, of completers, roughly half ($n = 10$) reported living with family, roughly a quarter ($n = 4$) reported living with a romantic partner, four completers reported living with roommates, and none reported living on their own. Of non-completers, the majority ($n = 6$) reported living with family, two reported living with a romantic partner, and one reported living alone. Of non-starters, almost half ($n = 11$) reported living with family, roughly a third ($n = 7$) lived with roommates, almost a quarter ($n = 5$) reported living with a romantic partner, and one non-starter reported living alone.

The number of nights completers reported sharing their bed with a partner per week ranged from 0 to 7 nights ($M = 2.28$, $SD = 3.12$, $Mdn = 0.00$). The number of nights non-completers reported sharing their bed with a partner per week ranged from 0 to 7 nights ($M = $

1.75, *SD* = 3.24, *Mdn* = 0.00). The number of nights non-starters reported sharing their bed with a partner ranged from 0 to 7 nights (*M* = 2.32, *SD* = 3.22, *Mdn* = 0). A Kruskal Wallis test revealed that there were no group differences in number of nights sharing the beds with a bed partner, *H*(2) = .47, *p* = .791, *r* = 0.13.

In terms of sharing their bed with a pet, one completer reported sharing their bed with a pet seven nights a week. One non-completer reported sharing their bed with a pet two nights a week. Of the non-starters, four reported sharing their bed with a pet seven nights a week, and one reported sharing their bed with a pet four nights a week. Several participants reported taking medications to aid with sleep (see Table 1).

Table 1

Number of Participants Taking Medications to Aid With Sleep

	Prescription Medication			Over the Counter Medication
	Trazodone	Rhodiola	Imovane	Melatonin
Completers	1 (7)	0	0	0
Non-Completers	0	0	0	0
Non-Starters	1 (7)	1 (7)	1 (7)	1 (3)

Note. The number of nights per week the medication was reportedly taken is indicated in parentheses.

Academics and employment. Of the completers, roughly two-thirds (*n* = 12) identified as full-time students, and roughly a third (*n* = 3) reported being part-time students, and the remaining three completers reported being out of school for less than 12 months, or between studies. Within this group, four reported being fourth-year undergraduate students, three reported being third-year undergraduate students, one reported being a second-year undergraduate student, one reported being a first-year undergraduate student, three reported being graduate students, one reported being a college student, one reported taking extra courses, and one reported that taking courses towards a certificate. All the non-completers (*n* = 8) reported being

full-time students. Of this group, five reported being third-year undergraduate students, one reported being a first-year undergraduate student, one reported being a second-year undergraduate student, and one reported being a fourth-year undergraduate student. Of the non-starters, roughly two-thirds ($n = 19$) identified as full-time students, almost one-third ($n = 5$) identified as part-time students, and one non-starter reported being out of school for less than one year. Within this group, five reported being first-year undergraduate students, four reported being second-year undergraduate students, four reported being third-year undergraduate students, three reported taking extra courses, three reported being graduate students, two reported being between studies, two reported being a fourth-year undergraduate student, and one reported being a college student.

Participants received the program modules all at once; however, when queried regarding how they prefer receiving new information, participant responses indicated that they prefer receiving new information in a way that is structured for them to follow along, with information presented at regular intervals. Of completers, two-thirds ($n = 12$) reported preferring new information to be presented in a way that is already structured for them (e.g., receiving one module a week), and only one-third ($n = 6$) reported preferring new information to be presented in a way that would allow them to be in charge of how to integrate this new information, and being able to decide for themselves how much time to spend on various topics and sections (e.g., receiving module all at once). For the non-completers, just over half ($n = 5$) reported preferring the information to be presented in a way that is already structured for them (e.g., receiving one module a week), and almost half ($n = 3$) reported preferring to integrate new information themselves. Of the non-starters, just over half ($n = 15$) reported preferring new information to be presented in a way that is already structured for them, while one-third ($n = 8$) reported preferring

new information to be presented in a way that would allow them to be in charge of how to integrate this new information, and two non-starters did not indicate a preference in the presentation of new material.

The majority of participants reported working outside of school, with roughly two thirds of completers ($n = 14$) reporting working, just over half of non-completers (n = 5) reporting working, and roughly three-quarters ($n = 18$) of non-starters reporting working. The amount of time completers reported working per week ranged from 0 to 45.00 hours ($M = 21.82$, $SD = 14.79$, $Mdn = 17.50$). The amount of time non-completers reported working per week ranged from 5.00 to 30.00 hours ($M = 13.00$, $SD = 9.75$, $Mdn = 10.00$). The amount of time non-starters reported working per week ranged from 0 to 40.00 hours ($M = 13.82$, $SD = 11.09$, $Mdn = 12.50$). A Kruskal Wallis test revealed that there were no group differences in time working per week, $H(2) = 3.25$, $p = .197$, $r = 0.13$.

Reactions to the Program

Quantitative data. The primary area of interest was the reactions of participants to the program, including the level of acceptability endorsed by the participants regarding their experiences in the program. Acceptability was tested by measuring if, on average, completers rated the program as acceptable, as defined by endorsing a score on the TEQ of 20 or higher at post-program. Seventeen (94.44%) of the 18 completers endorsed a score of 20 or higher on the TEQ at post-program. The mean score for rating the acceptability of the program on the TEQ was 26.83 ($SD = 5.80$) out of a possible total of 35, with a mode of 27 and scores ranging from 16 to 35 (see Table 1 for a summary of the quantitative measures of reactions to the program).

For the satisfaction, helpfulness, and ease of understanding the program, it was tested if, on average, completers endorsed scores of 4 out of 7, or higher. For these three quantitative

questions, a score of 4 indicated that participants were *neutral* regarding whether: they were

satisfied with the program, the program was helpful or the program was easy to understand. A

score of 5 indicated that the program was *somewhat*: satisfying, helpful or easy to understand. A

score of 6 indicated that the program was *satisfying*, *helpful* or *easy to understand*. Finally, a

score of 7 indicated that the program was *very* satisfying, helpful or easy to understand.

The mean score for rating participants satisfaction with the program was 5.72 ($SD = 0.90$)

out of a possible total of 7, with a mode of 5 and scores ranging from 4 to 7. The mean score for

rating the helpfulness of the program was 5.28 ($SD = 0.96$) out of a possible total of 7, with a

mode of 5 and scores ranging from 4 to 7. The mean score for rating the ease of understanding

the program was 6.44 ($SD = 0.71$) out of a total possible of 7, with a mode of 7 and scores

ranging from 5 to 7 (see Table 1 for a summary of quantitative questions).

Table 2

Summary of Quantitative Measures of Reactions to the Program

Measures	Mean	Standard Deviation	Mode	Minimum	Maximum	Maximum Possible Score
TEQ	26.83	5.80	27	16	35	35
Satisfaction	5.72	.90	5	4	7	7
Helpfulness of program	5.28	.96	5	4	7	7
Ease of understanding	6.44	.71	7	5	7	7

Note. TEQ = Therapy Evaluation Questionnaire for Cognitive Behaviour Therapy for Insomnia.

Qualitative data. Qualitative data was analyzed for recurring themes (Crabtree & Miller,

1999) to organize and summarize the completers' responses to open-ended questions that queried

regarding reactions to the program. Completers were also questioned about which modules they

found most or least useful, and what devices they utilized to access the program. Due to the

small sample size, any point that was mentioned a minimum of twice was considered a theme. It

is possible that in a study with a larger sample size, these same themes would have a greater

amount of support. The questions queried participants regarding general comments about the program, and anything that they would suggest changing to make it more likely that someone like them would participate in the program, or make the program easier to understand. Responses to these questions are summarized below. Subthemes in all categories will be introduced beginning from the most represented to least represented.

The qualitative analysis yielded three main themes, with multiple subthemes. The main themes were: *benefits of the program*, *challenges of the program* and *possible additions or changes to the program*.

Benefits of the program. *Benefits of the program* contained ten subthemes.

Solid Program was supported by 13 responses. Participants stated that the program was a "great program" (Participant 878), "practical" (Participant 875), "logical" (Participant 824), and "useful" (Participants 875, 869, and 878). Participants stated that the readings were "grounded in empirical research" (Participant 889) and the "program brought up some good points in addressing my sleeping problems" (Participant 844). The program was described as having an "objective that is positive, to help people improve their sleep" (Participant 817). Participants expressed these overall positive comments about the program: "I enjoyed reading it" (Participant 875), "overall I liked it" (Participant 879), "I learned a lot" (Participant 817), and "liked how it was written" (Participant 847).

Easy to understand was supported by eight responses. Participants stated that the program was "easy to understand" (Participants 817, 875, 878, and 885), and that it was "easy to understand the modules" (Participant 824). One participant expressed that, "I thought the writer made it easy to understand and follow along with all the instructions" (Participant 834). Other responses included: "content was easily understandable" (Participant 889) and "the suggestions

made sense and were not hard to apply" (Participant 824).

Helpful approach was supported by seven responses from six participants, with one participant reporting that positives of the program included the program's "CBT approach" and how the program allowed them to "recognize cognitive distortions" (Participant 847), and another participant expressing that " scheduling a consistent sleep schedule was very helpful" (Participant 821). Participants also stated that they "liked the summaries" (Participant 834), and found the "recapping of everything in the module" to be useful (Participant 824). Further comments included: the program "presented strategies that are relevant to my sleep disturbance (e.g., worries before going to bed, beliefs about not getting enough sleep)" (Participant 889), and "some great techniques and tips will definitely come in handy" (Participant 879).

Positive impact on sleep was supported by six responses by four participants. Participant 874 stated that, "I found it amazing how dramatically I was able to sleep if I were to spend a whole day studying away from my bed than if I were to study in my bed." Two participants noted that "the logs helped me to track my patterns and realize that I don't sleep as well as I think" (Participant 817), and the program "allowed me to sleep more without frequent wakenings" (Participant 878). Participant 885 expressed that, "The information I had learned in this module was extremely helpful in minimizing my insomnia" (Participant 885). Participants stated that the program "allowed me to look at my sleeping patterns and find some solutions to it" (Participant 878), and it "allowed me to think of my sleeping habits and mentioned things I may not have thought of before" (Participant 879).

Clarity of information was supported by three responses. Participants stated that: "it was all very clear" (Participant 805), the information was "very straight and to the point" (Participant 885), and "I liked how clearly the modules were written" (Participant 889).

Manageable length was supported by responses from three responses. Participants expressed that the "reading were fairly short" (Participant 878), and that the program was a "manageable length" (Participant 869). Participant 889 expressed that, "I also liked the length of each module (not too long or time-consuming)."

Enjoyable research experience was supported by two responses. Participants stated that they "loved this research program" (Participant 869), and it was a "fun study" (Participant 817).

Relaxation is important was supported by two responses. Participants stated that the "chapter about taking quiet time in the evening and relaxing is really useful" (Participant 834) and that the program includes "really good tips about relaxation as well as ways to wind down at night" (Participant 817).

Finally, a *miscellaneous positive* theme was created to capture the responses that appeared only one time. Since the sample size for this study is quite small, it is possible that these responses would be independent themes in a study with a larger sample size; therefore, it is important to capture these responses. Participants expressed that they "appreciated the textbook format" (Participant 821), and "good reminder to read through the material" (Participant 884). Participants expressed that some of the benefits of the program included that it was "available online " (Participant 878), it was an "additional tool" (Participant 805), and they "liked how each chapter covered a different topic but still related back to previous chapters" (Participant 885).

Challenges of the program. *Challenges of the program* contained five subthemes.

Too long was supported by five responses. Participants described the program as "too much to read" (Participant 805), "very lengthy" (Participant 817), "a bit too long" (Participant 849). Participants suggested there should be "less material" (Participant 805), and to "make each module shorter, so that it is more manageable" (Participant 869).

Personal challenges was supported by five responses. One participant stated that the program was challenging, because it called for an "entire lifestyle change" (Participant 824) and one participant stated that they were in a "major location transition so I was not able to apply many of the principles well" (Participant 847). Another participant noted that, "I need more motivation", "I need due dates and a schedule to motivate myself to do things", and that they found it "difficult to remember to use the information on a daily basis, especially if the information was read in the morning" (Participant 858).

Dry material was supported by three responses. Participants indicated: the modules "did not captivate my interest" (Participant 805); "modules weren't the most interesting" (Participant 817); and "some of the modules were a bit boring content wise" (Participant 879).

Limited access was supported by two responses. Participants stated it was challenging for them to "not have the modules anymore" (Participant 817), and that they would like "unlimited access to the information post-study so that [they] can continue to refer to it" (Participant 821).

Finally, a *miscellaneous challenges* theme was created to capture the responses that appeared only one time. As previously discussed in relation to the *miscellaneous positive* theme, it is important to capture these responses, because it is possible that these responses would be independent themes in a study with a larger sample size. The *miscellaneous challenges* theme consisted of: "modules were repetitive" (Participant 824); and "hard to remember diaries, hard to think of what time to enter" (Participant 849); "not much new information" (Participant 858); "some pointers from the modules resulted in me straying from my sleep routine and delaying my bedtime" (Participant 858); "I do not like that it was self-regulated" (Participant 874), and "I did not like that the pages varied in length" (Participant 875).

Possible additions or changes to the program. *Possible additions or changes to the*

program contained two subthemes.

Possible additions was supported by 15 responses. Several participants expressed that the program could benefit from diagrams (Participants 849, 878, and 879), pictures or pictograms (Participants 863 and 879), and examples (Participant 878) or "examples from real people" (Participant 874). The addition of reminders being beneficial was supported by two participants, with Participant 858 sharing that it would be beneficial to "maybe send multiple emails and weekly reminders with a new module," and Participant 889 stating that, "I would have liked having reminders to read and keep up with the modules." Participant 885 suggested that, "it might be helpful for you to include a chapter on resources for individuals with severe insomnia." Participants 889 suggested that, "questions at the end of each module to test the reader's understanding of the material would have been helpful." Participant 884 suggested that, "an indication on the module denoting 'you have already completed this module' would have been helpful." Finally, participant 849 suggested the inclusion of "more studies on proven sleep tricks, for example weighted blankets and magnesium citrate." Visual changes were suggested by participant 879 who suggested that "changing the font and making it brighter would have helped when reading it," and participant 885 who shared that "perhaps bullet points as opposed to an essay structure" would be beneficial.

Alternate format options, was supported by eight responses. Participants stated that the program should be available in "book form, so I can carry it with me while I transit places" (Participant 821). Two other participants suggested that the program should be available as a book. Participant 805 expressed that "my interest would be to read a book on the subject if the results show success," and Participant 878 shared that "making the book available hard copy would be useful because even if we wanted to read a chapter in the middle of the night, we do

not have to open our computer." Other participants suggested that the program be "presented in video format as well" (Participant 834) or exclusively (Participant 863), available as a "PDF" (Participant 847), or formatted differently, with "all modules on the same page" (Participant 824), or with each "page… a similar length" (Participant 875).

    Modules. Completers ($n = 18$) were also queried regarding which modules they found most useful, and which modules they found to be the least useful. Participants were able to indicate multiple modules in either category (see Table 3 for a summary of the results). Modules that were endorsed as being most useful will be listed beginning from most endorsed to least endorsed. Module 7: The Difference Between how a Good Sleeper and a Poor Sleeper Think, and How to Think Like a Good Sleeper was endorsed by nine participants as being a most useful module. Module 1: Key Concepts Responsible for Production of Sleep, Sleep Drive, and Manipulating One's Sleep Drive and Module 6: Strategies for Reducing Worries in Bed were each endorsed by five participants as being among the most useful modules. Module 2: Identifying Your Optimal Sleep Schedule and Module 5: Relaxation Techniques were both endorsed by four participants as being among the most useful modules. The remaining three modules, Module 3: Reducing Mental Activity Before Bed, Module 4: Creating a Quiet Time in the Evening and Module 8: Targeting Daytime Worry, Challenging Unhelpful Beliefs About Sleep, and the Importance of Being Open and Accepting About Improving Your Sleep were each endorsed by three participants as being among the most useful modules.

    With regards to modules that were found to be the least useful, Module 2: Identifying Your Optimal Sleep Schedule was endorsed by five participants as being among the least useful modules. Module 1: Key Concepts Responsible for Production of Sleep, Sleep Drive, and Manipulating One's Sleep Drive and Module 4: Creating a Quiet Time in the Evening were each

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endorsed by four participants as being among the least useful modules. Module 7: The Difference Between how a Good Sleeper and a Poor Sleeper Think, and How to Think Like a Good Sleeper was endorsed by two participants as being among the least useful modules. The remaining four modules were endorsed as being among the least useful modules by one participant, including: Module 3: Reducing Mental Activity Before Bed; Module 5: Relaxation Techniques; and Module 6: Strategies for Reducing Worries in Bed; and Module 8: Targeting Daytime Worry, Challenging Unhelpful Beliefs About Sleep, and the Importance of Being Open and Accepting About Improving Your Sleep.

Table 3

Summary of Number of Participants who Endorsed Modules as Being Most or Least Useful

	Number of participants who endorsed module as being most useful	Number of participants who endorsed module as being least useful
Module 1: Sleep Drive	5	4
Module 2: Sleep Schedule	4	5
Module 3: Pre-Sleep Mental Activity	3	1
Module 4: Creating Quiet Time	3	4
Module 5: Relaxation Techniques	4	1
Module 6: Reducing Night Time Worries	5	1
Module 7: Thinking Like a Good Sleeper	9	2
Module 8: Reducing Day Time Worries	3	1

Note. Shortened titles have been utilized in this table. Full module titles are as follows: Module 1 = Key Concepts Responsible for Production of Sleep, Sleep Drive, and Manipulating One's Sleep Drive; Module 2 = Identifying Your Optimal Sleep Schedule; Module 3 = Reducing Mental Activity Before Bed; Module 4 = Creating a Quiet Time in the Evening; Module 5 = Relaxation Techniques; Module 6 = Strategies for Reducing Worries in Bed; Module 7 = The Difference Between how a Good Sleeper and a Poor Sleeper Think, and How to Think Like a Good Sleeper; Module 8 = Targeting Daytime Worry, Challenging Unhelpful Beliefs About Sleep, and the Importance of Being Open and Accepting About Improving Your Sleep.

Devices utilized and intention to utilize program in future. Participants were asked on what device(s) they accessed the program, and if they would have preferred to access the

program utilizing a different device. Nineteen participants answered the questions regarding devices used to access the program, and three participants reported accessing the program on more than one type of device. All participants reported that the way in which they accessed the program was their preferred way to access the program, and several participants reported utilizing more than one device to access the program. The most popular device for accessing the program was by laptop, with just over half ($n = 10$) of participants reporting that they accessed the program by laptop. In addition, roughly one-third ($n = 6$) utilized a smartphone to access the program, almost a quarter ($n = 4$) utilized a desktop computer to access the program, and two participants reported accessing the program by tablet. Completers ($n = 18$) were asked if they would utilize the information from this program in the future if they were to experience sleep problems again, roughly two-thirds ($n = 13$) said they would, and almost one-third ($n = 5$) of completers said they might. No participants reported that they would not utilize the information in this program should a similar problem arise in the future.

Feedback from participants who withdrew from the study. Of the participants who discontinued their participation in the study, eight participants completed the short survey regarding why they decided to not move forward with the study (see Appendix V). The survey included two questions, one that allowed them to select one or more of five reasons listed as to why they had decided to not continue with the study, and one open-ended question where they were invited to suggest ways in which the program could be altered to make someone like them more likely to utilize the program. *I feel like the program would take too much time* was indicated as a reason for discontinuing their participation in the study by just over a third ($n = 3$) of the participants. *Improving my sleep is not a priority at this time*, *I am not confident I could make this change*, and *I do not have the time right now* were all indicated by a quarter ($n = 2$) of

participants who completed this survey as to why they discontinued their participation in the program. The option *I do not have easy access to a computer/smartphone* was not indicated by any participants who completed this survey as a reason for discontinuing their participation in the program.

Four of the eight participants who completed this survey offered their thoughts on what could be altered to make someone like them more likely to complete the program.

> *Program content seems good but the length of the program is too big. Especially the book modules which is asked to finish after sleep diaries.*
>
> (Participant 880)

> *My main issue was the fact that I had to read and follow up over a long period of time. Personally, I would have preferred to have been given everything in one chunk to complete over one sitting.*
>
> (Participant 805)

> *Shorten the questionnaire. I do want to participate, but not interested in answering redundant questions.*
>
> (Participant 853)

> *I think the questions didn't seem entirely relevant and it was hard for me to record my sleeping pattern.*
>
> (Participant 831)

However, one participant expressed that nothing needs to be changed with the program.

> *No, my sleep habits greatly improved after we moved so I no longer needed the sleep assistance.*
>
> (Participant 826)

Knowledge Acquisition

Knowledge acquisition was analyzed by testing, if on average, completers demonstrated adequate knowledge acquisition, as defined by answering 50% or more of the questions on the

CBT-I-KQ accurately. The mean score for knowledge acquisition for completers was 19.39 (*SD* = 3.48), with a mode of 18 and scores ranging from 14 to 25. Knowledge acquisition was measured on a scale that had 28 as the highest possible total. On average, completers retained more knowledge, with scores ranging from 14 to 25 (*M* = 19.39, *SD* = 3.48) than non-completers, with scores ranging from 8 to 21 *(M* = 13.13, *SD* = 3.83). This difference, 6.26, BCA 95% CI [3.12, 9.41] was significant, *t*(24) = 4.11, *p* < .001, *r* = .64.

Behaviours

It was hypothesized that there would be a difference in scores between those with a low level of engagement versus those with a high level of engagement on measures of adherence (into bed variability, out of bed variability, and SHP). Engagement was measured by an aggregate score comprised of the number of modules completed and the score on the CBT-I-KQ. Participants were divided into low and high engagement by utilizing a median split of this aggregate score.

Into bed variability. At pre-program, into bed variability values for participants with lower engagement ranged from 1.75 to 9.00 (*M* = 4.40, *SD* = 2.22). At post-program, into bed variability values for participants with lower engagement ranged from 1.00 to 5.00 (*M* = 2.63, *SD* = 1.80). A related-samples Wilcoxon signed-rank test revealed that for those less engaged in the program, into bed variability was significantly reduced from pre-program (*Mdn* = 4.00) to post-program (*Mdn* = 2.25), *T* = 4.00, *p* = .050, *r* = -.69.

At pre-program, into bed variability values for participants with higher engagement ranged from 1.50 to 4.75 (*M* =3.58, *SD* = 1.06). At post-program, into bed variability values for participants with higher engagement ranged from 0.75 to 7.00 (*M* = 3.35, *SD* = 2.22). A related-samples Wilcoxon signed-rank test revealed that, for those highly engaged in the program, into

bed variability was not significantly different from pre-program (*Mdn* = 4.00) to post-program (*Mdn* = 3.09), *T* = 45.00, *p* = .972, *r* = .01.

Out of bed variability. At pre-program, out of bed variability values for participants with lower engagement ranged from 3.25 to 6.67 (*M* = 4.62, *SD* = 0.93), At post-program, out of bed variability values for participants with lower engagement ranged from 0.50 to 6.00 (*M* = 3.63, *SD* = 1.77). A related-samples Wilcoxon signed-rank test revealed that for those less engaged in the program, out of bed variability was not significantly different from pre-program (*Mdn* = 4.50) to post-program (*Mdn* = 4.29), *T* = 8.50, *p* = .183, *r* = -.47.

At pre-program, out of bed variability values for participants with higher engagement ranged from 1.42 to 11.50 (*M* = 4.36, *SD* = 2.59). At post-program, out of bed variability values for participants with higher engagement ranged from 1.16 to 9.50 (*M* = 4.41, *SD* = 2.24). A related-samples Wilcoxon signed-rank test revealed that for those highly engaged in the program, out of bed variability was not significantly different from pre-program (*Mdn* = 4.08) to post-program (*Mdn* = 3.75), *T* = 46.50, *p* = .944, *r* = .02.

Sleep hygiene. At pre-program, SHP scores for participants with lower engagement ranged from 23.00 to 59.00 (*M* = 39.77, *SD* = 11.33), At post-program, SHP scores for participants with lower engagement ranged from 21.00 to 72.00 (*M* = 35.62, *SD* = 13.17), A related-samples Wilcoxon signed-rank test revealed that for those less engaged in the program, SHP scores were not significantly different from pre-program (*Mdn* = 37.00) and post-program (*Mdn* = 33.00), *T* = 21.50, *p* = .169, *r* = -.38.

At pre-program, SHP scores for participants with higher engagement ranged from 11.00 to 49.00 (*M* = 35.54, *SD* = 11.69). At post-program, SHP scores for participants with higher engagement ranged from 16.00 to 42.00 (*M* = 30.31, *SD* = 7.96). A related-samples Wilcoxon

signed-rank test revealed that for those highly engaged in the program, SHP scores were not significantly different from pre-program (*Mdn* = 38.00) to post-program (*Mdn* = 28.00), *T* = 23.00, *p* = .115, *r* = -.44.

Possible Predictors

Acceptability. It was hypothesized that participant characteristics and psychological characteristics would predict acceptability as captured on the post-TEQ. Two separate variables were analyzed for participant characteristics (age, and average time spent online daily) and three separate variables were analyzed for psychological characteristics (stress, quality of life, and self-efficacy for sleep). The participant characteristic variables were chosen due to interest in investigating whether they functioned as predictors; therefore these analyses would be considered more exploratory in nature. Although participants were fairly close in age (ranging from 18 to 30 years old), possibly participants closer to the upper age limit may have become more accustomed to the new roles and life stressors that young adults experience during this time of transition (Lemma et al., 2012; Vela-Bueno et al., 2009). This may in turn result in those closer to the upper age limit being more able to complete an 8-week program. With regards to average time spent online daily, it was considered as possible that those who spend more time online daily may be more comfortable accessing a program online, and thus more likely to complete such a program. With regards to the psychological characteristics, stress was chosen as a possible predictor based on the results of a previous study that found that tension and stress accounted for 25% of the variance on a measure of sleep quality in college students aged 17 to 24 (Lund, Reider, Whiting, & Prichard, 2010). Quality of life was chosen as a potential predictor, because quality of life, including emotional, physical, and social components, has been associated with improvement on a measure of sleep quality with an adult population

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(Houdenhove, Buyse, Gabriëls, & Bergh, 2011). Self-efficacy for sleep was chosen as a potential

predictor due to the fact that previous research has found sleep locus of control mediated the

severity of insomnia in adults in computer delivered CBT-I (Vincent, Walsh, & Lewycky, 2010).

At post-program, TEQ scores ranged from 16.00 to 35.00 ($M = 26.04$, $SD = 5.52$). The

descriptive statistics for the participant characteristic being considered as potential predictors

were as follows: age of participants ranged from 18 to 29 years of age ($M = 22.52$, $SD = 2.57$),

and time spent online daily ranged from 3.00 to 10.00 hours ($M = 6.10$, $SD = 2.17$). One

participant's average amount of time spent online daily was eliminated, as it was beyond three

times the standard deviation from the mean. The descriptive statistics for the psychological

characteristics and symptoms being considered as potential predictors were as follows: Q-LES-

QSF scores ranged from 31.00 to 64.00 ($M = 47.65$, $SD = 8.46$), DASS Stress scores ranged from

6.00 to 32.00 ($M = 19.38$, $SD = 7.91$), and S-ES scores ranged from 12.00 to 36.00 ($M = 22.42$,

$SD = 6.14$).

Multiple regression, utilizing the forced entry method, was used to test if either of the

participant characteristics significantly predicted TEQ at post-program. The results of the

regression indicated that neither of the potential predictors significantly explain the variance of

the post-program TEQ, $R^2 = 0.018$, $F(2, 22) = .205$, $p = .816$. It was revealed that the two

proposed predictor variables did not significantly predict TEQ scores (see Table 4). For a

summary of the correlations of variables utilized in the regression analysis, see Table 5.

Table 4

Coefficients Values from Regression Analysis

Variable	B	t	p
Age	-0.148 (-1.09, 0.80)	-0.32	.748
Time spent online	-0.319, (-1.44, 0.80)	-0.59	.561

Note. Confidence intervals noted in parentheses. Degrees of freedom for *t*-test = 22.

Table 5

Summary of Correlations of Variables Utilized in Regression Analysis

	Post-TEQ	Age	Online Daily
Post-TEQ	1.00	-0.05	-0.12
Age		1.00	-0.14
Online Daily			1.00

Note. All correlations were found to be non-significant. TEQ = Therapy Evaluation Questionnaire for Cognitive Behaviour Therapy for Insomnia.

Multiple regression, utilizing the forced entry method, was used to test if any of the psychological characteristics significantly predicted TEQ at post-program. The results of the regression indicated that none of the potential predictors significantly explain the variance of the post-program TEQ, $R^2 = 0.064$, $F(3, 22) = 0.51$, $p = .683$. It was revealed that the three proposed predictor variables did not significantly predict TEQ scores (see Table 6). For a summary of the correlations of variables utilized in the regression analysis, see Table 7.

Table 6

Coefficients Values from Regression Analysis

Variable	B	*t*	*p*
Q-LES-QSF	-0.17 (-0.50, 0.17)	-1.05	.306
DASS Stress	-0.05 (-0.41, -.31)	-0.29	.778
S-ES	0.10, (-0.29, 0.49)	0.54	.593

Note. Q-LES-QSF = Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form; DASS Stress= Depression Anxiety Stress Scales, Stress Subscale, S-ES = Self-Efficacy for Sleep Scale. Confidence intervals noted in parentheses. Degrees of freedom for *t*-test = 22.

Table 7

Summary of Correlations of Variables Utilized in Regression Analysis

	Post-TEQ	Q-LES-QSF	DASS Stress	S-ES
Post-TEQ	1.00	-.222	.081	.113
Q-LES-QSF		1.00	-.548*	-.027
DASS Stress			1.00	.093
S-ES				1.00

Note. TEQ = Therapy Evaluation Questionnaire for Cognitive Behaviour Therapy for Insomnia; Q-LES-QSF = Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form; DASS

Stress= Depression Anxiety Stress Scales, Stress Subscale, S-ES = Self-Efficacy for Sleep Scale.
* This relationship is statistically significant at the $p = .05$ level (one-tailed).

Knowledge acquisition. It was hypothesized that participant characteristics and

psychological characteristics would predict knowledge acquisition as captured on the CBT-I-KQ.

Two separate variables were analyzed for participant characteristics (age, and time spent online)

and three separate variables were analyzed for psychological characteristics (stress, quality of

life, and self-efficacy for sleep).

The CBT-I-KQ scores were converted to scores out of 8, and scores ranged from 2.29 to

7.14 ($M = 4.99$, $SD = 1.31$). The descriptive statistics for the participant characteristic being

considered as potential predictors were as follows: age of participants ranged from 18 to 29 years

of age ($M = 22.52$, $SD = 2.57$), and time spent online daily ranged from 3.00 to 10.00 hours ($M =$

6.10, $SD = 2.17$). One participant's amount of time spent online was eliminated, as it was beyond

three times the standard deviation from the mean. The descriptive statistics for the psychological

characteristics and symptoms being considered as potential predictors were as follows: Q-LES-

QSF scores ranged from 31.00 to 64.00 ($M = 47.65$, $SD = 8.46$), DASS Stress scores ranged from

6.00 to 32.00 ($M = 19.38$, $SD = 7.91$), and S-ES scores ranged from 12.00 to 36.00 ($M = 22.42$,

$SD = 6.14$).

Multiple regression, utilizing the forced entry method, was used to test if either of the

participant characteristics significantly predicted CBT-I-KQ. The results of the regression

indicated that neither of the potential predictors significantly explain the variance of knowledge

acquisition, $R^2 = 0.213$, $F(2, 22) = 2.97$, $p = .072$. It was revealed that the two proposed predictor

variables did not significantly predict CBT-I-KQ scores (see Table 8). For a summary of the

correlations of variables utilized in the regression analysis, see Table 9.

Table 8

Coefficients Values from Regression Analysis

Variable	B	*T*	*p*
Age	0.19 (-0.01, 0.40)	1.96	.063
Time spent online	0.20, (-0.04, 0.45)	1.70	.102

Note. Confidence intervals noted in parentheses. Degrees of freedom for *t*-test = 22.

Table 9

Summary of Correlations of Variables Utilized in Regression Analysis

	CBT-I-KQ	Age	Online Daily
CBT-I-KQ	1.00	.33	.27
Age		1.00	-1.37
Online Daily			1.00

Note. All of these relationships were found to be non-significant. CBT-I-KQ = Cognitive Behaviour Therapy for Insomnia Knowledge Questionnaire

Multiple regression, utilizing the forced entry method, was used to test if any of the psychological characteristics and symptoms significantly predicted CBT-I-KQ. The results of the regression indicated that none of the potential predictors significantly explain the variance of the knowledge acquisition, $R^2 = 0.02$, $F(3, 22) = 0.15$, $p = .927$. It was revealed that the three proposed predictor variables did not significantly predict CBT-I-KQ scores. See Table 10 for details). For a summary of the correlations of variables utilized in the regression analysis, see Table 11.

Table 10

Coefficients Values from Regression Analysis

Variable	B	*T*	*p*
Q-LES-QSF	-0.01 (-0.09, 0.07)	-0.32	.754
DASS Stress	-0.02 (-0.11, 0.07)	-0.45	.656
S-ES	-0.02, (-0.11, 0.07)	-0.46	.654

Note. Q-LES-QSF = Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form; DASS Stress= Depression Anxiety Stress Scales, Stress Subscale, S-ES = Self-Efficacy for Sleep Scale. Confidence intervals noted in parentheses. Degrees of freedom for *t*-test = 22.

Table 11

Summary of Correlations of Variables Utilized in Regression Analysis

	CBT-I-KQ	Q-LES-QSF	DASS Stress	S-ES
CBT-I-KQ	1.00	-.02	-.08	-.11
Q-LES-QSF		1.00	-.548*	-.027
DASS Stress			1.00	.093
S-ES				1.00

Note. CBT-I-KQ = Cognitive Behaviour Therapy for Insomnia Knowledge Questionnaire; Q-LES-QSF = Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form; DASS Stress= Depression Anxiety Stress Scales, Stress Subscale, S-ES = Self-Efficacy for Sleep Scale. * This relationship is statistically significant at the $p = .05$ level (one-tailed).

Outcome Measures

To test the fifth hypothesis, sleep outcomes were investigated for feasibility as future outcome measures to study if a similar program is repeated in the future. The outcome measures of interest in this study were: subjective insomnia symptom severity as captured by the ISI, beliefs related to sleep as captured by the DBAS-16, and TWT as captured by the CSD.

ISI. Pre-program, for completers, ISI scores ranged from 10.00 to 24.00 ($M = 15.67$, $SD = 4.23$), and for non-completers, ISI scores ranged from 12.00 to 18.00 ($M = 14.63$, $SD = 1.92$). A Mann-Whitney test was conducted that indicated that pre-program, ISI scores of completers ($Mdn = 15.00$) were not significantly different from ISI scores of non-completers ($Mdn = 14.00$), $U = 62.50$, $z = -.531$, $p = .605$, $r = -.104$.

Post-program, ISI scores for completers ranged from 3.00 to 18.00, and for non-completers, ISI scores ranged from 7.00 to 17.00. An independent t-test was performed, which indicated that completers had lower ISI scores ($M = 9.28$, $SD = 3.79$) than non-completers ($M = 11.63$, $SD = 3.62$). This difference, -2.347, BCa 95% CI [-5.626, 0.932], was not significant $t(24) = -1.48$, $p = .153$, $r = 0.29$.

DBAS-16. Pre-program, DBAS-16 scores for completers ranged from 2.75 to 7.21, and

for non-completers, DBAS-16 scores ranged from 3.06 to 10.00. An independent *t*-test indicated that completers had lower DBAS-16 scores (*M* = 5.50, *SD* = 1.35) than non-completers (*M* = 6.41, *SD* = 1.91). This difference, -0.100, BCa 95% CI [-2.256, 0.437], was not significant *t*(24) = -1.39, *p* = .176, *r* = 0.27.

Post-program, DBAS-16 scores for completers ranged from 1.56 to 7.21, and for non-completers, DBAS-16 scores ranged from 1.38 to 6.94. An independent *t*-test indicated that completers had lower DBAS-16 scores (*M* = 4.36, *SD* = 2.02) than non-completers (*M* = 4.99, *SD* = 1.79). This difference, -0.627, BCa 95% CI [-2.341, 1.088], was not significant *t*(24) = -0.76, *p* = .458, *r* = 0.15.

TWT. Pre-program, TWT values for completers ranged from 0.13 to 3.13 hours, and for non-completers, TWT values ranged from 0.19 to 0.84 hours. An independent *t*-test indicated that completers had higher TWT values (*M* = 1.41, *SD* = 0.79) than non-completers (*M* = 0.60, *SD* = 0.36). This difference, 0.81, BCa 95% CI [0.011, 1.234], was significant, *t*(24) = 2.10, p = .046, r = 0.39.

Post-program, TWT values for completers ranged from 0.22 to 3.13 hours (*M* = 0.94, *SD* = 0.61), and TWT values for non-completers ranged from 0.25 to 0.57 hours (*M* = 0.36, *SD* = 0.18). A Mann-Whitney test was conducted that indicated that post-program, TWT values for completers (*Mdn* = 0.80) were significantly different from TWT values of non-completers (Mdn = 0.26), *U* = 4.00, *z* = -2.31, *p* = .017, *r* = -.50.

TWT of 60 minutes or less is considered to be normative (i.e., a combined SOL of 30 minutes or less and wake after sleep onset of 30 minutes or less; Schutte-Rodin et al., 2008). At post-program, 72.22% (*n* = 13) of completers had a mean TWT below 60 minutes, and 100% (n = 3) of non-completers had a mean TWT of 60 minutes or less. By post-program, four of the 18

completers (22.22%) achieved a 50% drop in TWT, and 14 of the completers (77.78%) did not achieve a 50% drop in TWT.

Since TWT was the primary value of interest, the data was also analyzed visually utilizing a case series design. The TWT data, for all completers and non-completers, are summarized in Figures 1 through 21. For completers ($n = 18$), the data reflected that, two-thirds of participants ($n = 12$) experienced a reduction in their mean TWT, less than one-third of participants ($n = 5$) experienced an increase in their mean TWT, and one participant experienced no change in their mean TWT. Of the completers who experienced an increase in their mean TWT ($n = 5$), two of these participants experienced increases of an amount less 6 minutes. For completers, just over one-third ($n = 7$) experienced a reduction in their mean TWT of 30 minutes or more. For non-completers ($n = 3$), the data reflected that two participants experienced a reduction in their mean TWT, and one experienced an increase in their mean TWT. For the non-completer who experienced an increase in their mean TWT, the increase was of less than 4 minutes. One non-completer experienced a reduction of their mean TWT that was greater than 30 minutes.

When conducting a case-series analysis, considering the change in level can also be informative (Kazdin, 1982). Change in level is derived by dividing the initial data point post-intervention by the final data point pre-intervention in order to obtain a ratio that indicates whether the initial post-intervention data point is above or below the final pre-intervention data point (Kazdin, 1982). A change in level above 1.00 indicates an increase in the data points from pre- to post intervention, and a change in level below 1.00 indicates a decrease in the data points from pre- to post-intervention. A change in level of 1.00 indicates that the final pre-intervention score and the initial post-intervention score are equal. For completers, just over half ($n = 10$)

experienced a change in level of less than 1.00, meaning that the initial post-program data point

for TWT was below the final pre-program data point for TWT. Just over one-third ($n = 7$) of

completers experienced a change in level of greater than 1.00, meaning that the initial data point

post-program for TWT was above the final pre-program data point for TWT. Finally, one

completer had no change in level from pre- to post-program. For non-completers, one

experienced a change in level of less than 1.00, meaning that the initial post-program data point

for TWT was below the final pre-program data point for TWT. Two non-completers experienced

a change in level of greater than 1.00, meaning that the initial post-program data point for TWT

was above the final pre-program data point for TWT.

Visual inspection of the graphs of multiple time points allows for the appreciation of how

quickly a change may occur after an intervention (Kazdin, 1982). If the change can be seen

visually immediately following the intervention, this is referred to as having short latency of

change. This rapidity of change can add support to whether an intervention can be viewed as

having contributed to a change in the variable in question. However, this rapidity of change can

be difficult to appreciate, considering that data are often quite variable (Kazdin, 1982). Visual

inspection of Figures 1 through 21 of the daily TWT indicates that there are just over one-third

of completers (Figures 2, 3, 4, 6, 7, 12, 14, and 17) and one non-completer (Figure 21) for whom

their TWT data may be consistent with short latency of change.
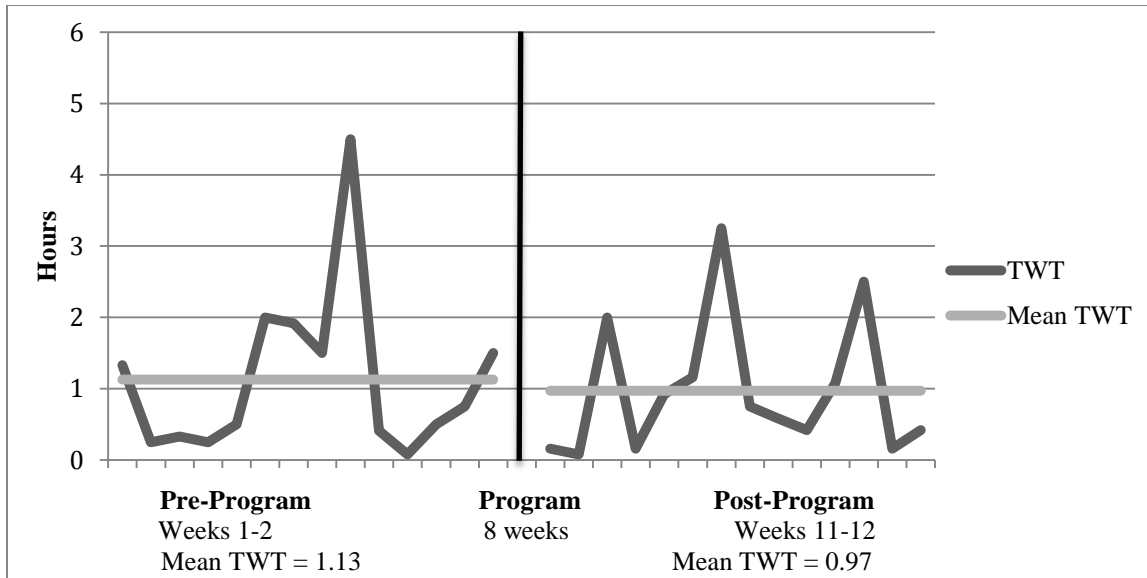
Figure 1. Daily TWT for Participant 805. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.11.
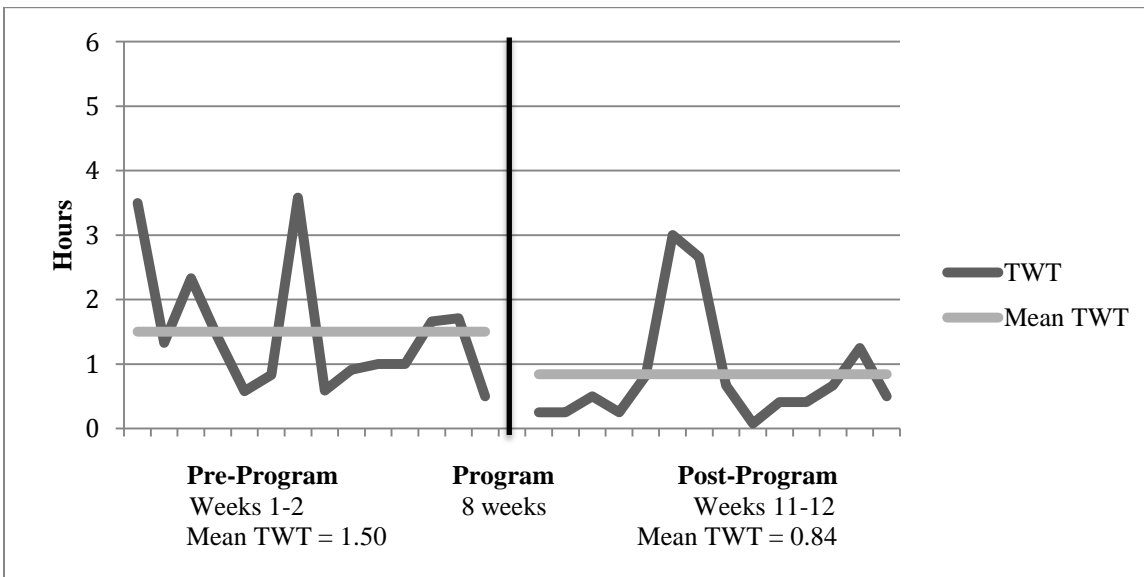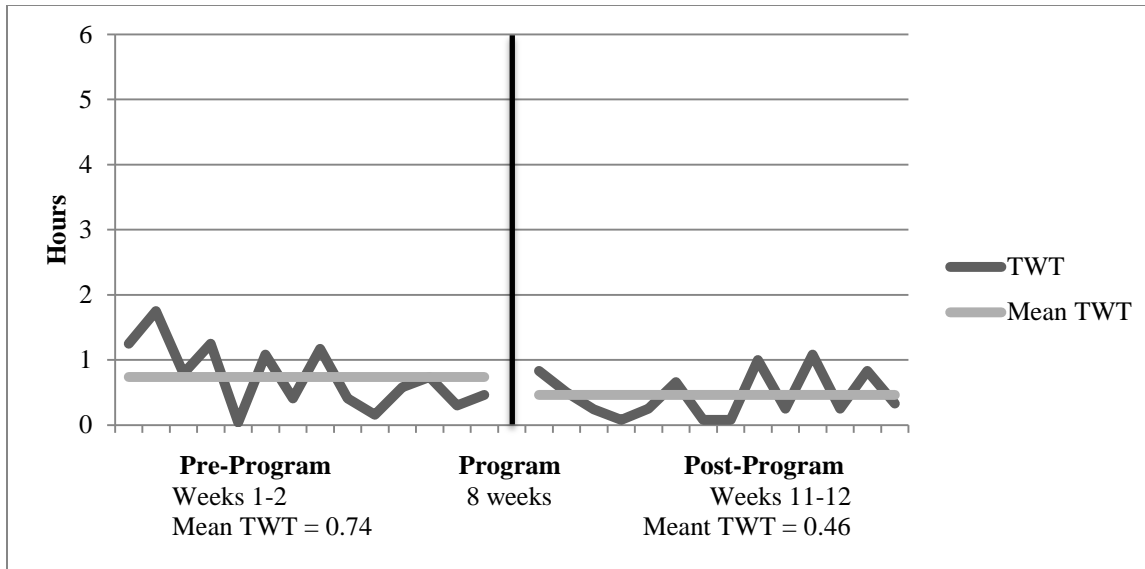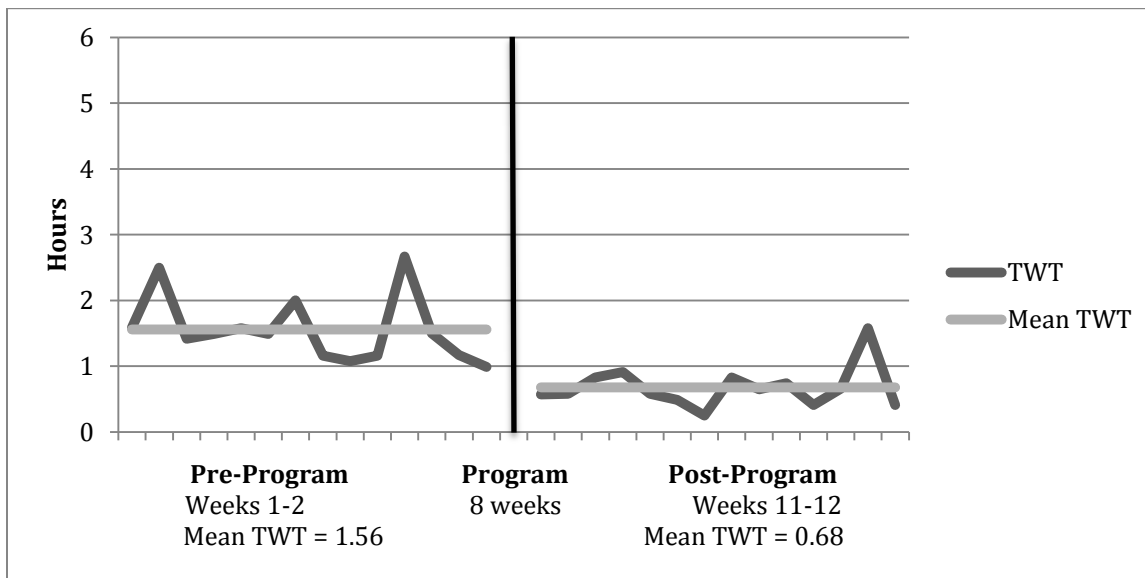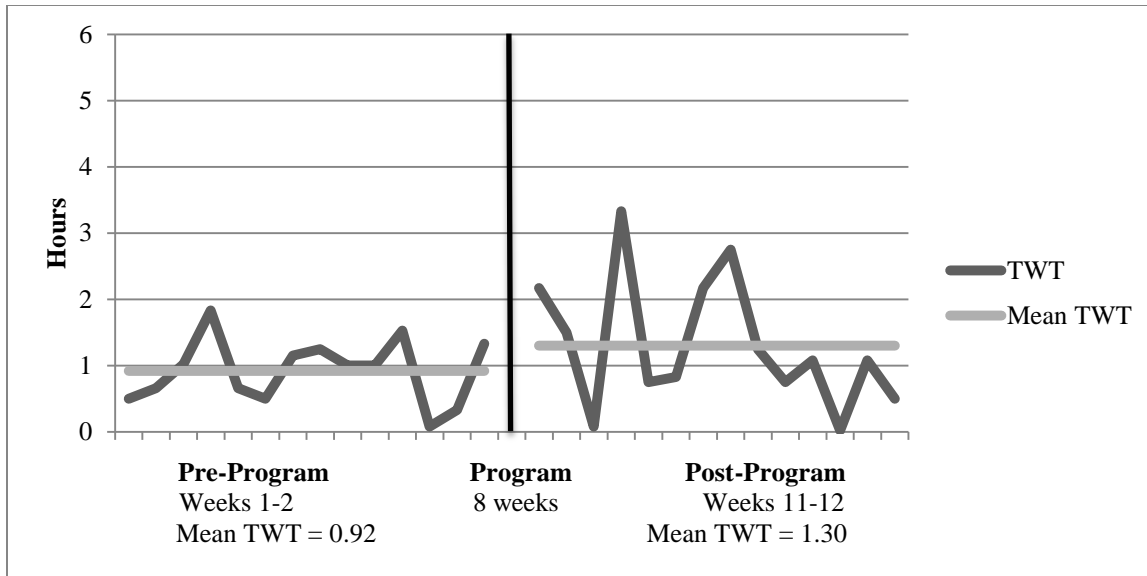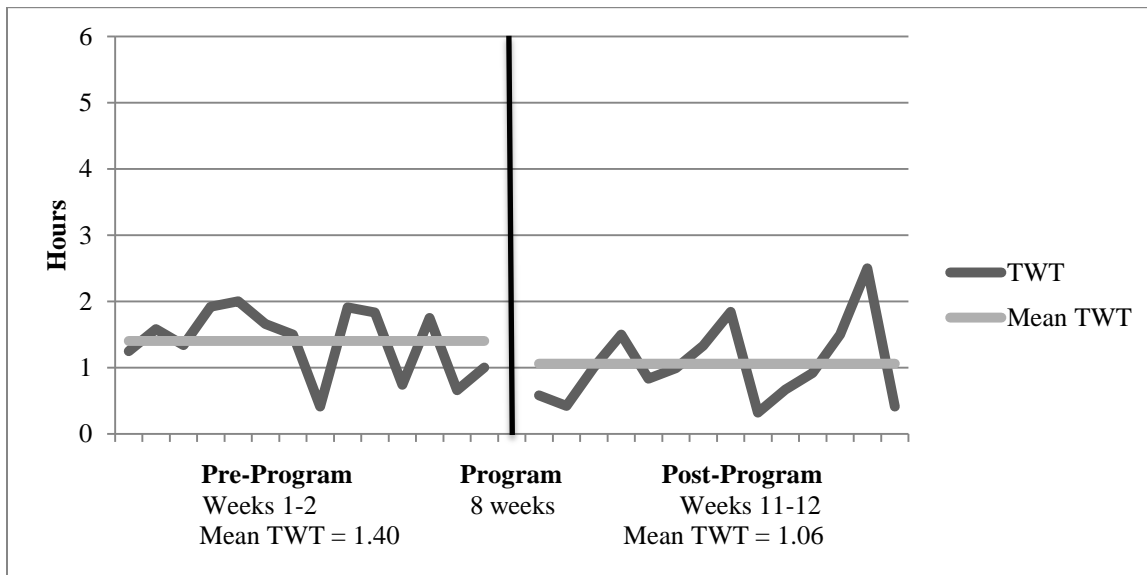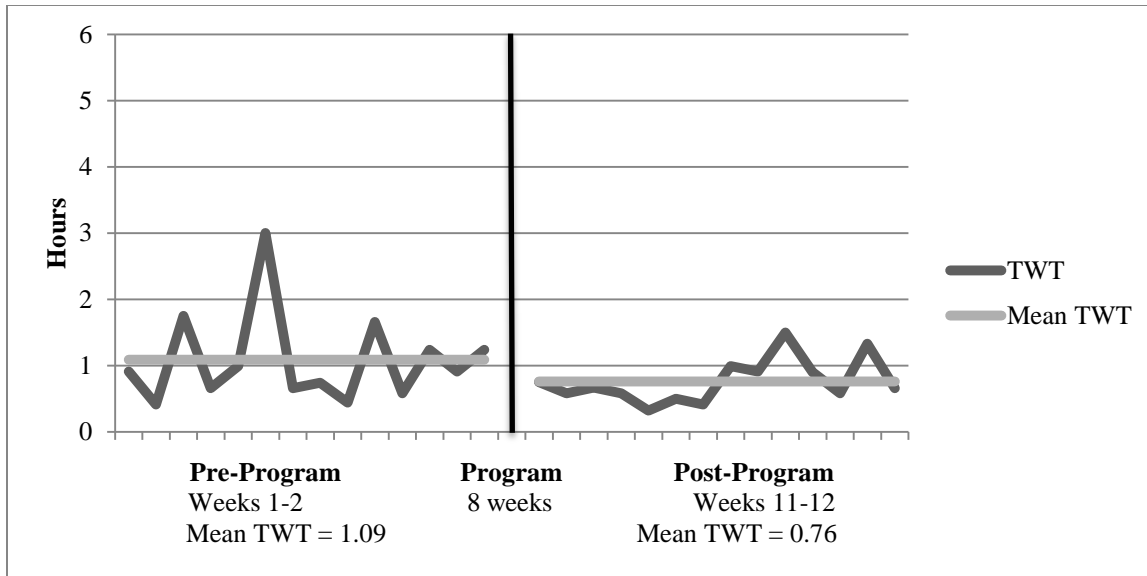

Figure 2. Daily TWT for Participant 817. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.50.

Figure 3. Daily TWT for Participant 821. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 1.80.
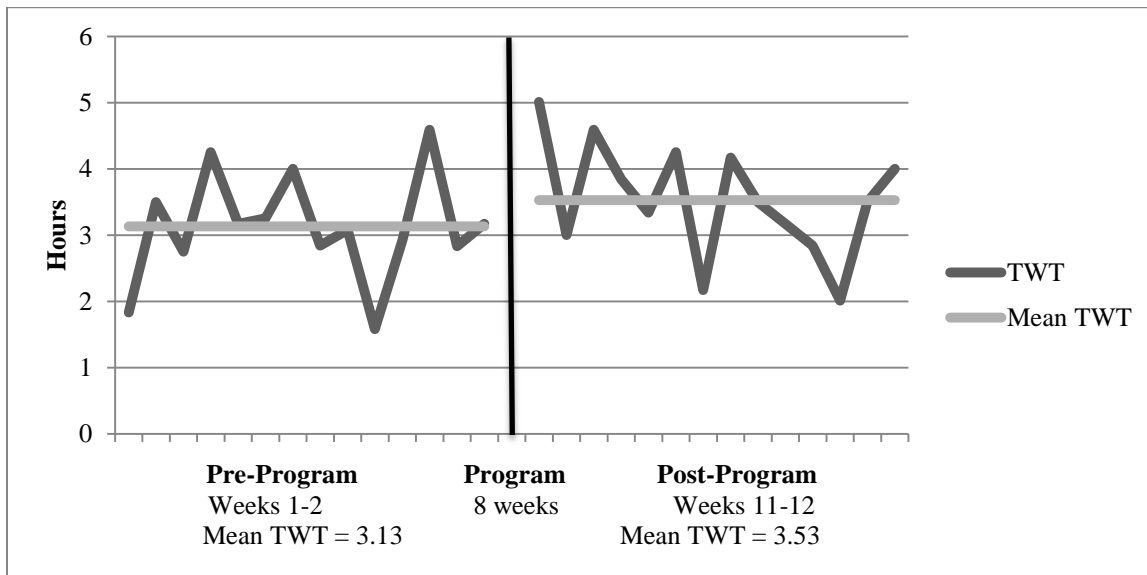

Figure 4. Daily TWT for Participant 824. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.58.
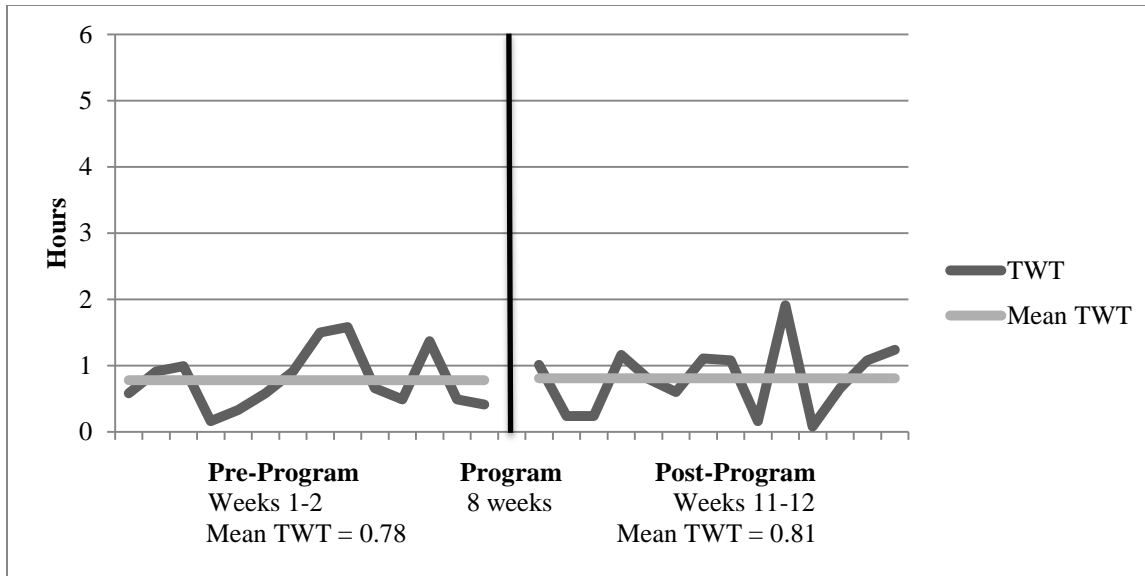
Figure 5. Daily TWT for Participant 834. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 1.63.

Figure 6. Daily TWT for Participant 844. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.60.
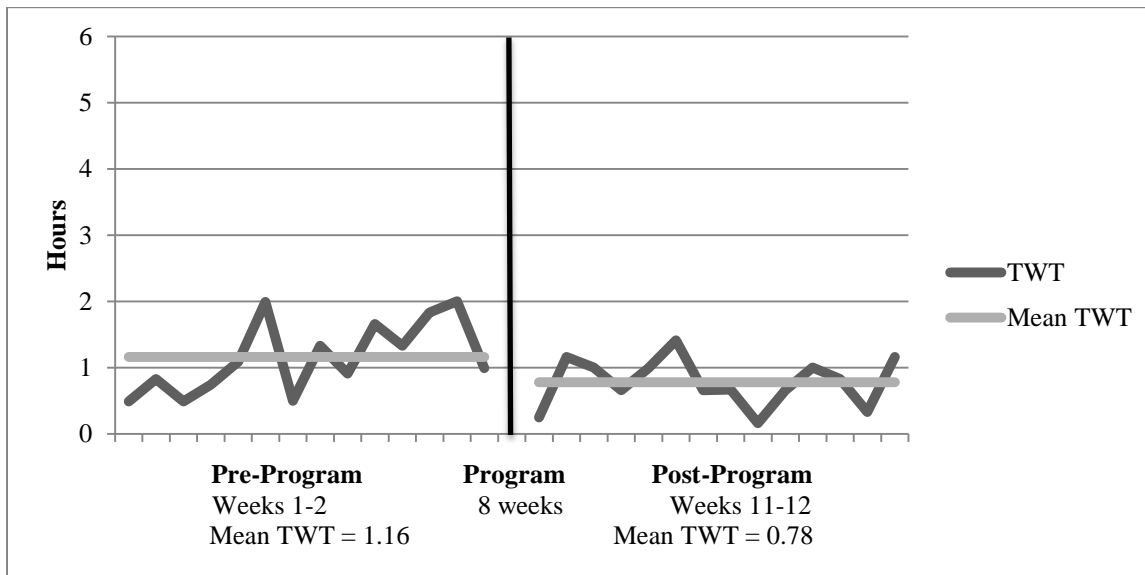
Figure 7. Daily TWT for Participant 847. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.60.
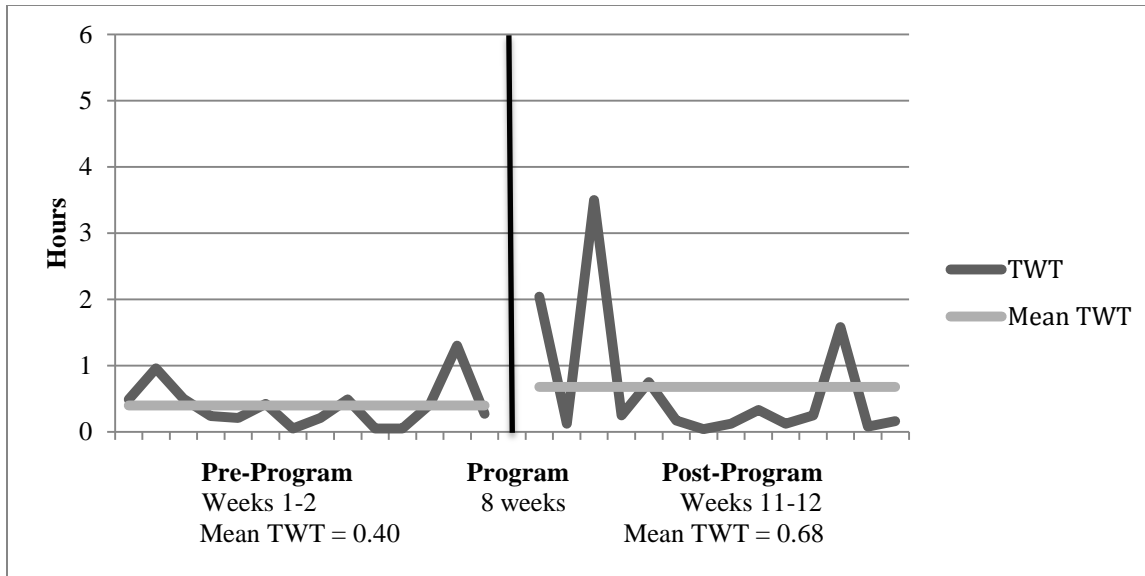

Figure 8. Daily TWT for Participant 849. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.58.

Figure 9. Daily TWT for Participant 858. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 2.46.
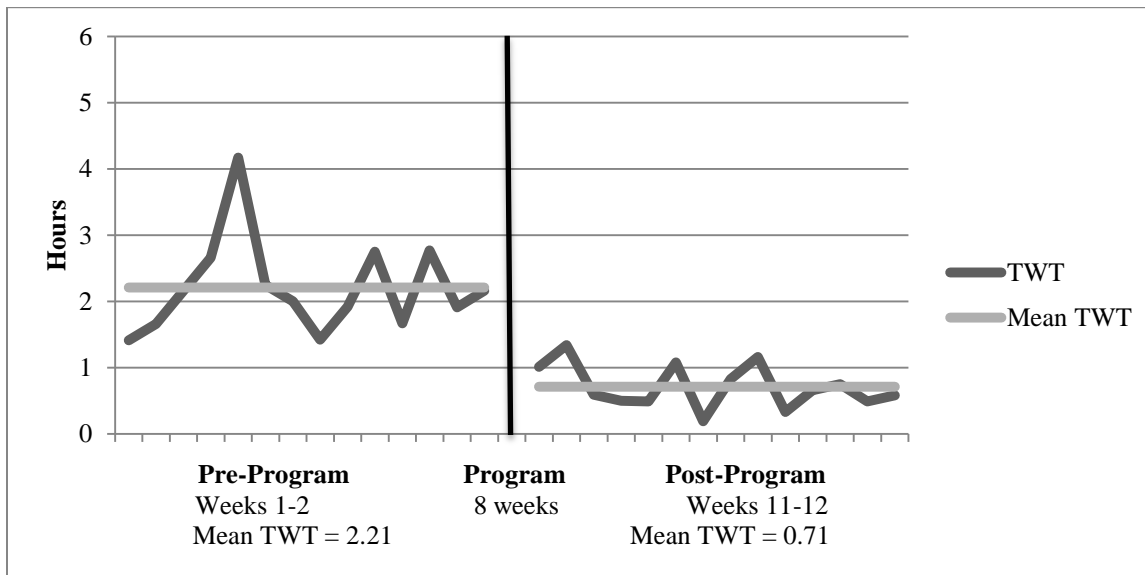

Figure 10. Daily TWT for Participant 863. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.25.

Figure 11. Daily TWT for Participant 869. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 7.56.
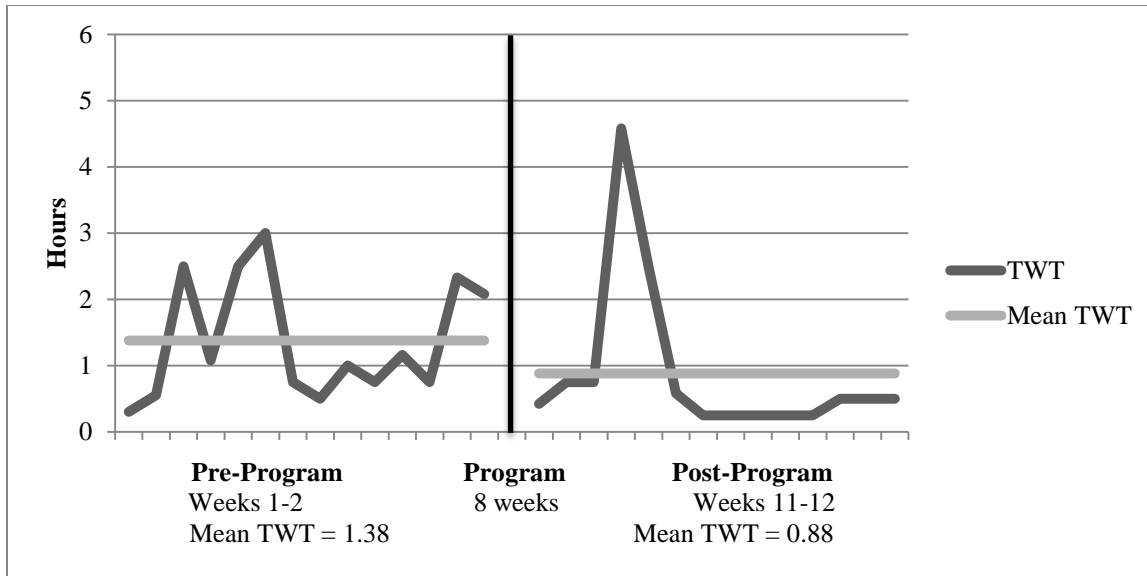

Figure 12. Daily TWT for Participant 874. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.46.
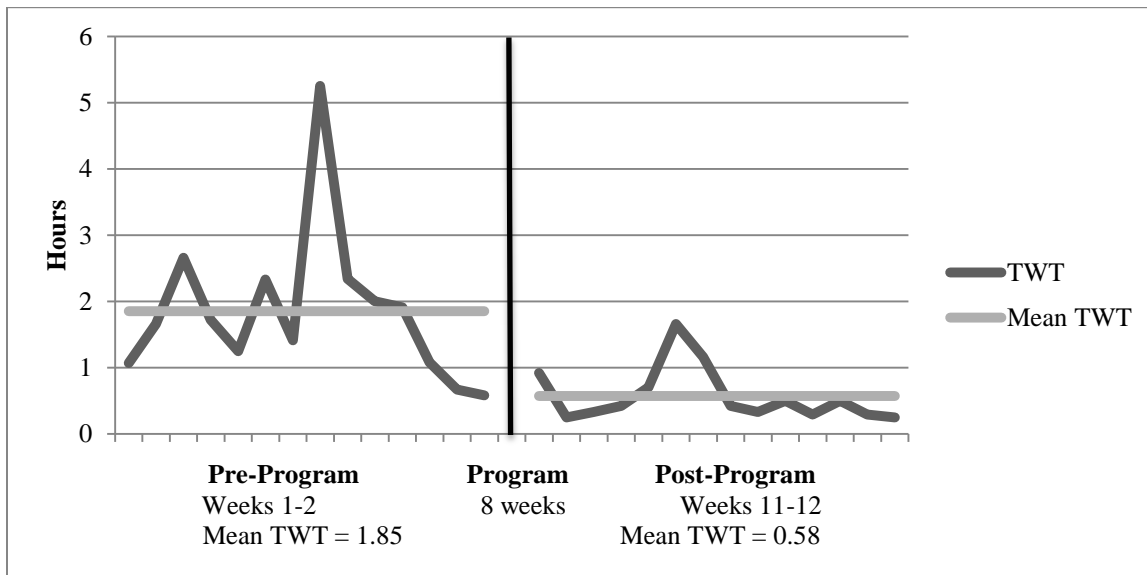
Figure 13. Daily TWT for Participant 875. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.20.

Figure 14. Daily TWT for Participant 878. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 1.59.
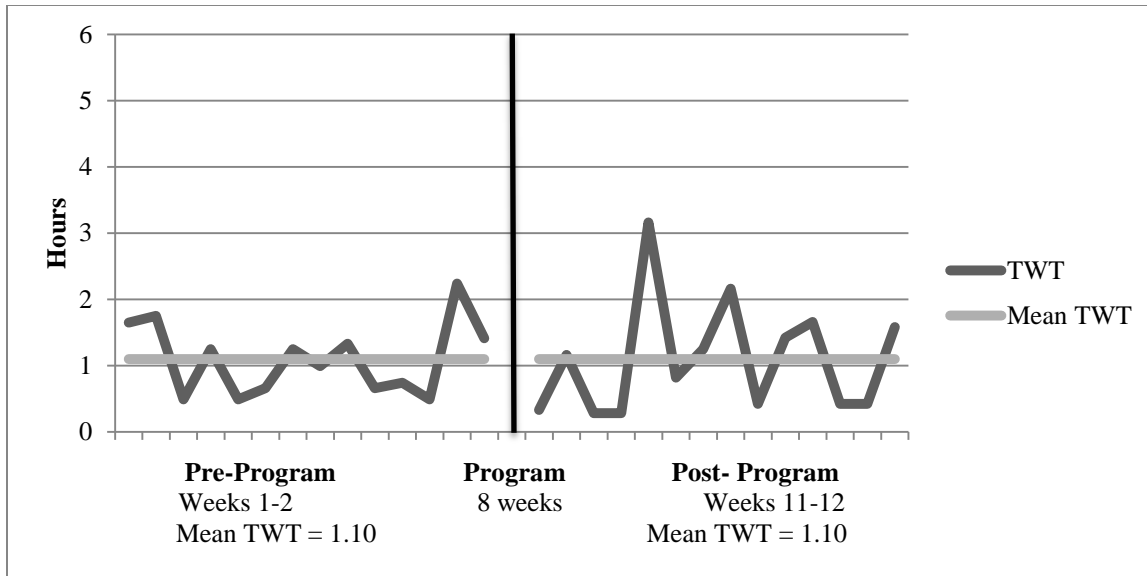
Figure 15. Daily TWT for Participant 879. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.23.
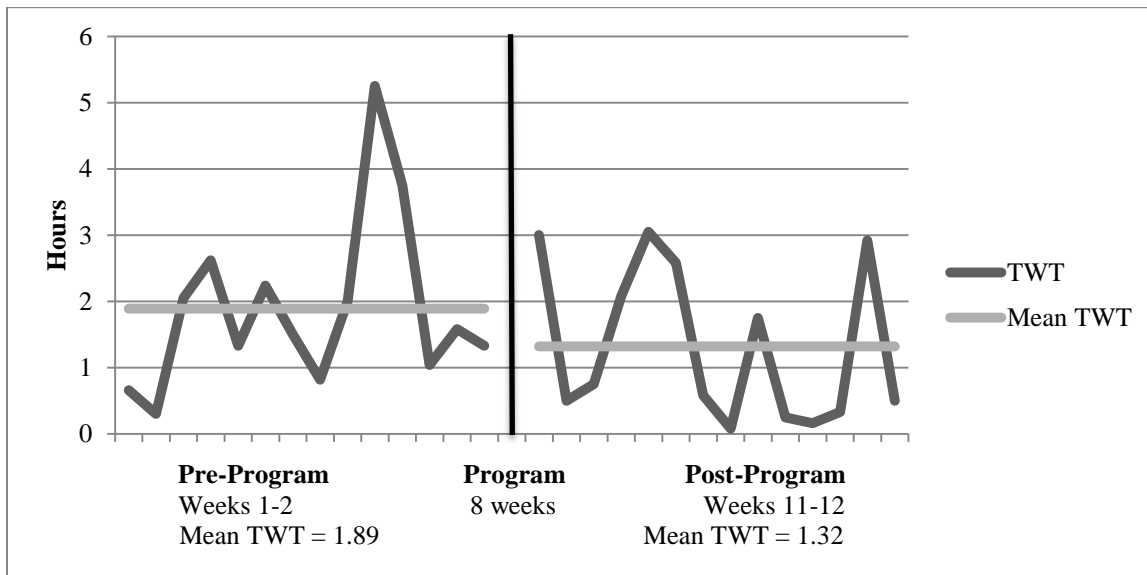

Figure 16. Daily TWT for Participant 884. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 2.26.
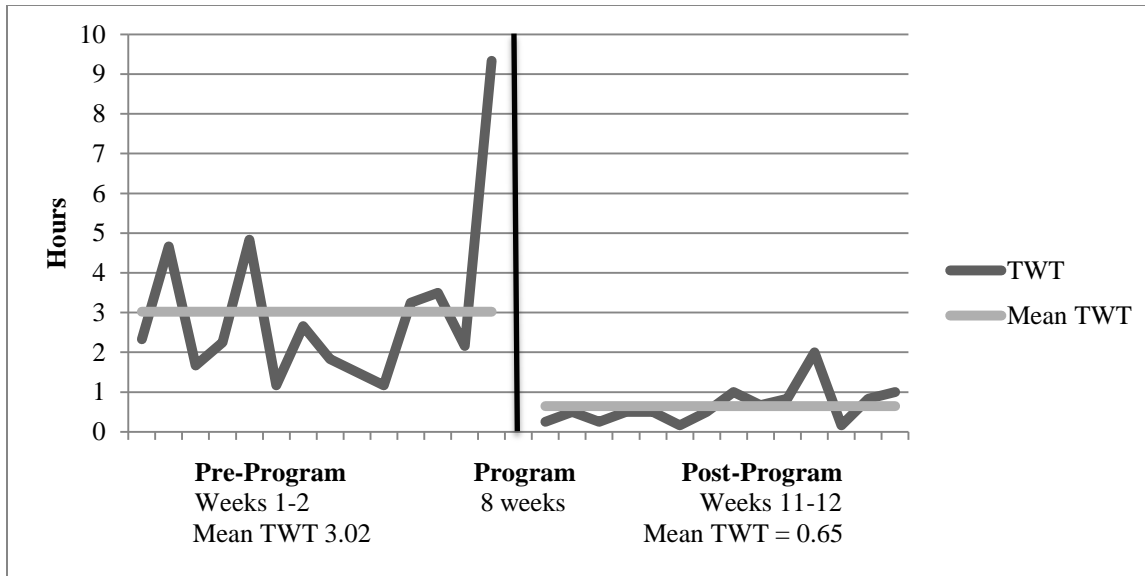
Figure 17. Daily TWT for Participant 885. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.03.
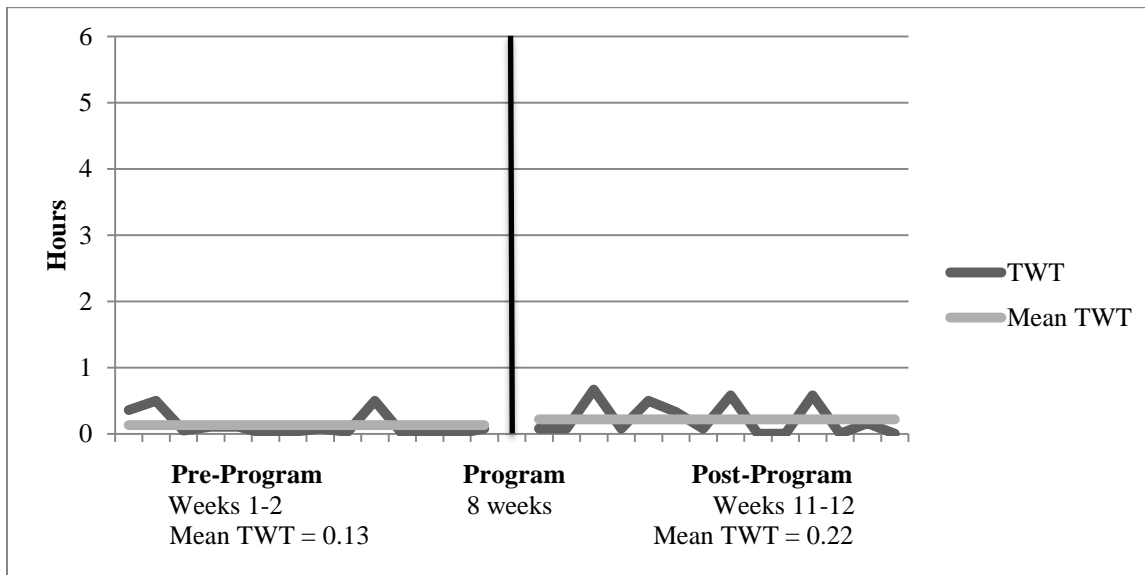

Figure 18. Daily TWT for Participant 889. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 1.00.

Figure 19. Daily TWT for non-completer Participant 870. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 10.44.

Figure 20. Daily TWT for non-completer Participant 886. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 13.50.
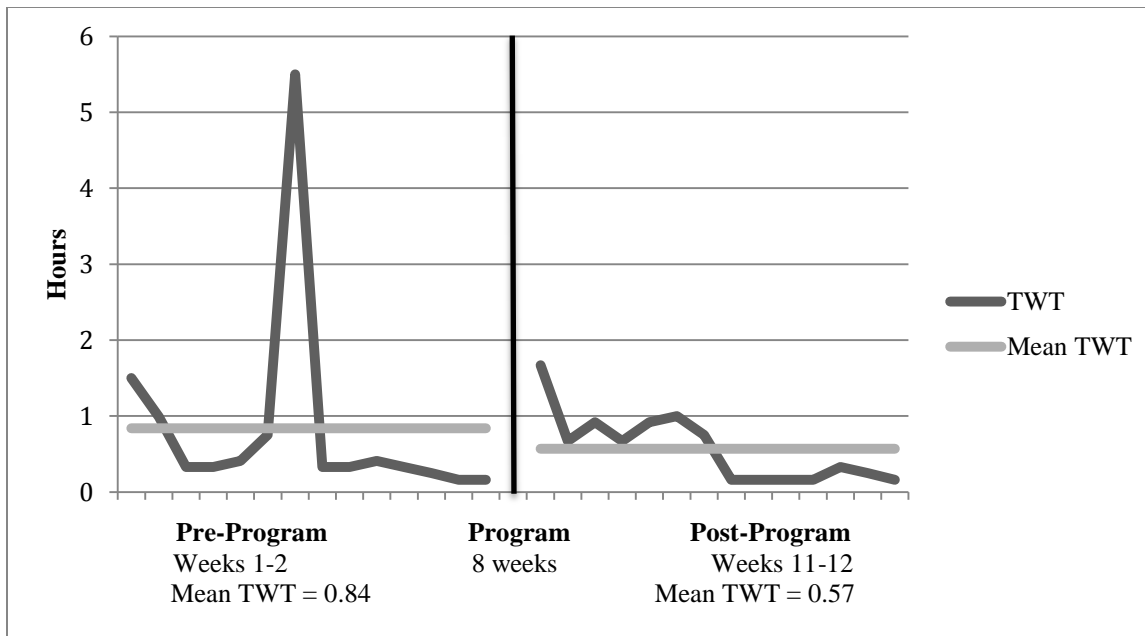
Figure 21. Daily TWT for non-completer Participant 887. TWT = total wake time. Eight weeks transpired between pre-program and post-program. During this time, participants had access to the eight modules from the book Goodnight Mind. Level of change for this participant is 0.46.
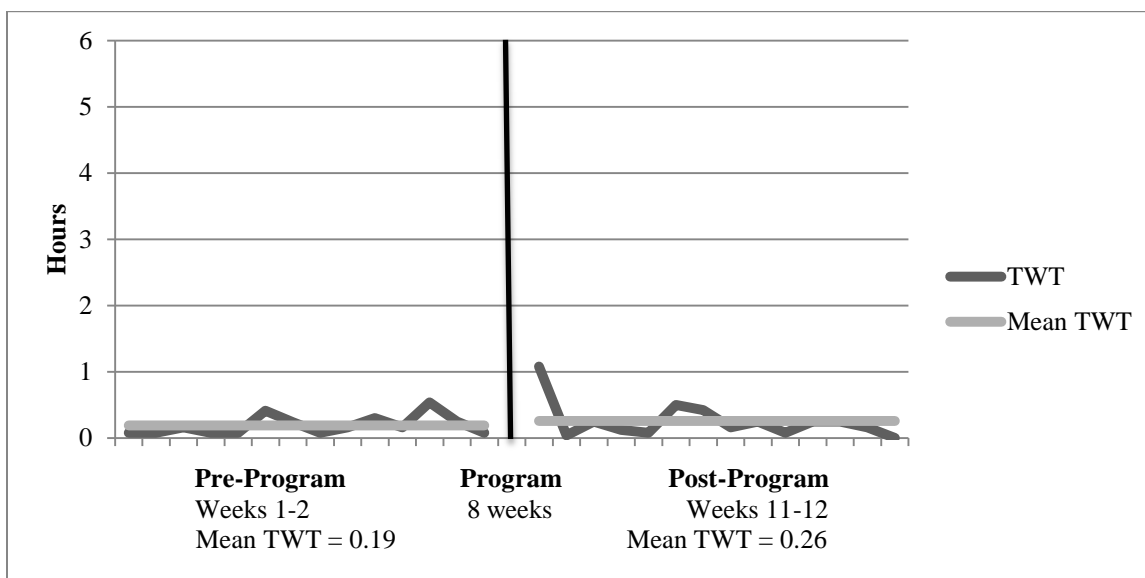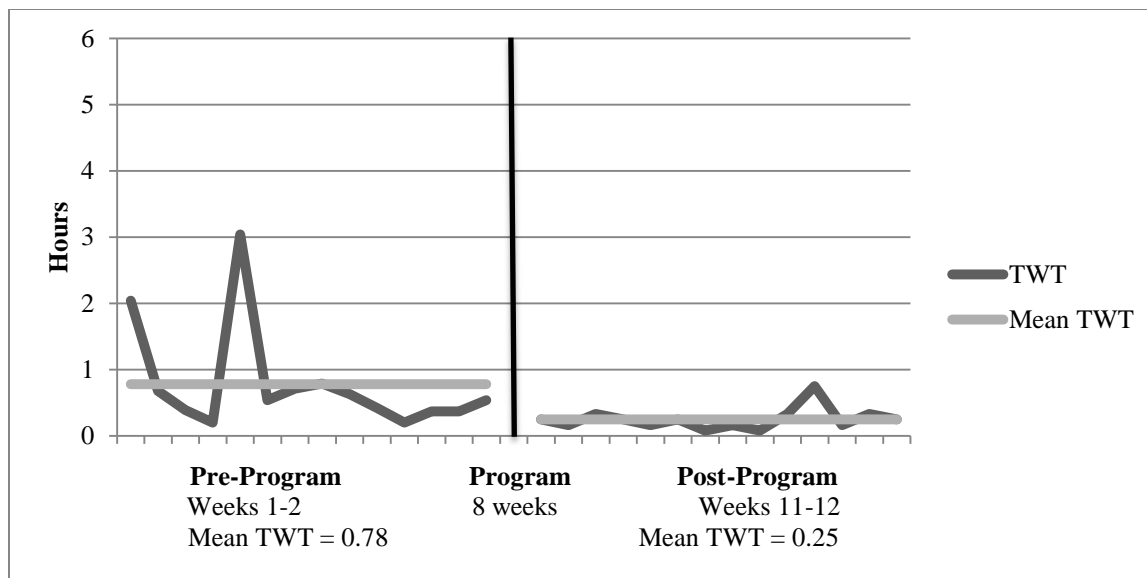
Discussion

This study was conducted to test a CBT-I self-management intervention for a young adult student population. There have been few studies investigating interventions targeting sleep problems in young adulthood (Colarusso, 2005), and none were identified in the existing literature that specifically investigated the use of CBT-I self-help interventions in a young adult student population. This study utilized the Kirkpatrick four-level learning evaluation model (Kirkpatrick, 1959; 1996) as a framework within which to evaluate this novel electronic CBT-I self-help intervention for young adult students. The first two levels of the Kirkpatrick model, reactions and knowledge acquisition, were the main focus of this research study. Behaviours, the third level of the Kirkpatrick model, were also explored by investigating whether engagement was associated with adherence to the program protocol. Whether participant demographic characteristics or psychological characteristics predicted acceptability or knowledge acquisition was also explored. Lastly, results, the fourth level of the Kirkpatrick model, were explored in order to assess whether certain measures would be appropriate to use as outcome measures in future studies investigating similar interventions.

Reactions to the Program

The first level of Kirkpatrick's four-level learning evaluation model focuses on reactions to the program. Study results indicated that, on quantitative measures, completers rated the program as acceptable, easy to understand, satisfactory, and useful. With respect to qualitative data, completers endorsed a high level of positive reactions to the program. The qualitative data revealed that many completers endorsed enjoying participating in the program, or the research process, and they found the program to be useful, clear, and easy to understand. The two main challenges of the program revealed by the qualitative data were the length of the material and

that some found the material to be dry. The majority of completers reported that they would utilize the information in this program in the future if they were to experience sleep problems again. These findings are consistent with the findings of the only other study investigating interventions for sleep problems for young adult students (Taylor et al., 2014) that queried participants regarding reactions to the intervention. Taylor et al. (2014)'s posttreatment questionnaire found that participants reported positive responses to the treatment, with many of the participants stating that they found it beneficial and enjoyed the process.

There were three modules that were highly endorsed as being among the most helpful modules, without being highly endorsed as being one of the least helpful modules. These were the modules dealing with how to think like a good sleeper, reducing worries in bed, and relaxation techniques. According to Morin et al. (2006) relaxation is highly effective for treating insomnia, and Taylor et al. (2014) also found that young adult student participants endorsed relaxation techniques as being very helpful.

One topic that reappeared was that these young adult students were concerned with the amount of time required to participate in the program. Also, the reactions of participants were varied. For example, some participants expressed that the modules were too long, and others stated that the modules were of a manageable length. Further, two completers thought the modules should be offered as a book, and another completer expressed that they would prefer the modules be offered as a PDF. Also, three modules were endorsed as being both the most useful and least useful for improving sleep. Finally, the majority of participants reported preferring to have new information presented in a way that guides them through the process, as opposed to receiving new information in a way that allows them to control how to integrate this information. Potentially, the delivery mode of the program not being consistent with the majority of

participants' preferences contributed to the number of participants who withdrew from the study, and the number of non-starters. Based on these findings, any program offered to young adults in the future may do well to offer options for personalization whenever possible (e.g., various formats, presentation styles, pacing, order of modules).

Knowledge Acquisition

The second level of Kirkpatrick's four-level learning evaluation model focuses on knowledge acquisition. According to Kirkpatrick (1959; 1996), it is important to assess a program based on the first two levels of reactions and knowledge acquisition before attempting to assess a program based on the two final levels of the Kirkpatrick model, behaviour and results. As hypothesized, completers demonstrated adequate knowledge acquisition, and this amount was significantly different than the amount of knowledge that non-completers were able to demonstrate on the CBT-I-KQ. Knowledge acquisition is important to verify when developing a program specifically for young adult students, because, although knowledge of sleep hygiene practices alone is not sufficient for improving sleep (Brown, Buboltz, & Soper, 2002), the majority of students with sub-optimal sleep habits are not aware of appropriate behaviours to improve sleep (Hicks, Lucerno-Gorman, Bautista, & Hicks, 1999). However, it is important to recognize that this program contained information beyond simply details regarding sleep hygiene.

Behaviours

Behaviours, the third level of Kirkpatrick's four-level learning evaluation model, were explored by investigating whether engagement was associated with adherence to the program protocol. On the measures of adherence, only the difference between pre- and post-program into bed variability values for those with lower engagement in the program was found to be

significant. One possible explanation for this significant difference from pre- to post-program on this measure of adherence for those with low engagement in the program is that those less engaged in the program were less anxious or concerned about their sleep, resulting in it being less challenging for this group to adhere to the recommendation to reduce into bed variability.

For the remaining measures, out of bed variability and SHP, there was no significant difference from pre- to post program. It is possible that the measure of engagement utilized in this study (i.e., an aggregate score comprised of modules completed as well as score on the CBT-I-KQ) was not an appropriate measure of engagement or that there is not a strong association between engagement and adherence within CBT-I. However, according to the Kirkpatrick model, engagement generally leads to greater effort in applying techniques introduced within a program (Kirkpatrick, 1959; 1996). In Trockel et al. (2011)'s study, participants who were more engaged in the program (i.e., completed more modules) experienced greater improvements in their sleep quality. However, it was not possible for this data to be analyzed to verify if this difference was statistically significant.

Possible Predictors

Participant demographic characteristics and psychological characteristics did not predict acceptability or knowledge acquisition. It is possible that the small sample size of this study made it impossible to detect if any of the demographic or psychological variables tested operated as predictors. It is also possible that there are other demographic and psychological characteristics that do predict acceptability and knowledge. None of the previously discussed studies that investigated programs or interventions targeting sleep problems in young adult students (Asano et al., 2015; Brown et al., 2006; Kloss et al., 2015; Quan et al., 2013; Taylor et al., 2014; Trockel et al., 2011) analyzed possible predictors of outcomes measures.

Outcome Measures

The fourth level of the Kirkpatrick four-level learning evaluation model focuses on results, or outcome measures. There was no significant association found between when looking at the group means for ISI or DBAS-16. It is possible that the sample size in this study was too small to detect whether a significant association does exist for these variables.

These non-significant results are not consistent with the results of previous studies that investigated interventions that targeted sleep problems in young adult student populations. Taylor et al.'s (2014) study found that from pretreatment to posttreatment, participants' scores on both the DBAS-16 and the ISI improved significantly, with effect sizes over 1.0. Kloss et al. (2015) also found a reduction is DBAS-16 scores from pre- to post-workshop. Participants in Taylor et al. (2014)'s study also experienced a statistically significant improvement in DBAS-16 scores from posttreatment to follow-up, which occurred 3 months after the treatment was completed. Taylor et al. (2014) suggest that there may be an incubation effect on DBAS-16 following CBT-I that might result in a change in DBAS-16 not being captured if this variable is measured exclusively pre- and post-intervention. It is possible that the current study was unable to capture changes in DBAS-16, since follow-up data was not collected.

There was a significant difference found between completers and non-completers on TWT at both pre-program and post-program. The TWT values for completers moved from being above the normative range of 60 minutes or less for TWT (Schutte-Rodin et al., 2008) at pre-program to within the normative range at post-program. Potentially, the TWT values for non-completers being within the normative range at pre-program may have contributed to these participants not completing the program.

With regard to sleep outcomes, none of the previous studies that investigated intervention

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targeting sleep problems in young adult populations analyzed TWT; however, these studies did find statistically significant improvement on several sleep variables. Taylor et al. (2014) found improvement, combined with effect sizes between 0.91 and 1.23, on five sleep variables: sleep efficiency, SOL, number of awakenings during the night, time awake after sleep onset, and sleep quality. Kloss et al. (2015) and Brown et al. (2006) also found improvement in SOL from pre- to post-workshop. Further improvements found were reduction in napping (Tsai & Li, 2004) and more consistent rise time (Quan et al., 2013). Additionally, the majority of studies found that participants endorsed improved sleep quality (Asano et al., 2015; Brown et al., 2006; Taylor et al., 2014; Trockel et al., 2011; Tsai & Li, 2004). It is important to note that only Taylor et al. (2014), Kloss et al. (2015), Trockel et al. (2011) included a cognitive component in the intervention offered in their respective studies, in addition to the educational and behavioural content that constituted the interventions of the remaining studies (Asano et al., 2015; Brown et al., 2006; Quan et al., 2013; Tsai & Li, 2004).

Ultimately, considering the sample size and previous results in a similar population, it is appropriate to investigate these three outcome measures in future studies of CBT-I self-help programs.

Limitations

A central limitation of this study is the sample size. Although this was a pilot study, and the results of the null-hypothesis testing are meant only to indicate future trends that may be worth investigating in future research (Tickle-Degnen, 2013), with such a small sample size it is not clear whether these non-significant results should discourage further investigations of these outcome variables. It is possible that although these results are not significant, there may be some important associations that were not found due to the small sample size.

The small sample size was due, at least in part, to challenges with recruiting. There are several possibilities of why recruitment was challenging. Evidently, there was an interest in the young adult student population in improving their sleep, as 285 people emailed to inquire about the study. Potentially, the incentive level ($20 Canadian) was too low for the length of time that participation in the study required (12 weeks). The incentive level followed the guidelines of previous studies conducted within the Sleep and Depression Laboratory; however, many interested individuals who contacted the principle investigator expressed that $20 was not sufficient incentive for them to participate over that length of time. Taylor et al. (2014) offered an incentive that was more than twice as high ($40 American) to university student participants in their study that was four weeks shorter (8 weeks) than the current study.

It is also possible that the 12-week duration of the study, in and of itself, deterred some interested individuals from participating. Some individuals expressed that they would be interested in participating in a program to improve their sleep; however, they felt that the length of time was too long to devote to such a program. Potentially, future studies of CBT-I interventions for young adult students would benefit from being shorter. Since average CBT-I treatment duration is 6.7 weeks (Morin et al., 1994), shortening the length of time commitment required might allow the intervention to be more appealing to this population while still remaining within the average intervention duration for CBT-I. It is also possible that the freedom of structuring their interaction with the material in the study was a deterrent for students to completing the study. According to del Valle and Duffy (2009), both a lengthy time commitment, as well as a high degree of freedom for participants regarding how to participate in a program can be problematic with online courses. Finally, it is possible that not enough time was allotted for recruitment. According to Rounsaville et al. (2001), a pilot study may take up to

3 years to complete. Therefore, it is possible that if there had been more time allotted for recruitment, the study recruitment target would have been met.

Another limitation is that participants were not required to monitor their sleep during the 8 weeks of the program, when they had access to the modules. They were required to monitor their sleep 2 weeks before and after the program; however, during the 8 weeks when they had access to the program modules, monitoring their sleep was at their discretion. An important part of CBT-I is to monitor during treatment so that participants can learn about their sleep and observe their sleep changing with behaviour change. Monitoring sleep during treatment also provides the data to test ideas about sleep (i.e., in behavioural experiments; Carney & Manber, 2015). Monitoring during their involvement in the program was not required to minimize the burden on participants; however, this may have mitigated the benefits of the program.

Lifestyle concerns could also have limited the internal validity of this study (Kazdin, 2003). The study spanned 12 weeks; therefore, participants could be in the middle of the semester when they started the study, and on vacation when they were completing the final questionnaires and sleep diaries, or vice versa. There is a great deal of variability in the level of stress experienced by a student depending on where they are in the semester, or if they are between semesters. Originally, there was a plan to control for stress levels within several of the analyses; however, this was not possible due to the small sample size. Due to the variability of when pre- and post-program measurements were obtained, it is impossible to conclude that the program is entirely responsible for any improvement appreciated in the variables of interest.

Another limitation of this study is that recruitment did not focus on individuals with ongoing insomnia. Many of those who expressed interest may have simply been experiencing transient, acute insomnia. If their sleep difficulties resolved prior to the termination of their

involvement in the study, there would be no reason for them to continue participating in the study. In fact, this was the reason given for discontinuing participating in the study by one of the eight participants who provided feedback as to why they dropped out of the study.

A further limitation is that the material contained in the program was not designed for a young adult population. Potentially, the material should have been adapted for this population before beginning this study.

A final limitation is that random assignment was not utilized, which limits the generalizability of any study results. It is possible that the positive reactions seen in this study are specific to the group of participants that completed the study. Potentially the participants that completed the study were highly interested and motivated to improve their sleep, and these individuals were not dissuaded by the time commitment that other potential participants had considered onerous. If this is the case, then the positive reactions endorsed by study participants could be due to selection bias (Kazdin, 2003), and therefore would be less generalizable.

Conclusion

Research supports that CBT-I is the gold standard for treating insomnia in the general population (Wilson et al., 2010); however, CBT-I is not widely available due to the limited number of specialists trained in the delivery of this highly beneficial treatment (Perlis & Smith, 2008). At RU, the CSDC is considering offering stepped-care models to students, because the clinic is not able to keep up with the demand for services (L. Girz, personal communication September 28, 2015). There are few existing studies investigating interventions targeting sleep problems in a young adult student population (Colarusso, 2005), and the studies that do exist have not employed self-help CBT-I interventions. A large number of Canadian post-secondary students are reportedly not getting enough sleep to feel rested (Kwan et al., 2013), and there is growing support for the use of self-help interventions for young adults for mental health issues other than insomnia (Boydell et al., 2014; Clarke et al., 2009; Radhu et al., 2012; van der Zanden et al., 2012). A self-help CBT-I program for young adult students would be beneficial; therefore this study was devised to investigate the reactions to such a program.

According to the Kirkpatrick four-level learning evaluation model, when creating a new program, the first two levels of the model, reactions and knowledge acquisition, should be investigated before considering the final two levels of the model, behaviours and results (Kirkpatrick, 1959; 1996). The rationale for considering the first two levels before moving on to the final two levels of the Kirkpatrick model is that when people find a program to be acceptable, they will be more engaged in the program, and this will lead to a greater likelihood of participants applying the techniques that the program introduced. Furthermore, feedback from participants at the first two levels is meant to inform the development of the program, which will, in turn, lead to a greater impact at the final two levels of behaviours and results (Kirkpatrick,

1959; 1996). Reflecting on study results, it is apparent that completers did find this program acceptable, and they did endorse more positive than negative reactions to the program. Completers also displayed adequate knowledge acquisition; therefore, within the framework of the Kirkpatrick model, it is appropriate for future studies to be conducted investigating the final two levels, behaviours and results.

Future studies would benefit from a larger sample size and random assignment. Based on the reactions of participants to this program, future studies may benefit from reducing the time commitment involved, personalizing the program whenever possible, The concern mentioned by several participants about the length of the time commitment is supported by the literature that indicates that young adults are adapting to changing social roles (Lemma et al., 2012), and they are dealing with multiple demands on their time (Buboltz et al., 2001). The reactions of participants also indicated that there were some participants who felt that a more dynamic visual presentation would have been beneficial for them to learn the material. It would be important for future studies to also consider ways in which to make their program appealing to individuals who identify as male, as well as those who identify as female.

This study also conducted some preliminary investigations of the final two levels of the Kirkpatrick four-level learning evaluation model, behaviours and results. With pilot studies, null-hypothesis testing is not appropriate, strictly speaking (Tickle-Degnen, 2013); however, the results can be utilized to see what variables may be appropriate to analyze in future studies. The null-hypothesis testing study results only indicated one significant finding, that there was a significant reduction in into bed variability from pre-program to post-program for those with lower engagement in the program. Although none of the other analyses utilizing null-hypothesis testing yielded significant results, due to the study's small sample size, it would be premature to

rule out further investigation of these variables based on the results of this study.

Another question this study attempted to answer was whether it was feasible to offer a CBT-I self-help program to young adult students utilizing a one-time delivery format. Based on the feedback from some participants of this study, reminders to read the modules, or a way of tracking which modules had already been read would be beneficial. This feedback is consistent with previous research that indicates that if there is a great deal of freedom in how they can participate in an online course, this may result in less participation (del Valle & Duffy, 2009). Therefore, a self-help program that is offered to students utilizing one-time delivery may not work well for all students. Potentially, a study utilizing random assignment could investigate whether a reminder system would result in a significant difference between those who are randomly assigned to receive reminders and those who are not.

Ultimately, the results from this study indicate that an electronically delivered self-help CBT-I program for young adult students was found to be acceptable by this population. These young adult students also endorsed more positive than negative feedback regarding the program and displayed adequate knowledge acquisition. Further investigation of an electronically delivered self-help CBT-I program for this population is warranted.

Appendix A

Poster

**DO YOU HAVE
TROUBLE SLEEPING?**

Are you an otherwise healthy student between 18 and 30 years old experiencing **sleep problems** (e.g., difficulty falling asleep, staying asleep, etc.)?

If so, you are invited to volunteer in this study of an electronically delivered program designed to improve sleep.
This study takes place completely online, and participation is confidential.

Your participation would involve participating in a free program to help reduce your sleep problems over the course of 8 weeks.
- You will be asked to fill in questionnaires regarding your sleep, the sleep program and daytime functioning, before and after the program.
- Filling in questionnaires will take roughly 30 minutes, before and after the program.
  - Participation involves keeping sleep diaries for 4 weeks.

This study involves a screening process that will take roughly 15 minutes, which involves filling in 4 questionnaires for which there is no incentive.

You will receive up to $20, if you complete the study.

This research study has been reviewed and approved by the Ryerson University Research Ethics Board.

This research project is being conducted by a graduate student in Psychology at Ryerson University.
If you are interested in participating in this study or for more information, please email: sleepstudy@psych.ryerson.ca

Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca	Preferences for Sleep Tip Information sleepstudy@psych.ryerson.ca

Appendix B

Social Media Postings

Twitter Template

Research Participants Sought #sleep problems #young adults @Ryerson, email:
sleepstudy@psych.ryerson.ca

Facebook or Reddit Template

Seeking research participants: students aged 18-30 years old with sleep problems (difficulty falling asleep, staying asleep, etc.). Otherwise healthy young adults are invited to volunteer in a study of an electronically delivered program designed to improve sleep. This research is being conducted by a graduate student in Psychology at Ryerson University. If you are interested in participating, or for more information, please email: sleepstudy@psych.ryerson.ca.

Appendix C

Advertisement for Newspaper

Trouble sleeping?
Researchers at Ryerson University are seeking students who are:
- Between the ages of 18 to 25 who have trouble sleeping (falling asleep, staying asleep,)
- Otherwise healthy

If you are eligible to participate in the study, you will have access to a free eBook, which contains an evidenced base program to help you sleep better. Please note, this study takes place entirely online.

An incentive of $20 is offered to those who complete all study components. There is no incentive for completing the 15-minute screening procedure, which involves filling in four surveys online.

For more information contact us at: sleepstudy@psych.ryerson.ca

Appendix D

Handout for Tabling

Trouble sleeping?
Researchers at Ryerson University are seeking students who are:
- Between the ages of 18 to 30 who have trouble sleeping (falling asleep, staying asleep,)
- Otherwise healthy

If you are eligible to participate in the study, you will have access to a free eBook, which contains an evidenced-based program to help you sleep better. Please note, this study takes place entirely online.

An incentive of 20$ is offered to those who complete all study components. There is no incentive for completing the 15-minute screening procedure, which involves filling in four surveys online.

For more information contact us at: sleepstudy@psych.ryerson.ca

Appendix E

First Five Questions of the Therapy Evaluation Questionnaire for CBT-I

<u>Instructions:</u> Choose the number on the scale provided for each question to indicate your response.

1. How logical does the program you received seem to you?

1	2	3	4	5	6	7
Not at all						Very Logical

2. How confident are you that this program will be successful in eliminating your insomnia?

1	2	3	4	5	6	7
Not at all						Very Confident

3. How confident would you be in recommending this program to a friend?

1	2	3	4	5	6	7
Not at all						Very Confident

4. How willing were you to undergo this treatment?

1	2	3	4	5	6	7
Not at all						Very Willing

5. How successful do you think this treatment is for treating other people with insomnia?

1	2	3	4	5	6	7
Not at all						Very Successful

Appendix F

CBT-I Knowledge Questionnaire

For the following questions, please answer from memory. There is no need to look back at the modules. We want to see how much people remember naturally after participating in the program.

1) Of the time that one is in bed, what is the optimal percentage of time that should be spent sleeping?
   a. Over 90%
   b. Roughly 85%
   c. Between 70% and 80%
   d. The is no optimal amount, it varies by individual

2) What is a key ingredient for getting a good night's sleep?
   a) Making an effort to get to bed early
   b) Listening to a self-hypnosis tape before bed
   c) Establishing a regular and optimally timed sleep opportunity (sleep window)
   d) Staying in bed until you are completely rested

3) If you have a short night's sleep one day, the next night, your sleep driver system will:
   a. Cause you to feel more stressed
   b. Keep you awake later
   c. Produce more sleep
   d. Produce deeper sleep

4) You can increase your deep sleep by:
   a. Limiting you time in bed
   b. Being active during the day
   c. Avoiding napping
   d. All of the above

5) How long will it take to know if your new sleep schedule is appropriate for you?
   a. A month
   b. Roughly a week
   c. A couple of days
   d. You will know if you have a really good night's sleep the first time you use the new schedule

6) How much time should spend in bed on a nightly basis?

a. Half an hour longer than the average amount of hours you spend sleeping
b. Eight hours
c. Enough time so that you feel rested
d. It is better not to track the amount of time you spend in bed

7) How can you tell if you have social jetlag?
   a. You regularly arrive late to social events
   b. You are tired by the time the evening rolls around due to lack of sleep
   c. Your sleep schedule is different than socially accepted norms
   d. You experience a difference greater than one hour between the earliest and latest time you get out of bed

8) Which of the below is not true of a rise time?
   a. Rise time is when your feet touch the floor in the morning
   b. Rise time should be chosen keeping in mind what time you naturally wake up
   c. Rise time should remain stable even if you go to sleep later than usual the night before
   d. Rise time refers to the time you wake up

9) When should you go to bed?
   a. When you feel sleepy, as long as it is after you predetermined earliest bedtime
   b. Eight hours before you plan to wake up
   c. Same time every day, sticking to your predetermined bedtime
   d. When you feel like it, it is best not to stress about your bedtime

10) What should you do if you wake up in the middle of the night and can't fall back asleep?
    a. Practice deep breathing until you fall back asleep
    b. Get out of bed, go to another room, and engage in an enjoyable activity that is not overly stimulating
    c. Keep a book by your bed, and read in bed until you fall back asleep
    d. Get out of bed, go to another room, and use this time to be productive (e.g. make a to-do list, or write important emails)

11) Which statement is most true about undertaking activities in bed?
    a. Any activities are fine to do in bed, as long as no activities are done during your established sleep schedule
    b. Do any activities in bed that feel comfortable, it is best for to stress about what activities you might do in bed
    c. Activities you usually do when awake should not occur while in bed
    d. Only very relaxing activities should be done in bed (e.g. meditating)

13) What is the typical recommended length of a wind down period in the evening?
   a. 15 minutes
   b. 1 hour
   c. A wind down period is only recommended on days when you feel very stressed
   d. Your wind down time should be equal to the average amount of time it takes you to fall asleep

13) Which of the following is not true of a buffer zone?
   a. A buffer zone gives you time to rest and distance yourself from the business of your day
   b. A buffer zone should include activities you enjoy and are not undertaken with any particular consequence in mind
   c. Different people may require buffer zones of different lengths
   d. If you eat right and work out regularly, you will not need a buffer zone

14) What is true about active relaxation practices?
   a. A relaxation practice may benefit individuals who are tense even with a buffer zone in place
   b. Relaxation is a skill and can be learned
   c. Learning to relax often takes a lot of practice
   d. All of the above

15) Which of the following is true about anxiety?
   a. If you are diligent about practicing relaxation, you will be able to eliminate anxiety from your life.
   b. Anxiety is a natural state, so you should not undertake effort to alter the amount of anxiety you experience
   c. Anxiety is a natural reaction of the body that is actually adaptive
   d. We all have a set level of anxiety that will not vary much, regardless of any attempts to alter our anxiety level

16) Which of the following is not true about the sympathetic nervous system?
   a. When confronted with an immediately dangerous situation, your sympathetic nervous system will cause an increase in your heart rate and breathing rate to enable you to most appropriately face the dangerous situation or run away from the situation.
   b. The sympathetic nervous system can become activated even when imagining a stressful situation
   c. The sympathetic nervous system becomes less active as the day goes on, which makes sleeping easier
   d. You will be unable to sleep if your sympathetic nervous system in aroused

17) Thinking about things that worry you can make it hard to get to sleep. What is good solution to deal with your worries?
   a. Anytime you can't sleep is a good time to make a list of worries, because you can at least make productive use of your time
   b. Schedule worry time for earlier in the evening, so that you can separate your worrying and bedtime
   c. It is best to schedule several mini-worry session throughout the day, so you are not overwhelmed by considering too many worries at one time
   d. Most people worry more than is healthy, so it is best to avoid worrying as much as possible

18) Which of the following was not suggested as a way to reduce worrying?
   a. Scheduling a worry time
   b. Occupying your mind with other pleasant thoughts, potentially telling yourself stories
   c. Writing down your worries and then tearing up the paper you wrote them on
   d. Having a glass of wine to relax

19) Some people worry specifically about sleeplessness (e.g. waking up in the middle of the night and not being able to fall back asleep) and these thoughts can worsen their sleeping difficulties. People who are worried about sleeplessness would be well advised to:
   a. Remind themselves of another time when they were up at the same time, but for a pleasant reason (e.g. staying up late talking to a friend)
   b. Stay in bed and try twice as hard to fall back asleep
   c. Remind themselves of a time when they had a hard time sleeping and had a bad day the following day
   d. Think of bad things that happened during the day, so that the difficulty falling asleep does not seem that bad in comparison

20) One difference between good sleepers and poor sleepers is that:
   a. Good sleepers have figured out a what tricks work for them and stick to them, and poor sleepers do not try hard enough to get to sleep
   b. Good sleepers are proactive thinking a lot about sleep and problems they have when they lie down to sleep, and poor sleepers do not think about sleep very much
   c. Good sleepers do not think very much about sleep, and poor sleepers think about sleep and problems they have when they lie down to sleep
   d. Good sleepers will take a sleeping pill preemptively when they need to get up extra early the next day, and poor sleepers wait too long before taking a sleeping pill

21) Fill in the blanks: In good sleepers, it is normal for it to take _____ to fall asleep, and during the night to wake _____.

a. 10 minutes; for a total of 1 hour
b. Up to half an hour; multiple times for a total of half an hour
c. 1 hour; every hour
d. Up to half an hour; only to use the washroom- other than that good sleepers do not actually wake up

22) Why do people with insomnia struggle to fall asleep most nights, but then are often able to fall asleep when they would prefer not to fall asleep?
a. When the pressure to sleep is not there, then it is easier to fall asleep
b. Life is unfair
c. Actually, it is always hard for people with insomnia to fall asleep, regardless of whether they would like to fall asleep or not
d. There is no explanation

23) When we worry during the day, we may be more likely to worry at night, thus experiencing poorer quality sleep. If you find yourself worrying a lot during the day, an effective strategy is to:
a. Focus on whatever issue has you worried until you are able to come up with a perfect solution
b. Ignore any worries that might come up, you do not want to give these thoughts any attention
c. Think of the next most logical step that you can take in the short-term towards solving the issue you are worrying about
d. Figure out someone who would be able to solve these problems for you

24) What was suggested as one of the main issues that may be maintaining a person's sleep problem?
a. The initial issue that cause the sleep problems to begin with has not been dealt with
b. Worries regarding sleep
c. An overreliance on sleeping pills
d. Lack of will power

25) What should you do if you do have a poor night's sleep?
a. Proceed with your day as normal
b. Cancel all plans
c. Carry out necessary obligations, but cancel social plans
d. Nap whenever you have a chance

26) Waking up feeling groggy and tired means that:
a. You got a bad night's sleep, so it's best to take it easy

b. This feeling is common in the morning, regardless of whether you had a good or bad night's sleep
c. You should be sleeping for longer
d. You most likely had too much to drink the night before

27) There are many reasons for feeling fatigued; of the following, which is not a strategy to combat fatigue?
a. Make sure you are hydrated
b. Eat healthy meals at regular times throughout the day
c. Stay active
d. Drink lots of caffeinated beverages

28) A sense of acceptance can lead to a quieter mind, and improved sleep. Which of the following is an example of acceptance?
a. Mindfulness, being present in the here and now
b. Observing your thoughts
c. Being open to whatever experiences come your way (e.g. being awake when you would rather be asleep)
d. All of the above

Appendix G

Consensus Sleep Diary

General Instructions
What is a Sleep Diary? A sleep diary is designed to gather information about your daily sleep pattern.
How often and when do I fill out the sleep diary? It is necessary for you to complete your sleep diary every day. If possible, the sleep diary should be completed within one hour of getting out of bed in the morning.
What should I do if I miss a day? If you forget to fill in the diary or are unable to finish it, leave the diary blank for that day.
What if something unusual affects my sleep or how I feel in the daytime? If your sleep or daytime functioning is affected by some unusual event (such as an illness, or an emergency) you may make brief notes on your diary.
What do the words "bed" and "day" mean on the diary? This diary can be used for people who are awake or asleep at unusual times. In the sleep diary, the word "day" is the time when you choose or are required to be awake. The term "bed" means the place where you usually sleep.
Will answering these questions about my sleep keep me awake? This is not usually a problem.
You should not worry about giving exact times, and you should not watch the clock. Just give your best estimate.

Sleep Diary Item Instructions
Date: Write the date of the morning you are filling out the diary. _____
1. What time did you get into bed? Write the time that you got into bed. This may not be the time you began "trying" to fall asleep. _____
2. What time did you try to go to sleep? Record the time that you began "trying" to fall asleep. _____
3. How long did it take you to fall asleep? Beginning at the time you wrote in question 2, how long did it take you to fall asleep? _____
4. How many times did you wake up, not counting your final awakening? How many times did you wake up between the time you first fell asleep and your final awakening? _____
5. In total, how long did these awakenings last? What was the total time you were awake between the time you first fell asleep and your final awakening. For example, if you woke 3 times for 20 minutes, 35 minutes, and 15 minutes, add them all up (20+35+15= 70 min or 1 hr and 10 min). _____
6a. What time was your final awakening? Record the last time you woke up in the morning. _____
6b. After your final awakening, how long did you spend in bed trying to sleep? After the last time you woke-up (Item #6a), how many minutes did you spend in bed trying to sleep? For example, if you woke up at 8 am but continued to try and sleep until 9 am, record 1 hour. _____
6c. Did you wake up earlier than you planned? If you woke up or were awakened earlier than you planned, check yes. If you woke up at your planned time, check no.

6d. If yes, how much earlier? If you answered "yes" to question 6c, write the number of minutes you woke up earlier than you had planned on waking up. For example, if you woke up 15 minutes before the alarm went off, record 15 minutes here. _____

7. What time did you get out of bed for the day? What time did you get out of bed with no further attempt at sleeping? This may be different from your final awakening time (e.g. you may have woken up at 6:35 a.m. but did not get out of bed to start your day until 7:20 a.m.) _____

8. In total, how long did you sleep? This should just be your best estimate, based on when you went to bed and woke up, how long it took you to fall asleep, and how long you were awake. You do not need to calculate this by adding and subtracting; just give your best estimate. _____

9. How would you rate the quality of your sleep? "Sleep Quality" is your sense of whether your sleep was good or poor. _____

10. How restful or refreshed did you feel when you woke up for the day? This refers to how you felt after you were done sleeping for the night, during the first few minutes that you were awake. _____

11a. How many times did you nap or doze? A nap is a time you decided to sleep during the day, whether in bed or not in bed. "Dozing" is a time you may have nodded off for a few minutes, without meaning to, such as while watching TV. Count all the times you napped or dozed at any time from when you first got out of bed in the morning until you got into bed again at night. _____

11b. In total, how long did you nap or doze? Estimate the total amount of time you spent napping or dozing, in hours and minutes. For instance, if you napped twice, once for 30 minutes and once for 60 minutes, and dozed for 10 minutes, you would answer "1 hour 40 minutes." If you did not nap or doze, write "N/A" (not applicable). _____

12a. How many drinks containing alcohol did you have? Enter the number of alcoholic drinks you had where 1 drink is defined as one 12 oz beer (can), 5 oz wine, or 1.5 oz liquor (one shot). _____

12b. What time was your last drink? If you had an alcoholic drink yesterday, enter the time of day in hours and minutes of your last drink. If you did not have a drink, write "N/A" (not applicable). _____

13a. How many caffeinated drinks (coffee, tea, soda, energy drinks) did you have? Enter the number of caffeinated drinks (coffee, tea, soda, energy drinks) you had where for coffee and tea, one drink = 6-8 oz; while for caffeinated soda one drink = 12 oz. _____

13b. What time was your last caffeinated drink? If you had a caffeinated drink, enter the time of day in hours and minutes of your last drink. If you did not have a caffeinated drink, write "N/A" (not applicable). _____

14. Did you take any over-the-counter or prescription medication(s) to help you sleep? If so, list medication(s), dose, and time taken: List the medication name, how much and when you took EACH different medication you took tonight to help you sleep. Include medication available over the counter, prescription medications, and herbals (example: "Sleepwell 50 mg 11 pm"). If every night is the same, write "same" after the first day. _____

15. Comments: If you have anything that you would like to say that is relevant to your sleep feel free to write it here. _____

<div align="right">Consensus Sleep Diary © 2011</div>

Appendix H

Sleep Hygiene Practice Scale of the Sleep Hygiene Awareness and Practice Scale

For each of the following behaviours state the number of days per week (0-7) that you engage in that activity or have that experience. Base your answers on what you would consider an average week for you.

Indicate the number of days or nights in an average week you:
1. Take a nap _____
2. Go to bed hungry _____
3. Go to bed thirsty _____
4. Smoke more than one pack of cigarettes _____
5. Use sleeping medications (prescription or over-the-counter) _____
6. Drink beverages containing caffeine (e.g., coffee, tea, colas) within 4 hours of bedtime _____
7. Drink more than 3 ounces of alcohol (e.g., 3 mixed drinks, 3 beers, or 3 glasses of wine) within 2 hours of bedtime _____
8. Take medications/drugs with caffeine within 4 hours of bedtime _____
9. Worry as you prepare for bed about your ability to sleep _____
10. Worry during the day about your ability to sleep at night _____
11. Use alcohol to facilitate sleep _____
12. Exercise strenuously within 2 hours of bedtime _____
13. Have your sleep disturbed by light _____
14. Have your sleep disturbed by noise _____
15. Have your sleep disturbed by a bedpartner _____ (put NA if no partner)
16. Sleep approximately the same length of time every night _____
17. Set aside time to relax before bed _____
18. Exercise in the afternoon or early evening _____
19. Have a comfortable nighttime temperature in your bed/bedroom _____

Appendix I

Insomnia Severity Index

1. Please rate the current severity of your insomnia problem(s):

	None	Mild	Mod.	Severe	Very Severe
Difficulty falling asleep	0	1	2	3	4
Difficulty staying asleep	0	1	2	3	4
Problem waking up too early	0	1	2	3	4

2. How satisfied/dissatisfied are you with your current sleep pattern?

Very Satisfied		Moderately Satisfied		Very Dissatisfied
0	1	2	3	4

3. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g., daytime functioning, ability to function at work/daily chores, concentration, memory, mood, etc.)?

Not at All	A little	Somewhat	Much	Very much
0	1	2	3	4

4. How NOTICEABLE to others do you think your sleeping problem is in terms of impairing the quality of your life?

Not at All	A little	Somewhat	Much	Very much
0	1	2	3	4

5. How WORRIED/distressed are you about your current sleep problem?

Not at All	A little	Somewhat	Much	Very much
0	1	2	3	4

Appendix J

Dysfunctional Beliefs and Attitudes About Sleep-16

Several statements reflecting people's beliefs and attitudes about sleep are listed below. Please indicate to what extent you personally agree or disagree with each statement. There is no right or wrong answer. For each statement, **choose number that best reflects your personal experience**. Consider the whole scale, rather than only the extremes of the continuum.

1. I need 8 hours of sleep to feel refreshed and function well during the day.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
2. When I do not get proper amount of sleep on a given night, I need to catch up on the next day by napping or on the next night by sleeping longer.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
3. I am concerned that chronic insomnia may have serious consequences for my physical health.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
4. I am worried that I may lose control over my abilities to sleep.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
5. After a poor night's sleep, I know that it will interfere with my daily activities on the next day.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
6. In order to be alert and function well during the day, I am better off taking a sleeping pill rather than having a poor night's sleep.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
7. When I feel irritable, depressed, or anxious during the day, it is mostly because I did not sleep well the night before.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
8. When I sleep poorly on one night, I know that it will disturb my sleep schedule for the whole week.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
9. Without an adequate night's sleep, I can hardly function the next day.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
10. I can't ever predict whether I will have a good or poor night's sleep.	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*
11. I have little ability to manage the negative consequences of disturbed	*Strongly Disagree*	0	1	2	3	4	5	6	7	8	9	10	*Strongly Agree*

sleep.			

12. When I feel tired, have no energy, or just seem not to function well during the day, it is generally because I did not sleep well the night before.	*Strongly Disagree*	0 1 2 3 4 5 6 7 8 9 10	*Strongly Agree*	
13. I believe that insomnia is essentially a result of a chemical imbalance.	*Strongly Disagree*	0 1 2 3 4 5 6 7 8 9 10	*Strongly Agree*	
14. I feel that insomnia is ruining my ability to enjoy life and prevents me from doing what I want.	*Strongly Disagree*	0 1 2 3 4 5 6 7 8 9 10	*Strongly Agree*	
15. Medication is probably the only solution to sleeplessness.	*Strongly Disagree*	0 1 2 3 4 5 6 7 8 9 10	*Strongly Agree*	
16. I avoid or cancel obligations (social, family, occupational) after a poor night's sleep.	*Strongly Disagree*	0 1 2 3 4 5 6 7 8 9 10	*Strongly Agree*	

Appendix K

Initial Response Letter

Thank you for your interest in the Preferences for Sleep Tip Information in Young Adults study, which is investigating an electronically delivered self-management sleep program for young adults, aged 18-30 years old.

Your participation would involve engaging in a free program to help reduce your sleep problems over the course of 8 weeks.

- This study involves a screening process that will take roughly 15 minutes, which involves filling in 4 questionnaires for which there is no incentive.
- Before the program, you will be asked to fill in questionnaires regarding your sleep, and daytime functioning. This will take about 30 minutes. You will also be asked to keep sleep diaries for two weeks before the program begins, which takes 5 minutes each morning.
- The program consists of 8 modules, which will be either delivered once a week for 8 weeks, or all at once. The modules take about 20 to 30 minutes to read.
- After the program, you will be asked to fill in questionnaires regarding your sleep, the sleep program and daytime functioning. This will take about 30 minutes. You will also be asked to keep sleep diaries for two weeks after the program ends, which takes 5 minutes each morning.

Please read the attached consent form, which contains information regarding the potential benefits and risks of participating in this study, as well as further information regarding the study. If you have any questions after reading the consent form, please contact us. If you decide you would like to participate, the link to the study is below.

Qualtrics link

Take care,

Annabelle Torsein, B.A.
Master's student
Psychology Department
Ryerson University
sleepstudy@psych.ryerson.ca

Appendix L

Consent Form
Preferences for Sleep Tip Information in Young Adults

Ryerson University
Consent to Participate in Research Agreement

You are being asked to participate in a research study. Before you give your consent to volunteer, it is important that you read the following information to be sure you understand what will be involved.

<u>**Investigators**</u>
Principal Investigator, Annabelle Torsein, B. A., Ryerson University
- Master's student in Clinical Psychology
- This research study is being conducted as part of the requirements necessary for obtaining a master's degree in Clinical Psychology at Ryerson University.
- The project is being conducted under the direct supervision of Ryerson University faculty member, Dr. Colleen Carney.
Supervisor, Colleen E. Carney, Ph.D., C.Psych., Ryerson University

<u>**Purpose of this study**</u>
The purpose of this study is to examine the acceptability of an electronically delivered sleep program for insomnia. A maximum of 60 individuals between the ages of 18 to 30 will be enrolled in this study. We will enrol people who are physically and emotionally healthy, and without any conditions that would interfere with their wellbeing should they chose to participate.

<u>**Description of the Study**</u>
If you decide to participate in this study, you will be asked to give your consent after you have read this information and you will be directed to a questionnaire, which should take about 15 minutes to complete. If you qualify to participate in this study, after completing the initial questionnaire, you will be invited by email to participate in the study. If you do not qualify for the study, you will receive an email informing you of this fact.

If you agree to participate in the study, you will be assigned to one of two groups. Both groups will receive an electronically delivered copy of the book "Goodnight Mind" by Drs. Colleen Carney and Rachel Manber, two experts in research and treatment of insomnia. This book contains a self-management program for improving one's sleep. The book contains 10 chapters, which have been packaged into 8 modules. The information in "Goodnight Mind" is supported by research as being effective in helping people to sleep better. One group will receive the modules all at once, and the other group will receive one module per week over the course of 8 weeks. The information from "Goodnight Mind" will give you strategies for improving your sleep.

You will also be asked to keep track of your sleep on a daily basis for two weeks before, and two weeks after the program. This should take roughly 5 minutes in the morning.

At the beginning of the program, and 10 weeks after receiving the initial "Goodnight Mind" electronic delivery, you will be asked to complete several questionnaires to assess how much, if any, improvement there has been in your sleep, and several other areas of your life. These measures include questions regarding: your attitudes towards sleep, how tired you feel during the day, your mood, general well-being, how ready you are to make a change to your sleep habits, social supports, likelihood to procrastinate, and understanding of proper sleep habits. Furthermore, when completing questionnaires after the program, you will be asked about your reactions to the program.

What is Experimental in this Study
The procedures and questionnaires included in this study are all supported by research. The experiment is comparing the two different delivery pacings.

Risks or Discomforts
It is possible that you will experience discomfort when filling in the questionnaires about symptoms.

The risks in this study are considered to be minimal. You may also refuse to answer any of the questions and you may take a break at any time during the study. You may stop your participation at any time. At any time, if you feel that you are experiencing discomfort due to participating in this study, or for any other reason, please contact the Sleep and Depression Laboratory at (416) 979-5000, extension 2185, or email the principal investigator, Annabelle Torsein, at sleepstudy@psych.ryerson.ca. Alternately, you can contact the Mental Health Hotline, which is accessible 24 hours a day, seven days a week at 1-866-531-2600.

Benefits of the Study
Information gathered in this study may inform future intervention programs for students aged 18 to 30 who suffer from sleep problems. You may also experience a reduction in sleep problems, or an improvement in daytime functioning. It is also possible that you will not derive any benefits from the program.

Confidentiality
Unless required by law, you will never be identified by name, address, telephone number, or any other direct personal identifier in study records disclosed outside of Ryerson University. Some identifying data will be kept in an encrypted file, and this database will contain name and contact information exclusively. This identifying data will only be kept for the actual data collection portion of the study. Once the data collection portion of the study is complete, the file containing the identifying information of participants will be destroyed. While the results of this study may be presented at scientific meetings or published in a scientific journal, the identity of participants will never be revealed.

Your study information will be identified by a unique code, with no other identifying details associated. Only the principal investigator and supervisor will have access to your personal information. Files containing only de-identified (research) data only will be stored for 7 years after the completion of the study, which is the standard amount of time that data from research

participants is kept within the field of Psychology. This allows time for further analysis of data, and dissemination of findings. Data is also kept for this length of time in order to be able to make the data available to researchers who may ask to verify the findings of the study.

The above measures will be followed to ensure you personal identification; however, there are limits to confidentiality, specifically:
1. If you reveal that you are a danger to yourself or someone else, we must break confidentiality in order to attempt to keep you safe.
2. If you inform us that a child's wellbeing is at risk, we will contact Children's Aid Society.
3. If you inform us that a member of a regulated health care profession in Ontario has been sexually inappropriate with you, we must inform that individual's regulatory body.
4. If your records are subpoenaed by a court of law, we would be required to comply with the demand.

How Your Information will be Protected and Stored

This survey uses Qualtrics^{TM}, which is a United States of American (USA) company. Consequently, USA authorities under the provisions of the Patriot Act may access the survey data.

To further protect your information, data stored by the researcher will be password protected and/or encrypted. Only the researchers named above in this study will have access to the data as collected. Any future publications will include collective information (i.e., aggregate data). Your individual responses (i.e. raw data) will not be shared with anyone outside of the research team.

When the research is completed, the researcher/s will keep the de-identified data in secure storage for up to 7 years after the study is completed. The identifying data and de-identified (research) data will be stored on separate encrypted memory sticks. The identifying data will not be retained after the termination of the study. All information on the drive with the identifying data will be securely erased and the drive will be reformatted as soon as the study is terminated. After seven years have passed, all information from the study will be securely erased and the drive on which the data was stored will be reformatted.

Incentives to Participate

There is no incentive offered for the screening process, which involves filling out four questionnaires to verify eligibility. This will take roughly 10 to 15 minutes. If eligible to participate, before and after the program, you will be asked to fill out questionnaires and complete two weeks of sleep diaries. The questionnaires will take roughly a half an hour to complete and the sleep diaries take approximately 5 minutes each morning to complete (one hour for the two weeks). In total, completion of the questionnaires and the sleep diaries will take 1.5 hours before the program, and 1.5 hours after the program. An incentive of $10 will be offered for your time before the program (roughly 1.5 hours), and another incentive of $10 will be offered for your time after the program (roughly 1.5 hours). If the sleep diaries are not completed, compensation will be prorated.

Therefore, the total incentive for participating in the entire study is $20. Your incentive payment can be picked up in person at the Sleep and Depression Laboratory located in the South Bond Building, Room 218. Please email sleepstudy@psych.ryerson.ca to arrange pick up.

There is no incentive offered for the time engaged in the modules, but you will be receiving a free eBook designed to help individuals experiencing sleep problems.

By participating in this study, you will also be aiding in furthering scientific knowledge regarding insomnia interventions.

Costs and/or Compensations of Participating
There is no financial compensation for participating in the program. No costs associated with participating in the study (e.g., internet service fee, transit fare, etc.) will be reimbursed.

Participation is Entirely Voluntary
Participation in this study is completely voluntary. Whether you choose to participate or not will have no impact on any future relationship you might have with Ryerson University. Also, you may withdraw your consent and stop participating at any time during the study without penalty by simply closing your browser. You may refuse to answer any questions or stop participating entirely at any point in the study. If you stop participating in the study, your de-identified data will still be retained in data analysis, in order to assess if there is a difference related to those who complete versus those who drop out of the program. However, if you request that your data be removed from the study records, all your data will be removed. Finally, to request removing your data from the study, please email Annabelle Torsein at sleepstudy@psych.ryerson.ca.

Questions about the study
If you have questions about this project now, or in the future, please contact:

> Principal Investigator: Annabelle Torsein, B.A.,
> Master's student in Clinical Psychology at Ryerson University
> Study email: sleepstudy@psych.ryerson.ca
>
> Supervisor: Colleen Carney, Ph.D. C.Psych
> Telephone Number: (416) 979-5000 ext. 2177

If you would like to know more concerning your rights as a human subject and participant in this study, you may contact the Ryerson University Research Ethics Board.

> Research Ethics Board
> c/o Office of the Vice President, Research and Innovation
> Ryerson University
> 350 Victoria Street
> Toronto, ON M5B 2K3
> 416-979-5042
> rebchair@ryerson.ca

Agreement

By clicking in the consent box below, you are indicating that you have read the above information and have taken the time to email the principal investigator about any questions you may have regarding the study. You are also indicating that you agree to participate in the study and are aware that you can withdraw your consent and stop participating at any time. You are not giving up your legal rights.

At any time, if you would like to withdraw your information from the study, please contact the lead investigator, Annabelle Torsein, to inform us of your decision (sleepstudy@psych.ryerson.ca).

A copy of this consent agreement was included in the initial email sent to you. Please retain a copy for your records.

After the completion of this study, a reprint of the final report will be available on the Sleep and Depression Laboratory website: http://psychlabs.ryerson.ca/carney/

Appendix M

STOP-Bang Questionnaire

1. Do you snore loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)? (Yes/No)
2. Do you often feel tired, fatigued, or sleepy during the daytime (such as falling asleep during driving or talking to someone)? (Yes/No)
3. Has anyone observed you stop breathing or choking/gasping during your sleep? (Yes/No)
4. Do you have or are being treated for high blood pressure? (Yes/No)
5. Is your body mass index more than 35 kg/m^2? (Yes/No)
6. Age older than 50 year old? (Yes/No)
7. For male, is your shirt collar 17 inches/43 cm or larger? For female, is your shirt collar 16 inches/41 cm or larger? (Yes/No)
8. Gender = Male? (Yes/No)

Appendix N

Demographics questionnaire

When there are two or more questions together, the second or third question(s) will only show up on Qualtrics if the first question is answered in the affirmative.

1. Age (text box)
2. Gender (drop down: female, male, prefer not to answer, do not identify as either gender)
3. Do you live in the greater Toronto area? (Yes/No)
4. How would you rate your sleep? (drop down: good sleeper; fair sleeper; poor sleeper; severe insomnia)
5. Do you have a smartphone (i.e. a cellular phone that you can use to access the internet)? Examples of smartphones include, android, BlackBerry, and iPhone. (Yes/No)
6. On average, how many hours do you spend online daily, including usage from all devices? (text box)
7. How much time on average a day do you spend on social media sites? (text box)
8. Do you belong to any of these social networking sites: (tick boxes)
   - Facebook
   - Twitter
   - Reddit
   - Linked In
   - Other (text box)
9. Do you commute to school or work? (Yes/No) How long is your commute (round up to the nearest kilometer)? (text box) Mode of transportation most often used for commute? (text box) On average, how long does your commute take in minutes (round up to nearest fifteen minute interval)? (text box)
10. What is your living arrangement? (drop down: live alone, live with romantic partner, live with roommate(s), live with family)
11. How many nights a week on average do you share your bed with another person? (drop down: 1 to 7)
12. Do you have pets that sleep in your bed? (Yes/No) How many nights on average does your pet sleep on your bed?
13. Do you take any medication for sleep? (Yes/No) What medication and what dose? (text box)
14. Are you a student? (drop down: Yes/No)
    - STUDENT→ Are you a fulltime or part-time student? (drop down: fulltime, part-time) What year of study are you in? (drop down: year one, year two, year three, year four, year five, taking extra classed, not enrolled in a degree program, not sure) Do you work, either outside of school or a job on campus? (Yes/No) How many hours on average do you work a week? (text box)

15. Do you do shift work? Definition: Shift work refers to working overnight shifts for an extended period of time, or having a schedule that shifts to cover different portions of the 24 hour that are in a day, with some of these shift requiring working overnight. (Yes/No)
16. Have you ever been diagnosed with bipolar disorder or psychotic disorder? (Yes/No)
17. When learning new information, do you prefer: (tick boxes)

- Having the information presented to you in a way that is structured for you to follow along, with information presented at regular intervals.
- Being able to structure the learning as you see fit, by deciding for yourself how much time to spend on various topics or sections.
- Other (text box)

Appendix O

Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

0 = no chance of dozing
1 = slight chance of dozing
2 = moderate chance of dozing
3 = high chance of dozing

SITUATION   CHANCE OF DOZING

Sitting and reading   _____
Watching TV   _____
Sitting inactive in a public place (e.g., a theater or a meeting)   _____
As a passenger in a car for an hour without a break   _____
Lying down to rest in the afternoon when circumstances permit   _____
Sitting and talking to someone   _____
Sitting quietly after a lunch without alcohol   _____
In a car, while stopped for a few minutes in traffic   _____

Appendix M

Reactions to the Program Questionnaire

Thank you for participating in this study. We are hoping to collect feedback from participants that will help to improve this program for future users. Please answer the following questions honestly, including any negative or positive comments you may have.

Did you read/peruse at least one module? (Yes/No)

IF NO →
You indicated that you didn't do the modules. We would like to know the reason to better plan our program. Select the reasons that apply to you:
- Improving my sleep is not a priority at this time
- I do not have easy access to a computer/smartphone
- I am not confident that I could make this change
- I feel like the program would take too much time
- I don't have time right now

Next time around, is there anything we should change or include to make someone like you more likely to access the program: (text-box)

IF YES →

If you did not read all of the modules, we would like to know the reason to better plan our program. Select the reasons that apply to you:
- Improving my sleep is not a priority at this time
- I do not have easy access to a computer/smartphone
- I am not confident that I could make this change
- I feel like the program would take too much time
- I don't have time right now
- I read all the modules

Overall
- Thinking of the program as a whole, what comments (negative or positive) do you have regarding the program? Consider what you may have liked, or not liked about the program. (Open ended - text box)

Content
- How easy to understand did you find the program? (1-7)

- What would have made the information easier to understand? (Open ended- text box)
- Were there specific sections or modules of this program that were especially useful or not useful? (2 sets of drop down menus)
  - Drop down menu
    - Module 1: key concepts responsible for production of sleep (circadian rhythm, homeostatic system, and the arousal system), sleep drive, and manipulating one's sleep drive
    - Module 2: identifying your optimal sleep schedule
    - Module 3: reducing mental activity before bed
    - Module 4: creating a quiet time in the evening
    - Module 5: relaxation techniques
    - Module 6: strategies for reducing worry in bed
    - Module 7: the difference between how a good sleeper and a poor sleeper think, and how to think like a good sleeper
    - Module 8: targeting daytime worry, challenging unhelpful beliefs about sleep, and the importance of being open and accepting about improving your sleep

Format:
- On what device(s) did you access this program? (Text box)
- Was this your preferred device? (Text box)
- What device(s) would you most like to use for accessing this program, or a program like this in the future? (Text box)

Satisfaction:
- Overall, how satisfied are you with this program? (1 to 7)
- Overall, how helpful was this program in addressing your sleep problem? (1 to 7)
- If you experience a similar problem with you sleep in the future, would you use the information in the program again? Why, or why not? (Text box)
- Next time around, is there anything we should change or include to make someone like you more likely to access the program: (Please use the following space to include any other comments you have not mentioned yet.) (Text box)

Appendix Q

Quality of Life Enjoyment and Satisfaction Questionnaire – Short Form

Use the following scale to rate the categories below:

1 = very poor
2 = poor
3 = fair
4 = good
5 = very good

Taking everything into consideration, during the past week how satisfied have you been with your...

- …physical health?
- …mood?
- …work?
- …household activities?
- …social relationships?
- …family relationships?
- …leisure time activities?
- …ability to function in daily life?
- …sexual drive, interest and/or performance?
- …economic status?
- …living/housing situation?
- …ability to get around physically without feeling dizzy or unsteady or falling?
- …your vision in terms of ability to do work or hobbies?
- …overall sense of well being?
- …medication? (Not applicable option included with this category)
- …How would you rate your overall life satisfaction and contentment during the past week?

Appendix R

Stress Subscale of the Depression, Anxiety and Stress Scale

Please read each statement and choose a number 0, 1, 2 or 3 which indicates how much the statement applied to you <u>over the past week</u>. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
0 Did not apply to me at all – NEVER
1 Applied to me to some degree, or some of the time – SOMETIMES
2 Applied to me to a considerable degree, or a good part of the time – OFTEN
3 Applied to me very much, or most of the time – ALMOST ALWAYS

I found it hard to wind down	0 1 2 3
I tended to over-react to situations	0 1 2 3
I felt I was using a lot of nervous energy	0 1 2 3
I found myself getting agitated	0 1 2 3
I found it difficult to relax	0 1 2 3
I was intolerant of anything that kept me from getting on with what I was doing	0 1 2 3
I felt that I was rather touchy	0 1 2 3

Appendix S

Self-Efficacy for Sleep Scale

For the following 9 items, please rate your ability to carry out each behaviour. If you feel able to accomplish a behaviour some of the time but not always, you should indicate a lower level of confidence.

Indicate how confident you are that you can:

-Lie in bed, feeling physically relaxed.

1	2	3	4	5
Not confident at all				Very confident

-Lie in bed, feeling mentally relaxed.

1	2	3	4	5
Not confident at all				Very confident

-Lie in bed with your thoughts "turned off."

1	2	3	4	5
Not confident at all				Very confident

-Fall asleep at night in under 30 minutes.

1	2	3	4	5
Not confident at all				Very confident

-Wake up at night fewer than 3 times.

1	2	3	4	5
Not confident at all				Very confident

-Go back to sleep within 15 minutes of waking in the night.

1	2	3	4	5
Not confident at all				Very confident

-Feel refreshed upon waking in the morning.

1	2	3	4	5
Not confident at all				Very confident

-Wake after a poor night's sleep without feeling upset about it.

1	2	3	4	5
Not confident at all				Very confident

-Not allow a poor night's sleep to interfere with daily activities.

1	2	3	4	5
Not confident at all				Very confident

Appendix T

Response Letter to Those not Eligible

Thank you for your interest in the Preferences for Sleep Tip Information in Young Adults study. Unfortunately, due to the eligibility requirement of this study, we are not able to invite you to participate in the study. If you would like to access information regarding improving your sleep, there are two books available from the Toronto Public Library that may be helpful to you.
- Goodnight Mind: Turn Off you Noisy Mind & Get a Good Night's Sleep
  by Drs. Colleen Carney and Rachel Manber
- The Harvard Medical School Guide to a Good Night's Sleep
  By Dr. Lawrence Epstein

If you are experiencing any discomfort, and would like to access support for how you are feeling, there is a free service you can access:
- The Mental Health Hotline at 1-866-531-2600

If you are a student, you may also have access to counselling services within you college or university.

Please feel free to respond to this email, if you would like help accessing services, or if you have any questions.

Sincerely,

Annabelle Torsein
Master's Student, Clinical Psychology
Ryerson University

Appendix U

Debrief

Thank you for participating in this study. There was no deception used within this study. Our aim is to gather information regarding acceptability of and reactions to this electronically delivered self-management intervention for insomnia for individuals 18 to 30 years of age. Everyone who participated in this study received the same program, based on the book "Goodnight Mind" by Drs. Colleen Carney and Rachel Manber, two experts in the research and treatment of insomnia. There is research support behind the strategies in this book. This book is a self-management program based on a cognitive behavioural therapy for insomnia program. In order to investigate whether there is a benefit to delivering the program either all at once or paced out over two months, half of the participants received all eight modules at once, and the other half received the modules on a weekly basis. The information gathered from this study may be used to inform future intervention programs for undergraduate students experiencing sleep problems.
If you are interested in reading more about the effectiveness of cognitive behavioural therapy for insomnia, the following articles are being suggested as a possible starting point:

National Institute of Health (2005). National Institute of Health state of the science conference statement on manifestations and management of chronic insomnia in adults. *Sleep, 28*, 1049-1057.
Wilson, S. J., Nutt, D. J., Alford, C., Argyropoulos, S. V., Baldwin, D. S., Bateson, A. N., … & Wade, A. G. (2010). British Association for Psychopharmacology consensus statement on evidence-based treatment of insomnia, parasomnias and circadian rhythm disorders. *Journal of Psychopharmacology, 24*, 1577-1601.

If you are experiencing any anxiety, stress or any other issues after participating in this study, please contact:
- The Sleep and Depression Laboratory at (416) 979-5000, extension 2185, or email the principal investigator, Annabelle Torsein, at sleepstudy@psych.ryerson.ca.
- The Mental Health Helpline is accessible 24 hours a day, seven days a week at 1-866-531-2600.
- If you are a student, there may be a counseling center available to you on campus.

If you have any questions or concerns about the study, please contact
- Principle Investigator: Annabelle Torsein, Master's student in Psychology at Ryerson University. Email: sleepstudy@psych.ryerson.ca
- Supervisor: Dr. Colleen Carney, Ph.D, Associate Professor at Ryerson University. Telephone number: (416) 979-5000, ext. 2177

Appendix V

Questions to Capture Reactions of Non-Completers

We noticed you didn't do the modules. We would like to know the reason to better plan our program. Select the reasons that apply to you:

- Improving my sleep is not a priority at this time
- I do not have easy access to a computer/smartphone
- I am not confident that I could make this change
- I feel like the program would take too much time
- I don't have time right now

Next time around, is there anything we should change or include to make someone like you more likely to access the program: (text-box)

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