Lessons learned from delivering an internet intervention for insomnia in an Australian public hospital outpatient setting

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Compliance with Ethical Standards

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Abstract

Objectives: This study examined the feasibility of delivering an online cognitive behavioural therapy for insomnia intervention (Sleep-e) within an Australian public hospital outpatient insomnia clinic.

Method: This study was conducted as an open trial pilot study. Fifty-two patients waiting for clinic treatment were invited to participate, with ten commencing and six completing the 7-week internet intervention. Participants completed a battery of questionnaires regarding their demographic information, sleep and insomnia symptoms, and provided feedback about the program. Exclusion criteria were minimal, and the study allowed for participants to have other health, psychiatric and sleep disorder co-morbidities.

Results: Post-program satisfaction results suggested that Sleep-e was easy to use; participants were satisfied with it; and found it beneficial in improving sleep. Paired samples *t*-tests for the intention-to-treat sample indicated reductions in participants' insomnia severity (p = .02) and sleep onset latency (p = .04) from pre- to post-program. However, a larger sample is needed to generalise the results to the wider population.

Conclusion: The findings support Sleep-e as a helpful treatment for insomnia in a public hospital outpatient population for at least a subgroup of patients. However, significant lessons were learned regarding the importance of educating health care providers and patients about novel models of internet service delivery. Potential models of adaptive or blended stepped-care are discussed to facilitate program implementation. Future research should identify how to implement internet interventions more effectively in public health settings to take advantage of their potential to improve clinical efficiency.

Keywords: insomnia, CBT, clinical/counselling psychology, internet intervention, stepped-care, public hospital

Key Points

What is already known about this topic

- Cognitive Behavioral Therapy for insomnia (CBT-I) is an efficacious, yet underutilised treatment for insomnia
- Internet-delivered CBT-I has the ability to increase access to treatment for insomnia
- Research evidence supports internet-delivered CBT-I as an effective treatment for insomnia in self-referring, highly educated, and computer literate participants and has been found to be effective in participants with comorbid conditions

What this topic adds

- Internet-delivered CBT-I can be a helpful treatment for insomnia in a public hospital outpatient population with comorbidities
- However this study highlights the need to increase exposure to and education about the validity of internet interventions in order to increase patient uptake
- The potential for adaptive or blended models of stepped-care to increase treatment access to CBT-I is discussed, along with facilitating patient engagement and clinical efficiency

Sleep disturbances are a growing public health concern with an estimated 13-33% of the Australian adult population having difficulty either falling or staying asleep (Bartlett, Marshall, Williams, & Grunstein, 2008; Lack, Miller, & Turner, 1988). Sleep disturbances are common in times of stress, but for some people, these sleep disturbances become chronic and are referred to as insomnia (Cunnington & Junge, 2016). According to the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5), insomnia is a debilitating sleep disorder characterised by inability initiating or maintaining sleep or early-morning awakening, that occurs at least three times a week and lasts for at least three months (American Psychiatric Association, 2013). The difficulties with sleep result in clinically significant distress or impairments in daytime functioning, such as a pervasive sense of tiredness, low energy, impaired concentration, irritability and depressed mood. Insomnia therefore places a significant burden on the individual as well as the Australian economy (Hillman et al., 2018; Morin & Benca, 2012).

Fortunately, Cognitive Behavioural Therapy for Insomnia (CBT-I) is efficacious and recommended as first-line treatment for insomnia (Qaseem et al., 2016; Riemann et al., 2017). Despite this, CBT-I is underutilised, and people with insomnia cannot routinely access this evidence-based treatment (Ancoli-Israel & Lieberman, 2004; Manber & Simpson, 2016; C. M. Morin, 2017). CBT-I is underutilised for many reasons, including geographic isolation, unfamiliarity with non-pharmacological treatments for insomnia, a lack of trained clinicians, high cost and time of treatment, stigma around seeking help for insomnia, and insomnia is often not being viewed as a 'real' problem by the medical community (Araujo, Jarrin, Leanza, Vallieres, & Morin, 2017; Cheung, Bartlett, Armour, Laba, & Saini, 2018; Edinger & Means, 2005; C. M. Morin, 2015, 2017; Stinson, Tang, & Harvey, 2006). To overcome these barriers, CBT-I has been developed into a self-help format and delivered via the internet. Internet intervention trials of CBT-I (iCBT-I) demonstrate positive effects on subjective measures of sleep and insomnia symptoms, comparable to face-to-face CBT-I (Anderson, Goldsmith, & Gardiner, 2014; Espie et al., 2012; Ritterband et al., 2009; Strom, Pettersson, & Andersson, 2004; Suzuki et al., 2008). iCBT-I programs, therefore, offer a convenient and effective treatment for insomnia.

Despite the convenience and efficacy of iCBT-I, the current research does have limitations. For example, many iCBT-I studies generally recruit nonclinical, computer-literate

samples that self-refer to an internet intervention. They also generally exclude patients with health, psychiatric and sleep disorder co-morbidities. However, many people with insomnia have medical and psychiatric co-morbidities (Anderson et al., 2014; Jernelov et al., 2012; Ritterband et al., 2009; Strom et al., 2004; Suzuki et al., 2008; van Straten et al., 2014). For example, Anderson et al. (2014) screened for sleep disorder co-morbidities and excluded 62% (*n* = 788) of patients accessing their iCBT-I program (*n* = 1281). Recognising this problem, Ritterband et al. (2017) recently conducted a large iCBT-I trial and included participants with co-morbidities. Although participants were self-referred, computer literate and highly educated, the results were positive and suggested iCBT-I is effective in an insomnia population with comorbidities (Meaklim & Cunnington, 2018; Ritterband et al., 2017).

Patients seeking treatment for insomnia in a public hospital setting typically have comorbidities including chronic health conditions (e.g., diabetes), psychiatric diagnoses (e.g., depression), and other sleep disorders (e.g., obstructive sleep apnoea) (Hebert, Vincent, Lewycky, & Walsh, 2010; Vincent & Lewycky, 2009; Vincent, Walsh, & Lewycky, 2013). CBT-I delivered face-to-face is as helpful to patients with insomnia and co-morbidities, as it is to patients with insomnia alone (Edinger et al., 2009; Smith, Huang, & Manber, 2005). A recent meta-analysis by Wu, Appleman, Salazar, and Ong (2015) identified that face-to-face CBT-I improves insomnia symptoms and sleep parameters in patients with comorbid insomnia, as well as small improvements in comorbid symptomatology. Christensen et al. (2016) found that iCBT-I reduced depression symptoms in a large group of internet users experiencing both insomnia and depression, and Ritterband et al. (2017) also found support for the effectiveness of iCBT-I for people with comorbidities. Therefore, iCBT-I may improve sleep and comorbid symptomatology in patients waiting for face-to-face insomnia treatment at a public hospital clinic.

iCBT-I has many potential service benefits in a public hospital setting, in addition to improving insomnia. Internet interventions have the ability to decrease service costs and waiting lists by reducing the need for face-to-face time with a clinician (Musiat, Goldstone, & Tarrier, 2014). The Australian Department of Health recognised these potential benefits on public mental health care and released mental health reforms in 2015 to encourage a stepped-care approach to mental health (Department of Health, 2015). This approach

127 focuses on using internet interventions to increase access to mental health care and better
128 matching services to mental health needs. Therefore, iCBT-I is an innovative way to increase
129 patient access to CBT-I treatment, reduce clinic waiting lists and costs, and is in line with
130 government mental health reforms.

131 Insomnia has been proposed as a suitable condition for the stepped-care approach
132 (Espie, 2009). The Vincent Model model of stepped-care for insomnia outlines that iCBT-I
133 should be provided to all patients with insomnia as a first 'step'. Then patients are 'stepped-
134 up' in the treatment hierarchy based on their symptom improvement and level of need, to a
135 one-off individual face-to-face session, group therapy, and then to individually tailored CBT-I
136 sessions, if required (Vincent & Walsh, 2013). The Vincent model was trialled in an
137 outpatient insomnia clinic in Canada and the results indicated that only 19 out of 50 patients
138 referred by a physician for insomnia treatment needed more intensive treatment than iCBT-
139 I alone. This result led to a 69% improvement in service efficiency, with a large reduction in
140 the number of patients requiring more intensive CBT-I sessions than prior to the
141 implementation of the stepped-care model (Vincent & Walsh, 2013). The results of this
142 study provide strong support for the use of iCBT-I within an outpatient insomnia clinical
143 setting to improve service efficiency and potential savings on psychologist staffing costs.

144 Given the current literature on the potential of iCBT-I to improve access to CBT-I and
145 service efficiency, the current study aimed to investigate the feasibility and effectiveness of
146 delivering iCBT-I to patients waiting for insomnia treatment at an Australian public hospital-
147 based outpatient insomnia clinic.

Method

Patients and procedure

The iCBT-i program, Sleep-e, was offered to all patients who met study inclusion criteria and were waiting for treatment at an outpatient insomnia clinic in Melbourne, Australia. All patients had a physician referral to receive insomnia treatment. The clinic waiting list was approximately three months and patients were advised that participation in the study would not impact clinic waiting times or future appointments. Inclusion criteria were: (a) clinically significant symptoms of insomnia as measured by the insomnia severity index (>7); (b) not currently receiving psychological treatment for insomnia; (c) depressive symptoms of less than 14 as measured by the DASS-21 because severe depressive symptoms may have required primary face-to-face treatment; (d) access to the internet via a desktop or laptop computer; (e) adequate computer literacy to allow completion of the intervention; (f) adequate comprehension of written English ; (g) aged ≥ 18 years of age; and h) an Australian resident. Medication usage was permitted, and this was reported at the commencement and end of the study. People who did not meet inclusion criteria, but required further assistance, were provided with referral advice.

Patients on the waiting list for insomnia treatment had their hospital records reviewed to determine potential eligibility for study participation. Suitable patients then received a telephone call inviting them to participate in the study. If patients indicated their interest in participating, a brief telephone screen of study eligibility was conducted to confirm computer access and literacy, adequate comprehension of written English, and the presence of insomnia symptoms. If patients declined the invitation, they were asked about their reason for not participating. Participants who were deemed eligible after the brief telephone screen received an email link to complete the pre-program assessments and confirm study eligibility (e.g., ISI score > 7; DASS-21 depression score < 14). Of the 52 patients contacted to participate in the trial, 21 advised they were interested in participating and were potentially eligible for the trial, and were invited to complete a series of online questionnaires collecting information on demographic profile, physical and mental health, sleep and insomnia symptoms to determine eligibility. Twelve participants completed the online questionnaires, with ten participants formally meeting trial eligibility

criteria and commencing the Sleep-e intervention (Figure 1). Participants enrolled in the study completed the online questionnaires again at mid-program. After the 7-week program access period, participants completed another two weeks of online sleep diaries and online post-program questionnaires. This research was approved by the Human Research Ethics Committees (HRECs) at Austin Health and Swinburne University of Technology. The trial was registered with the Australian and New Zealand Clinical Trials Registry on 18 November 2013: ACTRN12613001266752.

Intervention

Sleep-e is an interactive iCBT-I program, containing textual information, graphics, health professional videos, audio content, case examples, online and downloadable worksheets, and an online sleep diary. The program comprises six modules including psycho-education about sleep and insomnia (Module 1), stimulus control and sleep restriction (Module 2), sleep hygiene and relaxation (Module 3), cognitive restructuring (Modules 4 and 5), and relapse prevention (Module 6). All participants received a weekly email during the 7-week intervention period, which included administrative and technical assistance, as well as guidance and support through the treatment. Therapist-assistance emails were provided by a provisionally registered psychologist (eTherapist), supervised by a registered health psychologist, on the same day each week. The eTherapist was able to respond to any specific questions or concerns that the participant had emailed in a second email during that same week. Telephone calls were made to participants as required to assist with technical or clinical issues, with an average of two phone calls being made per participant throughout the program.

Measures

Demographic information. Participant demographic information was obtained at pre-program assessment and included: gender; age; education level; marital status; employment status; medication use (including sleep medications); co-morbid mental health conditions; and other sleep disorders.

Insomnia Severity Index (ISI). The seven-item ISI provides a quantitative index of overall sleep impairment and has been established as a valid and reliable measure (Bastien, Vallieres, & Morin, 2001). Respondents rate the severity of problems with sleep onset, sleep maintenance, early morning awakening, functional impairment, and distress, on a five-point scale ranging from 0 (*none*) to 4 (*very severe*). Scores on the ISI range from 0 to 28, and are interpreted as follows: No clinically significant insomnia (0-7); sub-threshold insomnia (8-14); clinical insomnia with moderate severity (15-21); severe clinical insomnia (22-28). Participants completed the ISI mid-program in addition to pre- and post-program. The Cronbach's reliability coefficient for the ISI at pre-program assessment was $\alpha = 0.78$, supporting the adequate reliability of the measure.

The Depression Anxiety Stress Scale (DASS-21). The DASS-21 is a 21-item self- report measure of stress, anxiety, and depressive symptoms (Lovibond & Lovibond, 1995). It has satisfactory internal consistency, with Espie et al. (2012) reporting internal consistency scores ranging from $\alpha = .82 - .92$ (Espie et al., 2012; Lovibond & Lovibond). Respondents rate 21 items on a four-point scale, ranging from 0 (*did not apply to me at all)* to 3 (*applied to me very much, or most of the time)*, indicating the severity of their stress, anxiety and depressive symptoms over the last week. The Cronbach's reliability coefficient for the DASS-21 in the current study at pre-program assessment was $\alpha = 0.70$.

Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16). The DBAS-16 is a 16-item scale measuring sleep-related cognitions (Morin, 1993). Respondents rate their level of agreement or disagreement on a six-point scale ranging from 0 (*strongly disagree*) to 5 (*strongly agree*) with a range of questions about their beliefs about sleep. A higher total score is associated with a higher level of dysfunctional sleep cognitions. The DBAS-16 discriminates between individuals with insomnia and good sleepers (Morin et al., 1993; Morin, Vallieres & Ivers, 2007). Also, Morin, Vallieres, and Ivers (2007) demonstrated that the DBAS-16 had adequate internal consistency for both clinical ($\alpha = .77$) and research samples ($\alpha = .79$). The Cronbach's reliability coefficient for the DBAS-16 was $\alpha = 0.62$ at pre-program assessment.

Sleep Diary. The Consensus Sleep Diary (CORE) was developed by insomnia experts in consultation with potential users (Carney et al., 2012). Respondents use the sleep diary to

record the time they went to bed, the time they tried to go to sleep, how long it took for them to fall asleep, how many times they woke up, how long these night awakenings were, time of final awakening, time they got out of bed, rating of sleep quality and any additional comments. The consensus diary includes a number of relevant metrics for monitoring and assessing sleep difficulties including sleep onset latency (SOL), wakefulness after sleep onset (WASO), number of total awakenings (NA), total sleep time (TST), total time spent in bed (TIB), sleep efficiency (SE), and sleep quality rating (SQR). In the current study, participants completed the sleep diary online, as part of the Sleep-e program. Participants were instructed to complete their diaries daily, upon awakening, from commencing the Sleep-e program through to two-weeks' post-program. The first two weeks of sleep diary entries were used for baseline sleep parameters as Module 1 which contained no active insomnia treatment.

Program Satisfaction Questionnaire. Using a questionnaire designed by the researchers, participants were asked about their experiences and satisfaction with Sleep-e and their treatment adherence behaviours after completing the program or upon program drop-out.

Data Analysis

Questionnaire and sleep diary data from pre- and post-program assessment was entered into SPSS 22.0 for analysis. Preliminary assumption testing was conducted and no serious violations of normality were noted. Although an original sample size of 25 participants was sought to achieve power at 80% ($\alpha = 0.05$) with an effect size of $dz = 0.35$, this sample size was not achieved. A post-hoc power calculation was determined by GPower, and the current study achieved power of 42% ($\alpha = 0.05$) with an effect size of $dz = 0.49$, as calculated from the ISI (Erdelder, Faul, & Buchner, 1996). Descriptive statistics were obtained for participants' demographic and pre- to post-program data. Paired samples *t*-tests were performed on the intention-to-treat (ITT) sample ($n = 10$ for questionnaire measures, $n=9$ for sleep diary measures) to explore the changes to outcome variables from pre-to post- program assessment.

Results

Figure 1 shows a flowchart of participation in the trial. A total of 52 patients were contacted between November 2013 and June 2014 and invited to participate. Of these, 31 declined to participate (60%). Of the 21 patients who provided informed consent and were telephone screened to be potientially eligible to participate in the study, nine never commenced Sleep-e (43%). Two patients were excluded after completing pre-program assessments as they did not meet inclusion criteria. Of the ten patients who commenced and engaged in participating in the trial, six participants completed the Sleep-e program and pre- and post-program assessments in full. The four participants that dropped out of the trial did so between Modules 1 and 4.

The final sample comprised four males and six females, aged between 28 and 67 years (M = 52.4, SD = 13.7). Seven participants reported co-morbid conditions, including obstructive sleep apnoea (n = 6), restless legs syndrome (n = 1), mixed anxiety and depression (n = 1), bipolar disorder (n = 1), and borderline personality disorder (n = 1). Seven participants were currently taking medication; five to help their sleep specifically. Baseline ISI scores ranged from 11 (subthreshold insomnia) to 27 (clinical insomnia – severe) (M = 17.5, SD = 4.3, clinical insomnia - moderate). The only observed difference between program completers (n = 6) and non-completers (n = 4)was gender, with all program non-completers being female. No differences in age, education level, or symptom severity were observed between program completers and non-completers.

Average pre- and post-program scores on study outcome measures for program completers are displayed in Table 1. There was a statistically significant decrease in insomnia severity, as measured by the ISI, from pre- to post-program assessment (p = .02). The eta squared statistic, $\eta 2$ = .49, indicated a large effect size. No significant change in participants' overall DASS-21 scores were found from pre- to post-program assessment (p = .16). Despite there being a reduction in participants' dysfunctional beliefs about sleep post-program as measured by the DBAS (average reduction of 19.7 points), this change was not statistically significant (p = .10). Among the sleep diary variables, participants' sleep onset latency significantly decreased (p = .04) from pre- to post- program assessment. Participants showed no other statistically significant improvements on the remaining sleep diary

295 measures from pre- to post-program assessment. These results should be viewed with
296 caution, however, because the ITT sample is still small, limiting the generalisability of the
297 findings.

***Table 1**: Sleep and mental health outcome measures (mean (SD))*

Measure		Pre-program	Post-program	*p*-value
ISI		17.50 (4.27)	13.40 (6.79)	.02*
DASS-21		13.60 (4.95)	10.70 (4.72)	.16
	Depression	4.80 (2.35)	3.70 (1.75)	.16
	Anxiety	3.00 (2.31)	2.00 (1.33)	.17
	Stress	5.80 (2.30)	4.90 (2.33)	.34
DBAS-16		99.50 (16.30)	87.70 (28.90)	.10
Sleep Diary				
	SOL (hours)	.89 (.62)	.42 (.39)	.04*
	WASO (hours)	.54 (.81)	.15 (.11)	.32
	NA (number)	1.82 (.72)	1.40 (.75)	.40
	TST (hours)	6.46 (2.25)	6.76 (2.31)	.50
	TIB (hours)	9.47 (2.05)	8.31 (2.45)	.09
	SE (%)	68.12 (14.38)	80.29 (15.79)	.08
	SQR	2.03 (.60)	2.05 (.72)	.28

Note:ISI = insomnia severity index; DASS-21 = depression anxiety stress scales 21; DBAS-16 = dysfunctional beliefs and attitudes and sleep scale-16; SOL = sleep onset latency; WASO = wake after sleep onset; NA = number of total awakenings; TST = total sleep time; TIB = time in bed; SE = sleep efficiency; SQR = sleep quality rating. Intention-to-treat sample size for the ISI, DASS-21 and DBAS-16 was $n = 10$. Intention-to-treat sample size for the sleep diary variables was $n = 9$.

Post-program satisfaction questionnaire

The six program completers completed the online program satisfaction questionnaire. Participants' ratings indicated they were very satisfied with the program, enjoyed using it, and spent six to seven hours reading and viewing program content over the course of the program. All participants rated Sleep-e as easy to use and said they would recommend Sleep-e to a friend or family member with sleeping difficulties. Ratings of the usefulness of information and exercises in Sleep-e varied from "somewhat useful" to "very useful". Four participants reported that they worked through the whole program, but two participants reported that being "too busy" and having "computer problems" prevented program completion. Three participants reported receiving additional support while completing the Sleep-e program, but only one stated what type of support that was (general psychological support). Three out of the six program completers reported taking medications (including the use of sleeping medications) at program completion, including melatonin, temazepam, and Seroquel. Participants' medications were the same at baseline.

The aspects of the program that participants most liked included: program content (e.g., its clarity and the interactive activities provided); sleep diary; getting answers about their sleep problem; modules were easy to use; and their increased understanding of their sleep. The aspects of the program that they liked the least included: sleep restriction; recording information in the sleep diary; and not being able to do the program on an iPad or tablet device. Participants were asked to select features that may have helped them engage more with Sleep-e and selected SMS reminders, email correspondence with a therapist and phone contact with a therapist.

Participants were offered the opportunity to provide recommendations for program improvement. Suggestions included: fixing technological issues; reducing the amount of content and homework activities in some modules; more opportunity for therapist contact; and interaction with other participants completing the program. All non-completing participants were contacted via email and phone and offered the opportunity to complete the post-program satisfaction survey or to provide feedback to the research team.

Unfortunately, no non-completers provided feedback about their experience with the program or reason for dropping out.

Discussion

The current study explored the feasibility and effectiveness of iCBT-I delivered to patients waiting for treatment at an Australian public hospital outpatient insomnia clinic. The study addressed these aims by exploring participant feedback on program satisfaction, usability and experience with the program, recruitment to the study, and also analysing demographic, survey and sleep diary measures.

Of the ten participants who consented to participate, six participants completed the Sleep-e program, thus demonstrating that CBT-I can be delivered in an online format to at least a *subgroup* of patients from a public hospital insomnia clinic. No clear demographic details, apart from female gender in a very small sample size, differentiated program completers from non-completers. Overall participant feedback among treatment completers was positive. Participants reported that Sleep-e was: easy to use; they were satisfied with the program; found it helpful in improving their sleep and daytime symptoms of insomnia; and planned to keep using the strategies that they found useful. Participants did acknowledge that adhering to the program could be challenging. Several participants also experienced IT issues. Questionnaire and sleep diary data suggests that program completers did experience improvements in insomnia despite the majority of participants having a co-morbid sleep or psychiatric condition. The improvements in insomnia symptoms did not appear to be solely attributable to the use of medications, as medication usage was similar at both pre- and post-program assessment. Overall, Sleep-e was viewed as an acceptable and helpful treatment by those who completed it.

Despite the positive feedback on Sleep-e, perhaps the most significant lesson learned from this study was regarding the challenge of implementing iCBT-I within an existing outpatient clinic. This has implications for the feasibility of iCBT-I interventions in outpatient settings. Sixty percent of patients (n = 31) contacted to participate declined, were unable to participate, or were not contactable. The main reasons reported for declining participation were: (1) patients were unable to use or did not have access to a computer or the internet; (2) they preferred face-to-face treatment; or (3) they just did not want to participate. Nine patients provided informed consent but did not commence the Sleep-e program. This was perhaps a failure of appropriate education and marketing to

patients to try, and clinic staff to promote, a novel alternative to the clinic's 'service-as-usual'. The process for study recruitment was for patients to be contacted by phone by the student researcher. Without prior exposure to internet interventions, or an introduction from the senior clinical psychologist or administration staff, patients may not have deemed the online study to be as valid as seeing the senior psychologist who had extensive experience in working with people with insomnia. Musiat et al. (2014) identified that despite the potential of internet interventions to increase access to mental health care, public perceptions that it is inferior to face-to-face treatment with a health professional are prevalent. Raising awareness of internet interventions amongst healthcare providers and administrative staff may increase public perception of the validity of internet interventions in health care settings (Musiat et al., 2014).

The demographic profile of the outpatient insomnia clinic may have contributed to the lack of uptake of the iCBT-I program. The outpatient insomnia clinic is part of a repatriation hospital, with patient's average age being over 50 years. The clinic provides a free service so that patients' employment status and financial resources do not prevent their treatment access. Vincent and Walsh (2013) identified that being older and unemployed predicted the use of more intensive insomnia services in their study of stepped-care for insomnia. In the current study, patients of the insomnia clinic may have preferred to wait for face-to-face treatment, given they had decided to seek specialist help, and may not have felt comfortable using an internet intervention. Also, older and unemployed patients may have more time available to attend appointments and wish to access an in-person service (Vincent & Walsh, 2013). The results of this study suggest that an insomnia clinic with a younger, employed and computer literate group of participants may be a better target for stepped-care insomnia services.

As acknowledged earlier, there were difficulties with study attrition. Participant attrition typically occurred after the introduction of sleep restriction and stimulus control. This high attrition rate is consistent with Vincent and Lewycky (2009), who reported a higher attrition rate for their physician referred (47%) compared to community-recruited patients (18%) to their iCBT-I study. It is important to note that in Vincent and Lewycky's study, all patients were referred by a physician. Unfortunately, all participants who dropped out of

Sleep-e declined to discuss their reason for dropping out, which makes it difficult to draw conclusions for study attrition or dissatisfaction with the program. However, the behavioural components of CBT-I are known to be challenging and counterintuitive (e.g., sleep restriction instructions are to spend less time in bed when you are not sleeping well) (Vincent, Lewycky, & Finnegan, 2008). It is critical for patients to understand the science behind behavioural interventions to implement and adhere to them, and this may be a significant challenge for iCBT-I programs. Potential solutions to increase participant engagement and understanding include adaptive or blended models of internet interventions, with clinician contact via both video-conferencing and emails interspersed throughout the internet intervention. This approach has been piloted in generalised anxiety disorder and preliminary findings suggest a strong therapeutic alliance is helpful to engagement (Rehm et al., 2017).

Lack of feedback from intervention non-completers is a common problem in research. One challenge with gathering this information is that it is often the study recruiter who contacts participants to collect this data and participants may not want to provide negative feedback to the person that recruited them to the trial. Future research could utilise a non-investigator to contact non-completing participants for their feedback. In addition, researchers may need to provide greater incentives, such as gift vouchers, to encourage participants to complete any satisfaction-related measures (irrespective of the more general post-assessment treatment outcome measures), given the importance of their input to improve interventions.

Information technology (IT) difficulties were identified as a potential barrier to participation in the Sleep-e program in this participant group. Several participants cited trouble with using or accessing the internet/computer as their reason for not participating. Many patients at the insomnia clinic were aged over 50 and had limited computer skills to engage in this type of intervention. Future research could investigate if providing increased IT support to patients with low computer literacy could increase recruitment to internet interventions. Incorporating IT-based strategies into general health care (e.g., doctors referring patients to health websites) may be a way to improve familiarity with online health interventions and increase the rate of uptake of online interventions.

Lastly, a major caveat in interpreting the results from this study is that it was underpowered. The study had a small sample size, which increases the likelihood of type II errors and limits the generalisabiliy of the findings to the wider population. Whilst the researchers attempted to increase recruitment sites to enlist more participants to the study, this unfortunately did not progress due to time constraints of the student researcher. Nevertheless, ITT analysis did reveal a significant reduction in insomnia severity and reduced sleep onset latency at program completion, which does provide some initial support to Sleep-e being a useful treatment for insomnia for at least a least a *subgroup* of patients from a public hospital insomnia clinic.

Improving uptake of iCBT-I in a hospital setting.

It is crucial for the future of Australian public health care to take advantage of technology to increase service efficiency. Long clinic wait-lists are unhelpful to both hospital administration and patients. Finding ways to eliminate hospital wait-lists and reduce the amount of time required to treat patients effectively is an essential area of future research.

Some possible areas for improving the uptake of iCBT-I are increasing education and marketing about online interventions to health care providers and patients. Ensuring health care providers are aware of the strong research and benefits of online interventions could facilitate increases in patients' views of the acceptability of these interventions (Apolinario-Hagen, Vehreschild, & Alkoudmani, 2017; Musiat et al., 2014). Some practical suggestions to increase recruitment specific to this study include providing written marketing material to participants by clinical and administration staff, for example. Offering face-to-face information sessions may also boost patients' perceptions of program credibility and provide them with a more direct opportunity to ask questions.

Non-completers of Sleep-e dropped out after the introduction of the sleep restriction and stimulus control. More frequent therapist contact via telephone or videoconferencing may have been helpful during these first modules to help patients understand and adhere to the behavioural strategies, or to escalate to more intensive services at this time, if required. Another alternative may be to trial Sleep-e within insomnia clinics attended by patients of different age and employment profiles. Trialing blended or adaptive stepped-care models may also be of use, where patients are triaged according to

their level of need, unique skills and capabilities, the seriousness of their problem, and personal preferences for treatment. This may assist researchers to identify the types of services that stepped-care models for insomnia are best suited to, and receive the return on investment in increased clinical efficiency and reduced clinic service costs . Exploring different models of stepped-care for insomnia is consistent with the Australian Government's plan for a stepped-care approach to mental health programs and services encouraging the use of internet interventions as a method of promoting timely access to mental health care (Department of Health, 2015).

Summary

Outpatients who completed the iCBT-I program, Sleep-e, reported positive program experiences and improvements in sleep and daytime insomnia symptoms. This suggests there is a place for online interventions in public hospital insomnia clinics to reduce waiting lists and also prepare patients to maximise face-to-face therapy, when and if, they attend an insomnia clinic. Significant lessons were learned about the importance of educating health care providers and patients to use a novel models of internet service delivery and choosing the right type of insomnia service for the implementation of internet interventions. Future research should aim to identify how to integrate psychological internet interventions more effectively in public health settings, to take advantage of their potential to improve service efficiency. Exploring further which patients benefit most from internet interventions and whether adaptive or blended stepped-care are the more successful model of delivery for online health interventions is crucial for future iCBT-I research.

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