Cognitive-Behavioral Self-Help Treatment for Nightmares and Insomnia

Jaap Lancee

Original cover art by Raymond Teitsma

ISBN 978-90-5335-373-8
Printed by Ridderprint BV, Ridderkerk

Cognitive-Behavioral Self-Help Treatment for Nightmares and Insomnia

Cognitieve Gedragstherapie voor Nachtmerries en Insomnie via Zelfhulp

(met een samenvatting in het Nederlands)

Proefschrift

ter verkrijging van de graad van doctor aan de Universiteit Utrecht op gezag van de rector magnificus, prof.dr. G.J. van der Zwaan, ingevolge het besluit van het college voor promoties in het openbaar te verdedigen op vrijdag 15 april 2011 des middags te 12.45 uur

door

Jaap Lancee

geboren op 21 januari 1980 te Zeist

Promotor:

Prof.dr. J. van den Bout

Co-promotor:

Dr. V.I. Spoormaker

Dit proefschrift werd mede mogelijk gemaakt met financiële steun van het Fonds Psychische Gezondheid te Amersfoort.

&

The research reported in this thesis was funded by the Research Institute for Psychology & Health, an institute accredited by the Royal Netherlands Academy of Arts and Sciences.

Table of contents

Chapter 1

Introduction

General introduction

Sleep disorders are among the most prevalent disorders in the general population, with up to 20% suffering from a particular sleep disorder. The most common sleep disorders are insomnia (10-15%),[1-4] sleep disordered breathing (3-7%),[5, 6] restless and moving legs (2-5%),[7-9] and nightmares (2-5%).[10-12] Sleep problems are reported to have negative consequences during the day. Sleep problems can lead to impaired cognitive functioning,[13] which results in impaired performance and an increased chance of (traffic) accidents.[14] In addition, sleep problems are associated with daytime sleepiness and fatigue,[13] disturbed and depressed mood,[15] increased anxiety levels,[15] and poorer physical health.[16]

In this thesis, we focus on the sleep disorders nightmares and insomnia. Both nightmares and insomnia have a large psychological component and they can be effectively treated by cognitive-behavioral therapy (CBT; this will be discussed in depth later).[17-19] Nightmares and insomnia receive relatively little attention in the general health care and a minority of all sleep-disordered persons seek face-to-face treatment;[2, 4, 20] most likely because the general public, as well as professionals are not sufficiently aware of sleep disorders and the possibilities for its treatment.[21]

Few professionals know how to identify and treat sleep problems,[21] and although sleep awareness has grown in the last 5-10 years, treating sleep disorders has yet to become a standard part of mental healthcare. Most general practitioners still tend to prescribe pharmacological agents to sleep disordered persons, although many studies conclude that CBT treatments, have shown better long-term effects.[22, 23]

And even if professionals are properly trained to treat sleep problems with CBT, long waiting-lists still remain in many places. This is partly due to work required from therapists in traditional mental health practices,[24] i.e. the dominant approach of weekly, one-hour sessions. It has been argued that current waiting-lists (with an ever-growing demand for CBT for several mental disorders) may only be shortened by less intensive approaches than standard face-to-face therapy;[25, 26] self-help CBT could be such an approach.

Because of its cost-effectiveness and promising effects, self-help CBT has been proposed as a first option within a stepped-care framework.[25-27] Stepped care refers to a model in which a patient first receives the least restrictive treatment that is still likely to provide significant health gain. If this first treatment does not provide enough health gain, a patient can be moved up to more intensive types of treatment.[26] Self-help CBT has

already been shown effective for several mental disorders, such as anxiety and depression.[28, 29]

At the start of the project leading to this dissertation, few studies on self-help CBT for nightmares and insomnia had been conducted. Because CBT for sleep problems such as insomnia and nightmares mainly consists of psycho-education about sleep and exercises to improve sleep-wake habits, the use of CBT self-help manuals for sleep problems within a stepped care framework seems promising.

Aim of the dissertation

In this dissertation the effects of self-help treatment for nightmares and insomnia were further evaluated. Before self-help CBT for insomnia and nightmares can be implemented in a stepped care approach, the effects should be understood and empirically validated.

'The main goal of this dissertation was to assess whether self-help CBT can be effective in treating nightmares and insomnia.'

Insomnia has been more thoroughly studied than nightmares. As a consequence, in this thesis, different research questions were posed with respect to both disorders. Therefore, in this introduction we will first give a brief introduction on nightmares and subsequently we will address insomnia. Both sections end with a specific research objective and an overview of the chapters.

Nightmares

Nightmares are typically defined as extremely frightening dreams leading to awakening (*Diagnostic and Statistical Manual of Mental Disorders,* 4th ed., text rev. – DSM-IV-TR),[30] although definitions vary. For instance, the *International Classification of Sleep Disorders* (2nd ed. – ICSD-2)[31] definition does not limit emotions to fear, since other emotions are also prevalent in nightmares.[32] Moreover, direct awakening does not appear to be associated with increased distress.[33]

Studies of the general population have indicated that around 2–5% of the adult population reports frequent nightmares.[10-12] A similar percentage is estimated to 'have a current problem with nightmares'. Frequent and chronic nightmares often go along with disrupted sleep, daily distress, and a variety of sleep and affective complaints (for recent reviews, see[19, 34]). Nightmares can have an unspecific origin or occur as part of a posttraumatic stress disorder (PTSD). Around 50-70% of PTSD patients reports frequent nightmares (for reviews see[35, 36]).

A range of cognitive-behavioral techniques effectively ameliorate nightmare frequency. Indirect interventions, such as recording of one's nightmares and relaxation exercises reduce nightmare frequency.[37, 38] Moreover, as nightmare sufferers often have disturbed sleep, improving dysfunctional sleeping habits directly (sleep hygiene) might be effective.[17] Nightmare-focused interventions, such as exposure and cognitive restructuring techniques seem to decrease nightmare frequency to a larger extent.[38, 39] With exposure, the nightmare is relived in imagination and with cognitive restructuring, the nightmare is relived in imagination in a changed (typically more positive) version. Examples of the latter are Imagery Rehearsal Therapy (IRT)[39] and Lucid Dreaming Treatment (LDT).[40] Wittmann et al.[36] concluded that IRT has been evaluated most extensively, but that it has been tested by one research group only (See Table 1 for an overview of the most important treatment formats).

Because the nightmare treatment exercises are comparatively easy to explain and fit in a straightforward format; self-help manuals for nightmares seem promising. At the start of this dissertation only one randomized controlled trial (RCT) on self-help treatment for nightmares had been conducted.[38] In this RCT a paper-and-pencil self-help format was used to compare exposure to a relaxation and waiting-list condition. Robust effects were found on nightmare frequency (effect sizes, Cohen's *d:* 0.3 – 1.1). Moreover, this RCT found that exposure treatment was more effective than the relaxation and the waiting-list condition. However, this RCT did not include IRT or LDT on which theory predicts that

they are more effective because they target not only the cognitive avoidance but also restructure the nightmare. Before the studies are explained, we will firstly address this theory.

Table 1 – *Overview of effective nightmare treatments*

Indirect interventions		
Recording[37] Keeping track of the nightmares.		*Relaxation*[38] Relaxation exercises such as progressive muscle relaxation.
Nightmare targeted interventions		
Imagery Rehearsal Therapy (IRT)[39] Cognitive restructuring by changing the end of the nightmare; desensitization through thinking about new endings and imagining the changed nightmare.	*Exposure*[38] Systematic desensitization through prolonged imagination of original nightmare.	*Lucid Dreaming Therapy (LDT)*[40] Cognitive restructuring by changing the nightmare during the day and within the dream; desensitization through imagining nightmares during the day while thinking that it is only a dream - thereby triggering lucidity during the nightmare.

Theory

Levin & Nielsen[41] proposed a neurocognitive model on nightmares. This model states that the formation of nightmares is similar to the formation of dreaming. In dreaming, memory elements rather than complete memories are activated. These elements are recombinated into dream imagery. According to Levin & Nielsen,[41] dreaming can serve the function of fear extinction through memory element activation, recombination, and expression of dreamed emotions. On a given day, the negative affect load in a dream can be higher through daily stress or other memory demands. An overload of this negative affect can lead to impaired fear extinction and as a consequence, memory elements are recombinated into a complete fear memory: a nightmare.

Recently, Spoormaker[42] published a cognitive model for recurrent nightmares which elaborates on the neurocognitive model by providing an explanation for the formation and persistence of recurrent nightmares. Spoormaker[42] proposes that in recurrent

nightmares the storyline becomes represented in a fixed expectation pattern - referred to as a nightmare script. The script becomes a fear memory in itself. Such a script, either based on a traumatic event or a specific theme (e.g., being chased, falling, or drowning) can be activated when elements in normal dreams are perceived as threatening and/or similar to the script (expectation). The script activates a highly negative affect load, which prevents fear extinction. Moreover, activation of the script results in a replay of the nightmare.

Cognitive and behavioral processes are supposed to affect the development of an incidental nightmare into a recurrent nightmare (and a spontaneous fear memory into a scripted fear memory). For instance, after a nightmare a dreamer may avoid thinking about the fear memory. This cognitive avoidance is thought to be a crucial mechanism in the development of nightmare scripts. Because of cognitive avoidance (while awake), a script is more likely to become an isolated independent memory if (emotional) normalization of the script is prevented.[42]

If cognitive avoidance prevents emotional normalization to the nightmare script, desensitization (prolonged imagination of the feared image) is supposed to break through this cognitive avoidance.[42] With desensitization (emotional) normalization of the nightmare script can take place which means reducing the negative affect load tied to the script. Now the next time a nightmare script is activated the negative affect load tied to the script is lower, and the nightmare sufferer can then tap into the normal dream process of memory element recombination that supposedly serves the function of fear extinction. Guided and controlled exposure will break through the negative cycle of cognitive avoidance and should therefore be more effective in reducing nightmare frequency and anxiety than other treatments that have been proved effective, such as monitoring of the nightmares (with some, but few exposure elements).[42]

Another crucial element in a nightmare may be the lack of variation in the nightmare script.[42] Images are strongly interlinked to one another and the script is replayed in the same format with fixed expectation patterns (but different details). The script expectation pattern can be restructured by introducing new nightmare elements that overwrite old patterns. These new (less threatening) nightmare elements can also decrease the negative affect load in a nightmare and thereby break the impaired fear extinction. Because IRT employs both desensitization (by imagining the nightmare imagery) and restructuring the nightmare script (by introducing new nightmare elements and thus changing the expectation pattern) it is expected to show better results than exposure alone.

From this perspective, this should also apply to LDT because this technique targets the cognitive avoidance and introduces new nightmare elements as well.

Aim of the nightmare studies

The main goal was to assess whether nightmares can be adequately treated with self-help CBT. Furthermore, of clinical and theoretical interest was which CBT technique demonstrates the largest effects. Other goals were to identify the current state of the empirical evidence on nightmare treatment and to determine associations between nightmare frequency and psychopathology measures. Following from the theory above, IRT should be superior to exposure, which would in turn be superior to simpler forms of exposure such as recording one's nightmare. To this aim a self-help IRT protocol was developed, in order to compare it to an exposure, recording, and waiting-list condition. Furthermore it was assessed whether IRT was more effective if the protocol was expanded with a sleep hygiene section or lucid dreaming section.

Studies

For this dissertation all published RCTs until May 1, 2008, were systematically reviewed (Chapter 2). Moreover, a large RCT was conducted on self-help CBT for nightmares (N = 399). In this RCT we compared IRT to exposure, recording, and a waiting-list condition (Chapter 4, 4-week follow-up; Chapter 5, 42-week follow-up). A second RCT was performed to investigate whether a sleep hygiene section or a lucid dreaming section have an extra benifical effect to IRT (N = 287; Chapter 6). The baseline measurements of both intervention studies (Chapter 4-6) were used to determine associations between nightmare frequency and psychopathology measures (Chapter 3).

Insomnia

With a prevalence of 10-15%, insomnia is a common disorder.[1-4] Insomnia is characterized by having trouble falling asleep, maintaining sleep or feeling tired during the day. For chronic insomnia, complaints have to persist for at least a month. Impaired sleep causes fatigue and distress during the day.[43-45] Insomnia is associated with psychological problems such as depression and anxiety,[1, 46] furthermore it is associated with the development of depression and other health problems.[47]

Insomnia can be treated effectively. Sleep medication is effective in the short time management of insomnia, but has adverse effect such as headaches, drowsiness, and dizziness.[22, 48, 49] Moreover, there is little evidence for long-term sleep medication use,[22, 23, 50] except for its association with addiction and tolerance.[51-53] CBT has shown similar short-term and better long-term outcomes than pharmacological interventions,[23, 50, 54] and several reviews and meta-analyses have demonstrated the short-term and long-term effectiveness of CBT for insomnia complaints.[17, 18, 55, 56] A somewhat older systematic review[17] could identify three types of therapy (relaxation / stimulus control / paradoxical intention) as 'well established treatment'; a more recent review[18] upgraded two other forms of therapy (sleep restriction / CBT) from 'probably efficacious' to 'well established treatment'. This recent review[6] concludes that it is more likely that a multi-component approach adequately addresses the different facets of insomnia. The multi-component approach is effective, although moderately: it increases total sleep time only with about 30 minutes.[17, 23, 56]

Because of the ever growing demand of CBT, self-help for insomnia has been proposed as a first option in a stepped care model.[25] As shown by a recent meta-analysis, the effects of self-help CBT on insomnia appear to be small to moderate.[57] All moderate-to large-scale self-help RCTs for insomnia have reported inconsistent, but mainly positive results on global insomnia symptoms, as measured by questionnaires (such as the Insomnia Severity Index[58]), and small or no significant effects on daily self-report measures of sleep, such as total sleep time, sleep onset latency, and sleep efficiency. These findings suggest that self-help CBT mostly works on global insomnia symptoms, in contrast to diary sleep measures. This would imply that self-help therapy for insomnia has an effect on thoughts about sleep (insomnia symptoms) rather than on sleep itself (sleep measures). Before self-help CBT can be implemented as a first option in stepped care, it should prove its effectiveness on primary outcome measures such as daily self-report measures of sleep in large-scale studies.

Theory

Primary insomnia is said to originate from maladaptive behaviors and cognitions.[59] Bad sleep comes from a combination of psychological tension (worrying in bed), conditioned sleep inhibition (the bedroom is associated with activities, thoughts and emotions that interfere with sleep), and cognitive and psychological arousal relating to the above. According to this model, chronic insomnia develops when individuals are overly preoccupied with sleep or getting to sleep. A vicious circle is initiated in which the harder the individual tries to sleep, the more frustrated and aroused he/she gets, which only further disrupts the ability of falling asleep.

In addition, Harvey[60] proposed a cognitive model for insomnia, which states that the overly preoccupation with bad sleep and consequences during the day results in excessive monitoring and selective attention towards sleep. The selective attention results in overestimation of the impaired sleep and daytime consequences, which in turn increases the worrying about the sleep which in turn may lead to real impairment in sleep and daytime functioning.

Based on theory, multiple trials have been conducted to assess the efficacy of different insomnia treatments. As discussed above, CBT for insomnia has proved itself as effective. Therefore, in this dissertation the focus lies not in further exploring the effectiveness of the different treatment components, but on the effectiveness of various treatment-delivery options. Effectiveness of self-help CBT for insomnia has not convincingly been demonstrated on primary sleep variables (such as total sleep time and sleep onset latency). The absence of effect in previous trials may be attributed to the inclusion of patients with a co-morbid depression, which may function as a confounding factor that masks real treatment effects. Self-help CBT for insomnia should first demonstrate its effects on primary sleep variables in order to be implemented as a first option in stepped care.

In recent years, there has been a shift from self-help CBT delivered by paper-and-pencil (bibliotherapy) to delivery via the Internet, owing to the cost-effectiveness of the latter method and increasing Internet access.[61] For example, in 2008, 88% of the population of the Netherlands was connected to the Internet.[62] The shift toward the Internet as a delivery method for self-help CBT, however, appears to be based on practical rather than empirical grounds. No RCT has directly compared bibliotherapy to Internet-delivered self-help CBT for insomnia.

Aim

The main goal was to assess whether insomnia can be adequately treated with self-help CBT. Of clinical interest was that self-help CBT for insomnia has yet to demonstrate convincing effects on diary sleep measures such as total sleep time and sleep onset latency. Moreover, of interest was which delivery method was most effective for self-help for insomnia. For this dissertation a self-help insomnia protocol based on a multicomponent approach was developed, in order to compare Internet-delivered self-help to bibliotherapy and a waiting-list condition.

Study

A large RCT was conducted on self-help CBT for insomnia. In this RCT we compared Internet-delivered self-help CBT to bibliotherapy and a waiting-list condition (N = 623; Chapter 7).

References

1. Ford D, Kamerow D. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *JAMA,* 1989;262:1479-1485.
2. Ancoli-Israel S, Roth T. Characteristics of insomnia in the United States: Results of the 1991 National Sleep Foundation Survey I. *Sleep,* 1999;22(Suppl. 2):347-353.
3. Mellinger GD, Balter MD, Ulenhuth EH. Insomnia and its treatment: Prevalence and correlates. *Arch Gen Psychiat,* 1985;42:225-232.
4. Morin CM, LeBlanc M, Daley M, Gregoire JP, Merette C. Epidemiology of insomnia: Prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep Med,* 2006;7:123-30.
5. Punjabi NM. The epidemiology of adult obstructive sleep apnea. *Proc Am Thorac Soc,* 2008;5:136-143.
6. Young T, Palta M, Demsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *New Engl J Med,* 1993;328:1230-1235.
7. Allen RP, Stillman P, Myers AJ. Physician-diagnosed restless legs syndrome in a large sample of primary medical care patients in western Europe: Prevalence and characteristics. *Sleep Med,* 2010;11:31-37.
8. Allen RP, Walters AS, Montplaisir J, Hening W, Myers A, Bell TJ, et al. Restless legs syndrome prevalence and impact: REST general population study. *Arch Intern Med,* 2005;165:1286-92.
9. Ohayon MM, Roth T. Prevalence of restless legs syndrome and periodic limb movement disorder in the general population. *J Psychosom Res,* 2002;53:547-554.
10. Bixler E, Kales A, Soldatos C, Kales JD, Healey S. Prevalence of sleep disorders in the Los Angeles metropolitan area. *Am J Psychiat,* 1979;79:1257-1262.
11. Spoormaker VI, van den Bout J. The prevalence of sleep disorders in the Netherlands. *Sleep-Wake Res Netherlands,* 2005;16:155-158.
12. Schredl M. Nightmare frequency and nightmare topics in a representative German sample. *Eur Arch Psychiat Clin Neurosci,* 2010;260:565-570.
13. Moul DE, Nofzinger EA, Pilkonis PA, Houck PR, Miewald JM, Buysse DJ. Symptom reports in severe chronic insomnia. *Sleep,* 2002;25:553-563.
14. Horne JA, Reyner LA. Sleep related vehicle accidents. *Br Med J,* 1995;310:565-567.
15. Spoormaker VI, van den Bout J. Depression and anxiety; relations with sleep disturbance. *Eur Psychiat,* 2005;20:243-245.
16. Irwin M, McClintick J, Costlow C, Fortner M, White J, Gillin JC. Partial night sleep deprivation reduces natural killer and cellular immune responses in humans. *FASEB,* 1996;10:643-653.
17. Morin CM, Hauri PJ, Espie CA, Spielman AJ, Buysse DJ, Bootzin RR. Nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine Review. *Sleep,* 1999;22:1-23.
18. Morin CM, Bootzin RR, Buysse DJ, Edinger JD, Espie CA, Lichstein KL. Psychological and behavioral treatment of insomnia: Update of the recent evidence (1998-2004). *Sleep,* 2006;29:1398-1414.
19. Spoormaker VI, Schredl M, van den Bout J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev,* 2006;10:53-59.
20. Benca RM. Diagnoses and treatment of chronic insomnia: A review. *Psychiatr Serv,* 2005;56:332-343.

21. Stores G, Crawford C. Medical student education in sleep and its disorders. 1998;32:149-153.
22. Holbrook AM, Crowther R, Lotter A, Cheng C, King D. Meta-analysis of benzodiazepine use in the treatment of insomnia. *CMAJ,* 2000;162:225-233.
23. Smith TS, Perlis ML, Park A, Smith MS, Pennington JY, Giles DE, et al. Comparative meta-analysis of pharmacotherapy and behavior therapy for persistent insomnia. *Am J Psychiat,* 2002;159:5-11.
24. Lovell K, Richards D. Multiple Access Points and Levels (MAPLE): Ensuring choice accessibilility & equity for CBT services. *Behav Cogn Psychoth,* 2000;28:379-391.
25. Espie CA. "Stepped Care": A health technology solution for delivering cognitive behavioral therapy as a first line insomnia treatment. *Sleep,* 2009;32:1549-1558.
26. Bower P, Gilbody S. Stepped care in psychological therapies: Access, effectiveness and efficiency. Narrative literature review. *Br J Psychiat,* 2005;186:11-17.
27. Scogin FR, Hanson A, Welsh D. Self-administered treatment in stepped-care models of depression treatment. *J Clin Psychol,* 2003;59:341-9.
28. Spek V, Cuijpers P, Nylklicek I, Riper H, Keyzer J, Pop V. Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta analysis. *Psychol Med,* 2007;37:319-328.
29. Gellatly J, Bower P, Hennessy S, Richards D, Gilbody S, Lovell K. What makes self-help interventions effective in the management of depressive symptoms? Meta-analysis and meta-regression. *Psychol Med,* 2007;37:1217-1228.
30. American Psychiatric Association. *Diagnostic and Statistic Manual of Mental Disorders*. 4th ed. Washington DC: American Psychiatric Press; 2000.
31. American Academy of Sleep Medicine. *International classification of sleep disorders: Diagnostic and coding manual.* 2 ed. Westchester, IL: American Academy of Sleep Medicine; 2005.
32. Zadra AL, Pilon M, Donderi DC. Variety and intensity of emotions in nightmares and bad dreams. *J Nerv Ment Dis,* 2006;194:249-254.
33. Blagrove M, Farmer L, Williams E. The relationship of nightmare frequency and nightmare distress to well-being. *J Sleep Res* 2004;13:129-136.
34. Nielsen T, Levin R. Nightmares: A new neurocognitive model. *Sleep Med Rev,* 2007;11:295-310.
35. Spoormaker VI, Montgomery P. Disturbed sleep in post-traumatic stress disorder: Secondary symptom or core feature. *Sleep Med Rev,* 2008;12:169-184.
36. Wittmann L, Schredl M, Kramer M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.
37. Neidhardt EJ, Krakow B, Kellner R, Pathak D. The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep,* 1992;15:470-473.
38. Burgess M, Gill M, Marks IM. Postal self exposure treatment of recurrent nightmares: A randomised controlled trial. *Br J Psychiat,* 1998;172:257-262.
39. Krakow B, Hollifield M, Johnston L, Koss M, Schrader R, Warner TD, et al. Imagery Rehearsal Therapy for chronic nightmares in sexual assault survivors with posttraumatic stress disorder: A randomized controlled trial. *JAMA,* 2001;286:537-545.
40. Spoormaker VI, van den Bout J. Lucid dreaming treatment for nightmares: A pilot-study. *Psychother Psychosom,* 2006;75:389-394.

41. Levin R, Nielsen TA. Disturbed dreaming, posttraumatic stress disorder, and affect distress: A review and neurocognitive model. *Psychol Bull,* 2007;133:482-582.
42. Spoormaker VI. A cognitive model of recurrent nightmares. *Int J Dream Res,* 2008;1:15-22.
43. LeBlanc M, Beaulieu-Bonneau S, Merette C, Savard J, Ivers H, Morin CM. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res,* 2007;63:157-166.
44. Roth T, Drake C. Evolution of insomnia: Current status and future direction. *Sleep Med,* 2004;5(Suppl. 1):S23-30.
45. Simon GE, Vonkorff M. Prevalence, burden, and treatment of insomnia in primary care. *Am J Psychiat,* 1997;154:1417-1423.
46. Taylor DJ, Lichstein KL, Durrence HH, Reidel BW, Bush AJ. Epidemiology of insomnia, depression and anxiety. *Sleep,* 2005;28:1457-1464.
47. Taylor DJ, Lichstein KL, Durrence HH. Insomnia as a health risk factor. *Behav Sleep Med,* 2003;1:227-47.
48. Glass J, Lanctot KL, Herrmann N, Sproule BA, Busto UE. Sedative hypnotics in older people with insomnia: Meta-analysis of risks and benefits. *B Med J,* 2005;331:1169-1173.
49. Buscemi N, Vandermeer B, Friesen C, Bialy L, Tubman M, Ospina M, et al. The efficacy and safety of drug treatments for chronic insomnia in adults: A meta-analysis of RCTs. *J Gen Intern Med,* 2007;22:1335-1350.
50. Rieman D, Perlis ML. The treatments of chronic insomnia: A review of benzodiazepine receptor agonists and psychological and behavioral therapies. *Sleep Med Rev,* 2009;13:205-214.
51. Soldatos CR, Dikeos DG, Whitehead A. Tolerance and rebound insomnia with rapidly eliminated hypnotics: a meta-analysis of sleep laboratory studies. *Int Clin Psychopharmacol,* 1999;14:287-303.
52. Kupfer DJ, Reynolds III CF. Management of insomnia. *N Engl J Med,* 1997;336:341-346.
53. Ashton H. The diagnosis and management of benzodiazepine dependence. *Curr Opin Psychiat,* 2005;18:249-55.
54. Jacobs GD, Pace-Schott EF, Stickgold R, Otto MW. Cognitive behavior therapy and pharmacotherapy for insomnia: A randomized controlled trial and direct comparison. *Arch Intern Med,* 2004;164:1888-1896.
55. Irwin MR, Cole JC, Nicassio PM. Comparative meta-analysis of behavioral interventions for insomnia and their efficacy in middle-aged adults and in older adults 55+ years of age. *Health Psych,* 2006;25:3-14.
56. Murtagh D, Greenwood K. Identifying effective psychological treatments for insomnia: A meta analysis. *J Consult Clin Psych,* 1995;63 79-89.
57. van Straten A, Cuijpers P. Self-help therapy for insomnia: A meta-analysis. *Sleep Med Rev,* 2009;13:61-71.
58. Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med,* 2001;2:297-307.
59. Spielman AJ, Caruso LS, Glovinsky PB. A behavioral perspective on insomnia treatment. *Psychiatr Clin North Am,* 1987;10:541-553.
60. Harvey AG. A cognitive model of insomnia. *Behav Res Ther,* 2002;40:869-893.
61. Andersson G. Using the internet to provide cognitive behaviour therapy. *Behav Res Ther,* 2009;47:175-180.
62. Statistics Netherlands. *Statistical yearbook 2009*. The Hague: Statistics Netherlands; 2009.

Chapter 2

A systematic review of cognitive-behavioral treatment for nightmares: Toward a well-established treatment

Published as:

Lancee, J., Spoormaker, V. I., Krakow, B., & van den Bout, J. (2008). A systematic review of cognitive-behavioral treatment for nightmares – toward a well-established treatment. *Journal of Clinical Sleep Medicine, 4*, 475-480.

Abstract

The aim of this review is to evaluate the effectiveness of cognitive-behavioral therapy (CBT) on nightmare frequency and to determine which kind of CBT is the most effective treatment. A systematic literature search was carried out in PsychInfo and PubMed articles published on or before May 1, 2008. The inclusion criteria were: nightmare treatment study, use of nonpharmacological treatment, not a qualitative case study, and randomized controlled trial (RCT). After selection, 12 peer-reviewed studies about 9 RCTs remained (2 follow-up studies and 1 displaying preliminary results). Several interventions have been reviewed including, recording one's nightmares, relaxation, exposure, and techniques of cognitive restructuring. The 12 evaluated articles varied in quality, and none fulfilled CONSORT guidelines. All articles used nightmare frequency as the primary dependent variable, and all found significant in-group differences (pre vs. post) for intervention or placebo (range d = 0.7–2.9). Five studies were able to find a significant group effect for the intervention compared to a waiting-list control group. Only 1 study found significant differences between 2 intervention groups. Nightmare-focused CBT (exposure and Imagery Rehearsal Therapy [IRT]) revealed better treatment outcomes than indirect CBT (relaxation, recording). IRT and exposure showed no meaningful differences, but only 1 RCT directly compared both techniques. Three different research groups demonstrated the effects of exposure, but only 1 group showed the effect of IRT. Thus, RCTs that compare IRT with exposure by independent research groups are much needed.

Keywords

Nightmares • Imagery Rehearsal Therapy (IRT) • Exposure • Treatment • Randomized controlled trial (RCT)

Introduction

Nightmares are typically defined as extremely frightening dreams leading to awakening (*Diagnostic and Statistical Manual of Mental Disorders, 4th ed.* [DSM-IV-TR]),[1] although definitions vary. For instance, the definition in the *International Classification of Sleep Disorder, 2nd ed.* (ICSD-2)[2] does not limit negative emotions in nightmares to fear alone, as anger or sadness are also prevalent in nightmares.[3] In the research literature, nightmares that do not lead to awakening are usually referred to as *bad dreams*,[4] and nightmare induced distress[5] is differentiated from nightmare frequency (NF): two related but independent constructs.

Studies of the general population have indicated that nightmares are highly prevalent, with up to 70% having occasional nightmares[6] and approximately 2% to 5% of the adult population suffering from frequent nightmares.[6-9] A similar percentage is estimated to 'have a current problem with nightmares', as frequent and chronic nightmares are associated with disrupted sleep,[7] daily distress,[4,8] and a variety of sleep complaints (e.g., night terrors,[9] chronic insomnia,[10] and sleep disordered breathing[11,12]) and affective complaints.[13,14] Nightmares can have an idiopathic (unspecific) origin or occur as part of a posttraumatic stress disorder (PTSD).[15] Approximately 50% to 70% of PTSD patients reports frequent nightmares.[16]

This high prevalence and impact of nightmares has resulted in several treatment outcome studies. In general, older studies on pharmacological treatment of nightmares (e.g., antidepressants) have shown poor results,[17] while a recent systematic review on pharmacological treatment of posttraumatic nightmares showed that effects are inconclusive/tentative at best.[18] The only clear exception is the α1-antagonist prazosin, which has shown very promising outcomes for posttraumatic nightmare reduction in three relatively small randomized controlled trials (RCTs),[19,20,21] although it appears that prazosin must be used continuously as nightmares return after drug withdrawal. To date, cognitive-behavioral therapy (CBT) has gained more empirical support[22] and is the treatment-of-choice for nightmares,[14] particularly in long-term scenarios.

A range of cognitive-behavioral techniques seem to effectively decrease NF. Indirect CBT such as recording[23] one's nightmares and relaxation exercises[24] reduce NF. Nightmare-focused CBT such as exposure or systematic desensitisation[24] and techniques of cognitive restructuring[25] seem to decrease NF even more. These techniques mostly include recording and relaxation with an extra component. In exposure-related techniques, nightmares are written down and relived in imagination during the day. In cognitive

restructuring techniques, nightmares are written down and thereafter changed in a (typically) more positive version. These changed nightmares can be relived during the day (Imagery Rehearsal Therapy [IRT])[26] or can be changed within the nightmare directly (Lucid Dreaming Treatment [LDT]).[27] In a review, Wittmann et al.[22] concluded that IRT has been evaluated most extensively but has been tested only by one research group.

To date the different nightmare treatment studies have not been reviewed systematically. The aim of this review is to evaluate whether CBT shows effects on diminishing nightmare frequency, and if so, which kind of CBT is most effective.

Method

Search Strategy

A systematic literature search was carried out in PsychInfo and PubMed for articles published on or before May 1, 2008. The terms "nightmares" AND "treatment" were used. References from each relevant paper, including three recent reviews of the literature[13,14,22] were examined for additional relevant studies.

The search strategy sought to obtain all relevant published databased RCTs based on the following criteria: nightmare treatment study, use of nonpharmacological treatment, not a qualitative case study, RCT. Follow-up studies were also included because they supplied information about the long-term effects of treatment. All RCTs on nightmare treatments for adults were reviewed by the first two authors.

Data Analysis

To adequately compare studies, Cohen's *d* was calculated for all studies with the software package *G*power 3.0.5*.[28] No effect sizes could be calculated for one study[29] because means and standard deviations were not reported, another study[30] only supplied NF information.[a]

G*power 3.05[28] was used to further explore the nonsignificant differences within- and between-groups. When there was no within-group (pre-post; $p > .05$) effect over time, we calculated the sample size necessary to detect a significant effect (using the difference in effect size, assumption of dependent groups and a power of 0.8). If there was no significant effect in a study between two groups (e.g., intervention, waiting-list), the sample size necessary to achieve adequate power (0.8) was determined (independent groups assumed).

[a] Both authors were contacted, but could not supply the missing data.

Results

Studies

The search string yielded 454 article titles in PsychInfo and 2645 in PubMed. After reviewing the abstracts, most articles were excluded because they were no-treatment articles. Of the remaining 108 articles, 70 were rejected because they were pharmacotherapy (30) or single case articles (40). The remaining articles were then reviewed; 17 of these were excluded because they were not controlled studies, one[31] was excluded because it was in-group controlled, and one[32] was excluded because the population was not ≥ 18 years of age. Twelve articles remained: nine studies,[23-27,29,30,33,34] two follow-up articles,[35,36] and one article displaying preliminary results[37] (see Table1).

Table 1 - *Search string*

	PubMed	Psychinfo
Treatment AND nightmares	2645	454
Treatment studies	50	58
Nonpharmacotherapy studies	33	45
No single-case studies	17	21
Controlled trials	12	14
Randomized controlled trials	11	13
Population ≥18 years	10	12
Studies	9	
Follow-up articles	2	
Article displaying preliminary results	1	

Study Characteristics

Of the articles we examined, 10 were written in the US, one in the UK,[24] and one in the Netherlands[27] (Table 2). The articles were published between 1978 and 2007. In the studies, a total of 437 participants were analyzed, the average number per study being 48.6 (*SD* = 35.8, range 20-114). In the two follow-up articles, intervention was offered to the waiting-list (or recording condition) after three months.[35,36] One preliminary[37] and original[26] study investigated sexual assault victims with PTSD and another study used students.[30] The remaining studies recruited participants through advertisements in the general media.

The published trials we examined varied in quality, yet none fulfilled CONSORT guidelines.[38] None of the articles explained how sample size was determined to achieve

enough power. Only three articles[26,29,34] explained how randomization was achieved, and one covered the issue of blinding procedure.[26]

All articles described eligibility criteria of participants. For inclusion, most studies used a minimum NF of once a week. Miller and DiPilato[29] used a minimum frequency of once a month. Cellucci and Lawrence[30] and Kellner et al.[33] did not mention a minimum frequency. Other inclusion criteria were: 18 years or older,[23,24,26,29,34,35,37] sexual assault survivors,[26,37] posttraumatic stress symptoms,[26,37] and having experienced a traumatic event.[34] Exclusion criteria included alcohol/drug abuse,[23,24,26,29,33-35,37] medication,[23,25,27,29,35,36] psychosis/schizophrenia,[25,26,33,34,36,37] severe (psychiatric) illness,[24,29] and other sleep disorders.[24,27]

Three studies did not suffer from any dropout.[23,25,27] Other studies mentioned the following reasons for dropout: failing to contact the participant, not sending back follow-up measurement, illness, got better. Krakow et al.[26,37] and Davis and Wright[34] found no statistical differences between completers and dropouts. Dropouts in the study of Burgess et al.[24] were more often single and had fewer nightmares in the relaxation group at baseline. Moreover, this study suffered the highest dropout (42% for treatment condition); this attrition rate is, however, not abnormal for self-help treatment.[39]

Four articles described an exposure type method,[24,29,30,33] seven articles IRT,[23,25,26,33,35-37] one study used 'exposure, relaxation and rescripting therapy' (ERRT), an IRT-like technique,[34] and one study used LDT.[27] Most studies used a waiting-list control group, and one[30] was placebo controlled. Four studies used a second intervention next to the control group. These second interventions consisted of relaxation,[29] recording,[30,35] and LDT group intervention.[27] Two studies compared only two interventions without using a control group.[23, 33] Treatment duration from a therapist ranged from 450 minutes[29] to zero minutes (self-help).[24] Most studies used one to three treatment sessions.

All studies used a measurement for nightmare frequency; some studies used a diary to assess NF,[24,30,37] others used interviews,[29] the remaining studies used questionnaires.[23,25-27,33,35,36] Some studies also measured nightmare intensity (NI),[30,33,34] nightmare distress (ND)[26,37] or amount of nights with nightmares per week.[25,26,30,34,36] Most studies used questionnaires to assess other sleep complaints or mental health complaints.

To test for changes in time within- and between-groups, repeated-measures analyses of variance and subsequent paired *t*-tests, were used by most articles. Some used only paired *t*-tests,[23,27] or did not describe their statistical analysis.[29,30] One did not provide

mean scores for variables,[29] and one only reported mean scores for NF.[30] Only three articles provided an intention-to-treat analysis.[24,26,34]

Table 2 - *General information included studies*

References	N[II] (m/f)	Treatment (start /completed[III])	Type	Diary
Cellucci and Lawrence[30]	29	Exposure (10/10) / Placebo (10/10) / Recording (9/8)	Ind	8 weeks
Miller and DiPilato[29]	32	Exposure (12/10) / Relaxation (12/11) / Waiting-list (12/11)	Ind	15 weeks
Kellner et al.[33]	26 (7/19)	IRT (14/13) / Desensitization (14/13)	Group / Ind	1-2 month
Neidhardt et al.[23]	20 (4/15)	IRT (10/10) / Recording (10/10)	Group	1 month
Krakow et al.[35]	19 (4/15)	IRT (10/9) / Recording (10/10)	Group	1 month
Krakow et al.[25]	58 (13/45)	IRT (39/39) / Waiting-list (19/19)	Group	none
Krakow et al.[36]	41	IRT (53/41)	Group	none
Burgess et al.[24]	103	Exposure (83/28) / Relaxation (61/33) / Waiting-list (62/42)	Self-help	12 weeks
Krakow et al.[37]	91 (0/91)	IRT (87/43) / Waiting-list (82/48)	Group	3 weeks
Krakow et al.[26]	114 (0/114)	IRT (88/54)/ Waiting-list (80/60)	Group	3 weeks
Spoormaker and van den Bout[27]	23 (6/17)	LDT Ind (8/8) / LDT group (8/8) / Waiting-list (7/7)	Group / Ind	none
Davis and Wright[34]	32	ERRT (21/17) / Waiting-list (22/15)	Group / Ind	3 weeks

Note. ERRT = Exposure, Relaxation and Rescripting Therapy; IRT = Imagery Rehearsal Therapy; LDT = Lucid Dreaming Therapy

[II] *N* = participants who completed treatment/first follow-up
[III] Completed = treatment and first follow-up (with exception of follow-up studies)

Table 2 - *Continued*

References	Measurements	Duration	Follow-up
Cellucci and Lawrence[30]	NF / NI / NW / Anxiety	5 weeks, 45-60 min a week	1 / 2 weeks
Miller and DiPilato[29]	NF / MMPI / POMS / DSS	6 weeks, 45-75 min a week	After diary / 10 weeks
Kellner et al.[33]	NF / NI / SQ / SCL-90	1 session	4 / 7 / 10 months
Neidhardt et al.[23]	NF / SQ / SCL-90	1 session	3 months
Krakow et al.[35]	NF / SQ / SCL-90	1 session	30 months
Krakow et al.[25]	NF / NW / SQ / VAS	1 session	3 months
Krakow e al.[36]	NF / NW / SQ / VAS	1 session	18 months
Burgess et al.[24]	NF / BDI / Fear	4 weeks / hour a day	1 month / 6 months
Krakow et al.[37]	NF / NW / ND/ PSS / PSQI	3 sessions (2 x 1 hour, 1 x 2 hour)	3 month follow-up
Krakow et al.[26]	NF / NW / PSS / PSQI	3 sessions (2 x 1 hour, 1 x 2 hour)	3 months / 6 months
Spoormaker and van den Bout[27]	NF / SRIP / SLEEP-50	1 x 2 hour session	12 weeks
Davis and Wright[34]	NF / NI / NW / BDI / PTSD / PSQI	3 weeks, 2 hour a week	1 week / 3 months / 6 months

Note. BDI = Beck Depression Inventory[43]; DSS = Dream Survey Schedule; Fear = Fear Questionnaire[44]; NF = nightmare frequency; NI = nightmare intensity; NW = Nights with nightmares per week; POMS = Profile of Mood States[45]; PSS = PTSD Symptom Scale[46]; PSQI = Pittsburgh Sleep Quality Index[47]; SCL-90 = Self-Report Symptom Inventory[40]; SLEEP-50 = sleep complaints[48]; SRIP = Self-Rating Inventory for PTSD[49]; SQ = symptom questionnaire[41]; VAS = Visual Analogue Scale (sleep).

Table 3 - *Effect sizes (Cohen's d) included studies*

		NF	Nightmare intensity (distress)	Nights week	SCL-90 (BDI)	SQ (fear)	PTSD	SLEEP (PSQI)
Cellucci and Lawrence[30]	Exposure / Placebo / Recording	2.9/0.9/0φ	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Miller and DiPilato[29]	Exposure / Relaxation / WL	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Kellner et al.[33]	IRT / Exposure	1.9/1.2	0.5/1.5	n.a.	1.3/0.8	1.6/0.8	n.a.	n.a.
Neidhardt et al.[23]	IRT / Recording	1.3/0.7	n.a.	n.a.	1.1/0.3φ	1.4/0.3φ	n.a.	n.a.
Krakow et al.[35]	IRT / Recording	0.9/0.7	n.a.	n.a.	1.1/0.3φ	1.2/0.7φ	n.a.	n.a.
Krakow et al.[25]	IRT / WL	0.7/0.3φ	n.a.	1.3/0.1φ	n.a.	0.4/0.15φ	n.a.	0.8/+ 0.1φ
Krakow et al.[36]	IRT / WL	1.6/n.a.	n.a.	1.9/n.a.	n.a.	0.5/n.a.	n.a.	0.7/n.a.
Burgess et al.[24]	Exposure / relaxation / WL	1.1/0.3/0.1φ	0.2φ/0.2φ/0φ		(0.8/0.1φ/0.1φ)	(0.6/0.1φ/0φ)	n.a.	n.a.
Krakow et al.[37]	IRT / Waiting-list	0.9/+ 0.3φ	(0.6/0φ)	1.2/0.1φ	n.a.	n.a.	1.2/0.4φ	0.7/0.3φ
Krakow et al.[26]	IRT / Waiting-list	0.8/+ 0.1φ	(1.1/0.1φ)	1.4/0.2φ	n.a.	n.a.	1.1/0.3φ	0.7/0.1φ
Spoormaker and van den Bout[27]	LDT ind / LDT group / WL	1.4/0.3/0φ	n.a.	n.a.	n.a.	n.a.	0.6φ/0.1φ/+0.1φ	0.1φ/0.2φ/ 0.3φ
Davis and Wright[34]	ERRT / WL	0.8/0.3φ	1.7/0.3φ	1.0/0.2φ	(0.6/+0.12φ)	n.a.	0.8/+ 0.1φ	1.2/0.4φ

Note. ERRT = Exposure, relaxation and rescripting therapy; IRT = Imagery Rehearsal Therapy; LDT = Lucid Dreaming Therapy; WL = Waiting-list; φ = No significant within-group difference; n.a. = Not available; follow-up studies effect sizes displayed are compared to baseline.

Intervention Efficacy

Key results for all the studies are displayed using standardized effect sizes (Cohen's *d*) in Table 3; for a quick overview, see Table 4. All articles used NF as a primary variable, and all found significant in-group differences (pre vs. post) for intervention or placebo (range *d* = 0.7 to 2.9), and none for waiting-list. Most studies found differences on secondary variables (range *d* = 0.4 to 1.6), one did not,[27] and three found these differences for only one of their interventions.[23,24,35] The insignificant findings might have been a result of a power issue as Spoormaker and van den Bout[27] would have needed an intervention group of *n* = 22 to pick up the difference in effect found for PTSD. The same applies to Neidhardt et al,[23] in which a sample size of 58 (SCL-90)[40] or 61 (SQ)[41] would have been needed per group to achieve adequate power to find this effect size. For the follow-up study,[35] 17 participants were needed to significantly find the difference of *d* = 0.7. Burgess et al.[24] had enough power to determine effect sizes as small as *d* = 0.4.

Three IRT,[25,26,37] one ERRT,[34] and two exposure[24,30] studies were able to find a significant group effect for the intervention compared to waiting-list or placebo intervention. Burgess et al.[24] also found significant differences between two groups (exposure and relaxation). Other studies were not able to display significant group-effects.[23,27,33,35] This may be a power issue, because the sample sizes of these studies were small. Sample sizes of *n* = 52,[33] *n* = 72,[23] and *n* = 24[27] were needed to detect significant ($p < .05$) differences in effect size with adequate power (0.8). Krakow et al.[37] does not mention a significant group-effect in the preliminary study, but the final report does report these group-effects.[26]

Table 4 - *Quick overview of efficacy of (groups of) techniques*

Type of treatment	Technique	Effect size (Cohen's *d*) for NF reduction	Effect on other sleep or affective complaints	Amount of studies	Total participants
None	Waiting-list	0-0.3[a]	No	4	154
Indirect CBT	Recording	0-0.7[b]	No	3	18
	Relaxation	0.3	No	1	44
Nightmare-focused CBT	Exposure / Desensitization	1.1-2.9	Yes	3	61
	LDT	0.3-1.4	No	1	16
	IRT	0.8-1.9	Yes	8	133

Note. a = All insignificant; b = One study insignificant; IRT = Imagery Rehearsal Therapy; LDT = Lucid Dreaming Therapy.

Discussion

Although the number of included studies is relatively small and the studied groups are quite heterogeneous, this first systematic review on nightmare treatment was able to demonstrate that nightmare-focused CBT showed superior effects to other forms of nightmare treatment for both nightmare reduction and amelioration of associated sleep and affective complaints. So while indirect CBT such as recording and relaxation are effective in reducing nightmares (but not associated complaints), nightmare-focused CBT demonstrated better results on all outcomes, most notably the techniques of exposure and IRT.

The only RCT comparing exposure with IRT found no statistical differences,[33] and this systematic review could not conclude that one was more effective than the other. The only possible difference so far may be a trend that IRT seemed to reduce related affective complaints to a larger degree. It would be interesting to compare IRT to exposure in a sample with adequate power.

Although IRT has been studied in more RCTs than exposure (five vs. three), all studies on IRT have been conducted by the same research group.[22] According to APA criteria for empirically supported treatments[42] this would mean that IRT is a *probably efficacious treatment* instead of a well-established treatment (criterion V for well-established treatments: effects must have been demonstrated by at least two different investigators or investigatory teams). Criterion I, 'superior to pill or psychological placebo or to another treatment', has not been fulfilled yet for IRT, as the only nightmare study so far with statistically significant differences between interventions was that of Burgess et al,[24] which showed stronger effects for exposure than for relaxation. Moreover, the effects of exposure have been demonstrated by three different research groups, making it the only well-established treatment for nightmares so far.

Including the ERRT as employed by Davis and Wright[34] as an IRT-like technique, may help lift the status of IRT, but RCTs following CONSORT guidelines[38] evaluating IRT by independent research groups are much needed. Comparisons should be made with other techniques (well-established ones such as exposure and/or psychological placebo like recording), and pharmacological treatment (e.g., prazosin) in larger samples with sufficient power; assessment should focus on nightmare (frequency and distress), sleep, and affective (anxiety, PTSD, and depressive) complaints.

References

1. American Psychiatric Association. *Diagnostic and Statistic Manual of Mental Disorders. 4th ed*. Washington DC: American Psychiatric Press, 2000.
2. American Academy of Sleep Medicine. *International classification of sleep disorders: Diagnostic and coding manual. 2nd ed.* Westchester, IL: American Academy of Sleep Medicine, 2005.
3. Zadra AL, Pilon M, Donderi DC. Variety and intensity of emotions in nightmares and bad dreams. *J Nerv Ment Dis,* 2006;194:249-254.
4. Zadra AL, Donderi DO. Nightmares and bad dreams: Their prevalence and relationship to well-being. *J Abnorm Psychol,* 2000;109:273-281.
5. Belicki K. Nightmare frequency versus nightmare distress: Relations to psychopathology and cognitive style. *J Abnorm Psychol,* 1992;101:592-597.
6. Hublin C, Kaprio J, Partinen M, Koskenvuo M. Nightmares: Familial aggregation and association with psychiatric disorders in nationwide twin cohort. *Am J Med Genet,* 1999;88:329-336.
7. Kales A, Soldatos C, Caldwell AB, Charney DS, Kales JD, Markel D, et al. Nightmares: Clinical characteristics and personality patterns. *Am J Psychiat,* 1980;137:1197-1201.
8. Berquier A, Ashton R. Characteristic of the frequent nightmare sufferer. *J Abnorm Psychol,* 1992;101:246-250.
9. Ohayon MM, Guilleminault C. Night terrors, sleepwalking and confusional arousals in the general population: Their frequency and relationship to other sleep and mental disorders. *J Clin Psychiat,* 1999;60:268-276.
10. Ohayon MM, Morselli PL, Guilleminault C. Prevalence of nightmares and their relationship to psychopathology and daytime functioning in insomnia subjects. *Sleep,* 1997;20:340-348.
11. Gross M, Lavie P. Dreams in sleep apnea patients. *Dreaming,* 1994;4:195-204.
12. Krakow B, Melendrez DC, Pedersen B, Johnston L, Hollifield M, Koss M, et al. Complex insomnia: Insomnia and sleep-disordered breathing in a consecutive series of crime victims with nightmares and PTSD. *Biol Psychiat,* 2001;49:948-953.
13. Nielsen T, Levin R. Nightmares: A new neurocognitive model. *Sleep Med Rev,* 2007;11:295-310.
14. Spoormaker VI, Schredl M, van den Bout J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev,* 2006;10:53-59.
15. Ross RJ, Ball WA, Sullivan KA, Caroff SN. Sleep disturbance as the hallmark of posttraumatic stress disorder. *Am J Psychiat,* 1989;146:697-707.
16. Spoormaker VI, Montgomery P. Disturbed sleep in post-traumatic stress disorder: Secondary symptom or core feature. *Sleep Med Rev,* 2008;12:169-184.
17. Friedman MJ. Drug treatment for PTSD: Answers and questions. *Ann N Y Acad Sci,* 1997;82:359-371.
18. Van Liempt S, Vermetten E, Geuze E, Westenberg HGM. Pharmacotherapy for disordered sleep in post-traumatic stress disorder: A systematic review. *Int Clin Psychopharmacol,* 2006;21:193-202.
19. Raskind M, Peskind E, Kanter E, Petrie E, Radant A, Dobie CTD, et al. Reduction of nightmares and other PTSD symptoms in combat veterans by prazosin: A placebo-controlled study. *Am J Psychiat,* 2003;160:371-373.
20. Raskind MA, Peskind ER, Hoff DJ, Hart KL, Holmes HA, Warren D, et al. A parallel group placebo controlled study of prazosin for trauma nightmares and sleep

disturbance in combat veterans with posttraumatic stress disorder. *Biol Psychiat,* 2007;8:928-934.
21. Taylor FB, Martin P, Thompson C, Williams J, Mellman TA, Gross C, et al. Prazosin effects on objective sleep measures and clinical symptoms in civilian trauma posttraumatic stress disorder: A placebo-controlled study. *Biol Psychiat,* 2008;63:629-632.
22. Wittmann L, Schredl M, Kramer M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.
23. Neidhardt EJ, Krakow B, Kellner R, Pathak D. The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep,* 1992;15:470-473.
24. Burgess M, Gill, Marks IM. Postal self exposure treatment of recurrent nightmares: A randomised controlled trial. *Br J Psychiat,* 1998;172:257-262.
25. Krakow B, Kellner R, Pathak D, Lambert L. Imagery rehearsal treatment for chronic nightmares. *Behav Res Ther,* 1995;33:837-843.
26. Krakow B, Hollifield M, Johnston L, Koss M, Schrader R, Warner TD, et al. Imagery rehearsal therapy for chronic nightmares in sexual assault survivors with posttraumatic stress disorder: A randomized controlled trial. *JAMA,* 2001;286:537-545.
27. Spoormaker VI, van den Bout J. Lucid dreaming treatment for nightmares: A pilot-study. *Psychother Psychosom,* 2006;75:389-394.
28. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods,* 2007;39:175-191.
29. Miller WR, DiPilato M. Treatment of nightmares via relaxation and desentisation: A controlled evaluation. *J Consult Clin Psychol,* 1983;51:870-877.
30. Celluci AJ, Lawrence PS. The efficacy of systematic desentisation in reducing nightmares. *J Behav Ther Exp Psychiat,* 1979;9:109-114.
31. Grandi S, Fabbri S, Panattoni N, Gonnella E, Marks IM. Self-exposure treatment of recurrent nightmares: Waiting-list-controlled trial and 4-year follow-up. *Psychother Psychosom,* 2006;75:384-388.
32. Krakow B, Sandoval D, Schrader R, Keuhne B, Mcbride L, Yau CL, et al. Treatment of chronic nightmares in adjudicated adolescent girls in a residential facility. *J Adolesc Health,* 2001;29:94-100.
33. Kellner R, Neidhardt J, Krakow B, Pathak D. Changes in chronic nightmares after one session of desensitization or rehearsal instructions. *Am J Psychiat,* 1992;149:659-663.
34. Davis JL, Wright DC. Randomised clinical trial for treatment of chronic nightmares in trauma-exposed adults. *J Trauma Stress,* 2007;20:123-133.
35. Krakow B, Kellner R, Neidhardt EJ, Pathak D, Lambert L. Imagery rehearsal treatment of chronic nightmares: With a thirty month follow-up. *J Behav Ther Exp Psychol,* 1993;24:325-330.
36. Krakow B, Kellner R, Pathak D, Lambert L. Long term reduction of nightmares with imagery rehearsal treatment. *Behav Cogn Psychother,* 1996;24:135-148.
37. Krakow B, Hollifield M, Schrader R. A controlled study of imagery rehearsal for chronic nightmares in sexual assault survivors with PTSD; a preliminary report. *J Trauma Stress,* 2000;13:589-609.

38. Moher D, Schulz KF, Altman DG. The CONSORT statement: Revised recommendations for improving the quality of reports of parallel-group randomised trials. *Lancet,* 2001;357:1191-1194.
39. Eysenbach G. The law of attrition. *J Med Internet Res,* 2005;7:e11.
40. Derogatis LR, Lipman RS, Covi L. Self-Report Symptom Inventory (SCL-90). In: Guy W, ed. *ECDEU assessment manual for psychopharmacology*. Washington: US Department of Health Education, and Welfare, 1976:313-331.
41. Kellner R. A symptom questionnaire. *J Clin Psychiat,* 1987;48:268-274.
42. Chambless DL, Baker MJ, Baucom DH, Beutler LE, Calhoun KS, Crits-Cristoph P, et al. Update on empirically validated therapies, II. *The Clinical Psychologist,* 1998;51:3-16.
43. Beck A, Ward C, Mendelson M, Mock J, Erbaugh J. Inventory to measure depression. *Arch Gen Psychiat,* 1961;4:561-567.
44. Marks IM, Matthews AM. Brief standard self-rating for phobic patients. *Behav Res Ther,* 1979;17:263-267.
45. McNair DM, Lorr M, Droppelman LF. *Manual for the Profile of Mood States.* San Diego: Educational and Industrial Testing Service, 1971.
46. Foa E, Riggs D, Dancu C, Rothbaum B. Reliability and validity of a brief instrument for assessing post-traumatic stress disorder. *J Trauma Stress,* 1993;6:459-473.
47. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiat Res,* 1989;28:193-213.
48. Spoormaker VI, Verbeek I, van den Bout J, Klip EC. Initial validation of the SLEEP-50 questionnaire. *Behav Sleep Med,* 2005;3:227-246.
49. Hovens JE, Bramsen I, van der Ploeg HM. *Manual for the Self-Rating Inventory for Posttraumatic Stress Disorder* (SRIP). Lisse: Swets Test Publishers, 2000.

Chapter 3

Nightmare frequency is associated with subjective sleep quality but not with psychopathology

Published as:

Lancee, J., Spoormaker, V. I., & van den Bout, J. (2010). Nightmare frequency is associated with subjective sleep quality but not with psychopathology. *Sleep and Biological Rhythms, 8*, 187-193.

Abstract

This study aimed to evaluate all known and hypothesized predictors for nightmare frequency measures in a population with frequent nightmares. A total of 666 Internet recruited participants completed questionnaires on nightmares, sleep, and psychopathology, 146 of whom further completed a subsequent 7-day diary. In contrast to previous research, comparison of questionnaire and diary measured nightmare frequency revealed a significantly higher log-transformed nightmare frequency on the questionnaire: $t(127) = 4.43$; $p < .001$. No differences were found regarding the number of nights with nightmares, $t(127) = 0.61$; $p = .54$. Regression analyses showed that subjective sleep quality was the only variable significantly associated with nightmare frequency variables in the whole sample (R^2_{adj} between 10.5% - 11.5%; $p < .01$). These results support the notion that nightmares are independent from other mental complaints in a population of nightmare sufferers and should therefore be viewed from a sleep medicine perspective: As a sleep disorder that can and should receive specific attention and treatment.

Keywords

Behavior and cognition • Nightmares • Parasomnias

Introduction

Around 2-5% in the general population has frequent nightmares,[1-3] which are commonly viewed by mental health professionals as part of an underlying anxiety disorder.[4, 5] In the DSM-IV-TR,[6] sleep disorders such as nightmares and insomnia can only be diagnosed if they *'do not occur exclusively during the course of another mental disorder'*. As a consequence, nightmares and insomnia rarely receive a specific diagnosis, as the implicit assumption seems to be that these sleep disorders disappear after the 'underlying disorder' has been treated. However, this assumption does not apply to, for instance, sleep complaints in posttraumatic stress disorder (PTSD), where sleep complaints start after a traumatic event but will persist if not specifically treated, even when PTSD-symptom-severity reduces.[5]

In line with this prevailing view, significant correlations between nightmares and general psychopathology have been reported.[7, 8] However, not all studies found these relationships.[9, 10] Nightmare distress has been suggested as a modulating factor,[11] whereby nightmare distress is only weakly related to nightmare frequency. The type of measurement also seems to influence the relationships as reports of nightmare frequencies seem to differ between questionnaires and diaries.[12] Crucially, most studies focused exclusively on populations of psychiatric patients or student populations, with limited generalizability to other populations. For instance, nightmares were unrelated to any mental complaint in a general adult population.[10] It is possible that the previously found relationships are confounded by extreme scores on both psychopathology and nightmare frequency (e.g., as occurs in posttraumatic stress disorder patients).

The aim of this study was to evaluate the relationships between nightmares and mental complaints in a population with frequent nightmares recruited through Internet. More specifically, we aimed to investigate whether nightmare frequency is associated with mental complaints. Sleep correlates, such as sleep quality were also included because associations with nightmares have been shown previously.[13] As different outcomes have been reported with prospective (i.e. diaries) and retrospective measurements (i.e. questionnaires), we included both.

Method

Nightmare definition

Nightmares are typically defined as extremely frightening dreams leading to awakening [DSM-IV-TR],[6] although direct awakening is not associated with lower well-being.[11] As emotions other than fear are commonly reported in nightmares,[14] the definition in the *International Classification of Sleep Disorder, 2nd ed.* (ICSD-2) does not limit negative emotions in nightmares to fear alone.[15] Therefore, we defined nightmares as intensely negative dreams that may lead to awakening – resulting in a fast orientation and clear recall afterwards (to distinguish nightmares from sleep terrors).

Table 1 – *Mean and SD scores on psychopathology variables*

	Range	*M*	*SD*
Anxiety	20-80	46.25	11.33
Depression	0-60	18.83	10.05
PTSD complaints	0-75	29.11	16.98
Neuroticism	1-5	3.33	0.73
Insomnia	8-32	18.50	5.35
Sleep quality	1-10	5.57	1.37

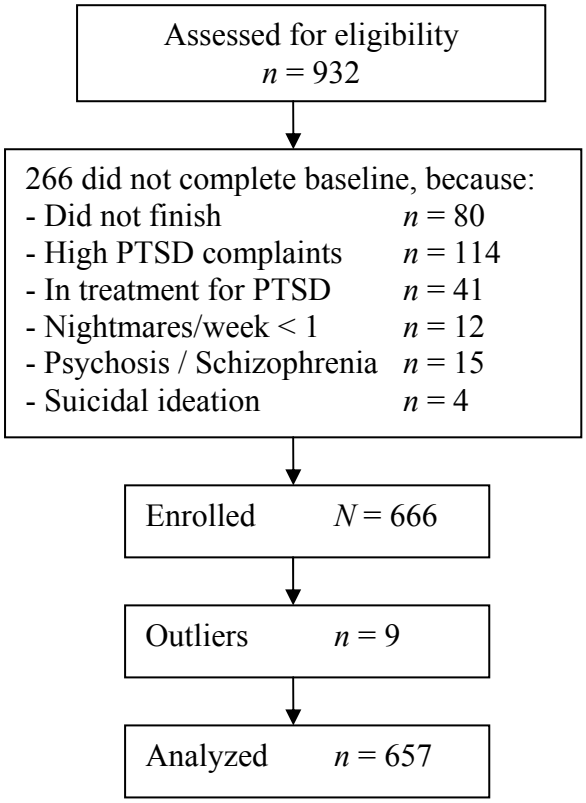
Participants

A total of 666 participants with a Dutch home address completed the baseline questionnaire: 518 (77.8%) females and 148 (22.2%) males with a mean age of 37.8 (*SD* = 15.1); 109 participants were 55 or older. After exclusion of nine outliers (see Statistical analysis), the analyzed sample consisted of 657 participants. See Tables 1 and 2 for mean scores on nightmares, anxiety, depression, insomnia, PTSD complaints, neuroticism, and sleep quality. The theme of the nightmares was recurrent for 56.3% (*SD* = 31.5) of the participants and 78.2% (*SD* = 20.9) of the participants always had the same emotion in their nightmares (e.g., anxiety / anger). The participants slept on average 7.2 (SD = 1.4) hours a night and rated their sleep with a 5.6 (*SD* = 1.4) on a scale from one to ten. A total of 109 (16.4%) participants were currently in treatment by a psychologist, and 140 (21.0%) took medication for psychological problems (most frequently taken medication were Selective Serotonin Reuptake Inhibitors - SSRI's > 90%). Of the 409 mailed diaries, only 146 (35.7%) were returned. This may be due to the reported observation that nightmare sufferers are reluctant to keeping a log.[18]

Procedure

Participants were recruited from May 2007 to April 2009 through a Dutch popular-scientific nightmare website (www.nachtmerries.org) as part of two large self-help intervention studies described elsewhere.[19] Dutch Internet penetration is the highest in Europe, with 83% of the Dutch households having access to the Internet in 2007.[20] Attention was drawn to this website via public media (all four national newspapers). The original study was approved by the Medical Ethics Review Committee of the Medical Centre of Utrecht University. To adhere to ethical guidelines the inclusion criteria for these intervention studies were: being 18 years or older and having self-reported nightmares based on the SLEEP-50.[21] Exclusion criteria were: extreme score on post traumatic complaints (n = 114; score > 53 on Dutch translation of the Impact of Event Scale - IES,[16] cutoff scores to indicate PTSD is 26), currently in treatment for PTSD (n = 41), suicidal ideation (n = 4), and schizophrenia (n = 15; Figure 1). Participants could enter the digital baseline questionnaire after informed consent was provided and they filled out questionnaires online. After baseline, participants were randomized in one of four conditions, one of which was a waiting-list condition that did not receive a diary (n = 157). The other conditions all received a diary as part of their treatment. The first week of the diary was analyzed for this study as the intervention started at week two. For a full description of the intervention design see Lancee *et al*.[19]

Figure 1 - Flowchart



Measurements

Nightmare frequency, insomnia, and sleep rating were measured by the 50-item SLEEP-50,[21] a sleep questionnaire with good reliability (α = .85, test-retest reliability .78). Compared with polysomnographic and clinical diagnoses, the SLEEP-50 shows good predictive validity for various sleep disorders. The cutoff for insomnia disorder is 19 or higher (range = 8-32; sensitivity = .71; specificity = .75). In addition the SLEEP-50 addresses the nightmare frequency for the past week, the amount of nights with nightmares a month, and the sleep rating (1 'very bad' – 10 'very good'). For nightmares, the sensitivity was .84 and the specificity was .77 compared to clinical diagnosis.

Anxiety was measured by the Dutch version of the 20 item Spielberger Trait Anxiety Inventory.[22] The Trait Anxiety Inventory consists of twenty statements about how much anxiety is generally experienced (e.g., 'I feel content'; 1 = 'almost never'; 4 = 'almost always'; range: 20 - 80). Reliability is good (α, range .87 - .96; test-retest correlation is .84 - .88), and so is the validity.[22]

Depression was measured by a Dutch translation of the 20 item Centre of Epidemiological Studies-Depression scale (CES-D).[17] The CES-D scale consists of 20

items. This scale (range 0 – 60) has good internal consistency (α, range .79 - .92; test-retest correlation is .90), and the validity of the Dutch scale is promising compared to Beck Depression Inventory (e.g., correlation of .56 - .66).[17] The CES-D uses a cutoff score of 16 to indicate mild depression and 27 to indicate major depression disorder.[23]

Posttraumatic stress complaints were measured by a Dutch translation of the 15 item IES.[16] Only participants who had experienced a trauma filled out the questionnaire (n = 453; range 0 - 75). Cutoff scores to indicate PTSD is 26 in the Dutch version; our sample had a mean score of 29.1 (SD = 16.9) showing that our sample included participants with (complete or incomplete) PTSD, whereas extreme scores were excluded (IES > 53). This scale has good internal consistency (α range: .87 - .96), and construct validity comparable with the original IES.[24]

Neuroticism was measured by a subscale of the Dutch translation of the Big Five Inventory (BFI; range 1-5).[25] Validity and internal consistency is good (α: .86) and consistent with the English original.[26]

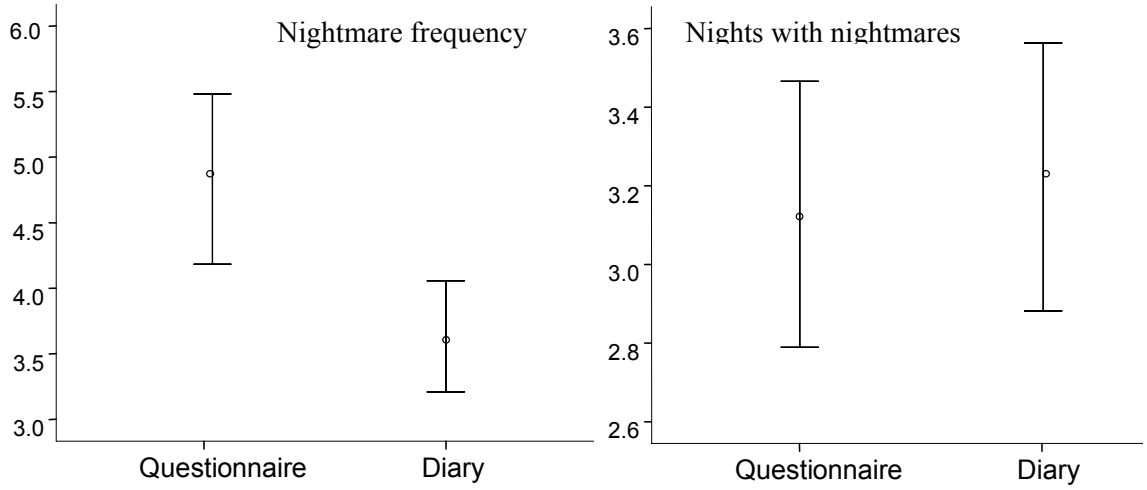
Statistical analysis

Paired t-tests were used to control for differences between nightmare frequency measures. The reported daily diary measurements and the nights with nightmares per month measured by the questionnaire were transformed to a weekly period. The dependent variable 'nightmare frequency a week' measured by both the questionnaire and the diary was log-transformed to meet the assumption of normality. Nine outliers were excluded from the retrospective questionnaire and two from the diary (z-score of above 3.29 on nightmare frequency). In addition, 11 participants did not fill out their diary each day and were excluded from the diary-analysis. The analyzed sample was n = 657 for questionnaire, and n = 133 for the diary.

Because of its ability to combine more variables within one model, multivariate analysis was used; the cross-sectional nature of the data made it impossible to draw conclusions on causality. Subgroup analyses were performed on questionnaire data for high/low scorers on PTSD complaints (≥ 26) and depression (≥ 27). Participants who failed to send back the diary (M = 5.66; SD = 4.14) scored marginally higher on the retrospective nightmare frequency than the participants that did send back the diary (M = 5.09; SD =

4.01): $F(1, 651) = 3.81$; $p = .052$.[a] For dependent questionnaire variables a dummy was used to control for this marginal difference (0 = no diary returned; 1 = diary returned). Of the participants that sent back the dairy 94 were randomized in an intervention condition and 49 were randomized in a recording condition. No difference in nightmare frequency was found on week one between the two groups: $F(1,131) = 0.01$; $p = .94$. Nonetheless, a dummy was used to control for group influence (0 = recording; 1 = intervention). A significance level of $p < .05$ (2-sided) was used throughout the course of the study.

Figure 2 - Nightmare frequency and nights with nightmares a week based on diary and questionnaire



Note. Weekly nightmare frequency: $t(127) = 4.43$; $p < .001$ (calculated with log-scores); nights with nightmares: $t(127) = 0.61$; $p = .54$.

[a] Paired sample means in Results section differ from these mean scores because of the 11 participants that send back their diary, but failed to fill out each day of the first diary week.

Table 2 – *Mean and SD scores on nightmare variables for the whole sample and divided by subgroups*

	Nightmare frequency questionnaire	Nightmare frequency diary	Nights with nightmares Questionnaire	Nights with nightmares diary	Nightmare distress questionnaire
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Total	5.54 (4.11)	3.63 (2.42)	3.50 (1.95)	3.21 (1.95)	15.44 (4.45)
Female	5.40 (4.02)	3.84 (2.29)	3.46 (1.92)	3.44 (1.87)	15.66 (4.43)
Male	6.01 (4.42)	3.03 (2.69)	3.66 (2.07)	2.75 (2.22)	14.67 (4.44) ┐ *
Age ≥ 55	5.22 (4.02)	3.29 (2.16)	3.36 (2.03)	3.04 (2.05)	12.99 (3.88) ┘
Age < 55	5.60 (4.13)	3.73 (2.48)	3.53 (1.94)	3.27 (1.93)	15.92 (4.39) ┐ ***
PTSD ≥ 26	5.79 (4.26)	4.04 (2.83)	3.70 (1.98) ┐ *	3.50 (1.13)	16.17 (4.35) ┐
PTSD < 26	5.35 (4.00)	3.35 (2.03)	3.37 (1.92) ┘	3.01 (1.79)	14.92 (4.45) ┘ ***
Depression ≥ 27	5.35 (4.00) ┐ ***	4.59 (2.99) ┐ *	4.03 (2.02) ┐ ***	3.90 (2.39)	18.27 (3.62) ┐
Depression < 27	5.12 (3.71) ┘	3.43 (2.25) ┘	3.35 (1.91) ┘	3.08 (1.84)	14.58 (4.32) ┘ ***

Note. Significant differences on ANOVA for pairs: * = $p < .05$; ** = $p < .01$; *** = $p < .001$.

Results

A paired sample *t*-test showed that participants scored significantly higher on log-transformed weekly nightmare frequency in the questionnaire compared to the diary: $t(127) = 4.43$; $p < .001$, $r = .51$. Paired mean scores on nightmare frequency were: questionnaire: $M = 4.85$; $SD = 3.71$; diary: $M = 3.63$; $SD = 2.42$. No difference was found between the questionnaire and diary on nights with nightmares a week: $t(127) = 0.61$; $p = .54$, $r = .57$. Paired mean scores on nights with nightmares were: questionnaire: $M = 3.12$; $SD = 1.93$; diary $M = 3.21$; $SD = 1.95$. See Figure 2 for graphic reproduction of mean scores on nightmare variables.

Multivariate regression analyses showed that only sleep quality ($p < .05$) was significantly associated with nights with nightmares – diary ($R^2_{adj} = 12.5\%$; $p < .01$), nights with nightmares – questionnaire ($R^2_{adj} = 10.6\%$; $p < .001$), and weekly nightmare frequency – diary ($R^2_{adj} = 11.5\%$; $p < .01$). For weekly nightmare frequency as measured by the questionnaire, sleep quality ($p < .001$) *and* insomnia ($p < .05$) explained a significant part of the variance ($R^2_{adj} = 10.5\%$ ($p < .001$). In contrast, nightmare distress was associated with subjective sleep quality, depression, insomnia, and neuroticism ($R^2_{adj} = 34.4\%$; $p < .001$). See Table 3 for explained variance and betas.

Subgroup analyses were performed for high/low scorers on PTSD complaints and depression. Two-hundred-seventy-four participants reached cutoff for PTSD (IES[16] ≥ 26), 150 participants reached cutoff to indicate major depression (CES-D[17] ≥ 27). Low scorers on PTSD complaints and depression followed the same pattern as found in the whole sample. Both high scorers on PTSD and participants with major depression showed that in addition to sleep rating, nightmare distress ($p < .05$) explained a part of the variance of weekly nightmare frequency and nights with nightmares ($R^2_{adj} = 5.0 – 11.9\%$; $p < .05$). For participants with high PTSD complaints weekly nightmare frequency ($p < .05$) now also explained a part of the variance of nightmare distress ($R^2_{adj} = 35.2\%$; $p < .001$). For high scorers on depression anxiety was now related to nightmare distress instead of neuroticism ($R^2_{adj} = 17.5\%$; $p < .001$). Moreover, the explained variance for high scorers on depression was lower compared to the analysis of the whole sample and the high scorers on PTSD complaints (Table 4).

Table 3 – *Regression coefficients associated with nightmare frequency, nights with nightmares a week, and nightmare distress for both diary and questionnaire*

	Nightmare frequency week questionnaire	Nightmare frequency week diary	Nights with nightmares questionnaire	Nights with nightmares diary	Nightmare distress questionnaire
	Beta	*Beta*	*Beta*	*Beta*	*Beta*
Filled out diary	-0.07	-	-0.07	-	-0.05
Received intervention	-	- 0.01	-	-0.01	-
Anxiety	0.00	-0.02	0.07	0.09	-0.01
Depression	0.09	0.02	0.00	0.02	0.26 ***
PTSD complaints	0.02	0.02	0.06	0.05	-0.04
Neuroticism	-0.01	-0.09	-0.04	-0.10	0.16 ***
Insomnia	-0.10 *	0.20	-0.04	0.18	0.14 ***
Sleep Quality	-0.30 ***	-0.25 *	-0.30 ***	-0.25 *	-0.25 ***
Nightmare distress	0.07	0.06	0.04	0.07	-
Nightmare frequency	-	-	-	-	0.05
R^2_{adj}	10.5 %	11.5 %	10.6 %	12.5 %	34.4 %

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4 – *Regression coefficients associated with nightmare frequency, nights with nightmares a week, and nightmare distress for questionnaire subgroup analysis for high scorers on PTSD complaints and depression*

	High score on depression (CES-D ≥ 27) *n* = 150			High score on PTSD (IES ≥ 26) *n* = 274		
	Nightmare frequency week	Nights with nightmares	Nightmare distress	Nightmare frequency week	Nights with nightmares	Nightmare distress
	Beta	*Beta*	*Beta*	*Beta*	*Beta*	*Beta*
Filled out diary	-0.14	-0.06	-0.03	-0.06	-0.04	-0.03
Anxiety	-0.03	-0.01	0.25 *	0.07	0.12	0.10
Depression	-0.04	-0.04	0.07	0.03	-0.07	0.22 **
PTSD complaints	-0.01	0.05	-0.06	0.07	0.11	-0.01
Neuroticism	-0.05	-0.04	0.07	-0.09	-0.09	0.15 *
Insomnia	-0.15	-0.05	0.17 *	-0.04	-0.01	0.15 *
Sleep Quality	-0.24 **	-0.21 *	-0.12	-0.25 **	-0.24 **	-0.18 **
Nightmare distress	0.18 *	0.21 *	-	0.15 *	-0.04 *	-
Nightmare frequency	-	-	0.16 *	-	-	0.11 *
R^2_{adj}	5.5 %	5.0 %	17.5 %	11.9 %	10.9 %	35.2 %

Note. Low scorers showed the same pattern as the full data (Table 3); * $p < .05$; ** $p < .01$.

Discussion

This study investigated the relationships between measures of nightmares and psychopathology in a large sample of frequent nightmare sufferers. In the whole sample we found only subjective sleep quality to be weakly associated with nightmare frequency. None of the traditional factors such as neuroticism, anxiety or posttraumatic complaints were found to be associated with nightmare frequency. But as previously found,[7, 11] nightmare *distress* did have strong relationships to psychopathology measures (though depression, not anxiety was a significant predictor - see Table 3).

Previous studies have reported relationships between PTSD complaints and nightmares (see for reviews[27, 28]). The current population scored on average high on PTSD complaints (1 *SD* above a sample with a work-related trauma[24]) and depression (1.5 *SD* above the population mean[17]). The difference with studies on psychiatric and student samples is that we excluded subjects with extreme scores on PTSD, which may have a very high nightmare frequency and very severe PTSD and other psychopathology scores. Such extreme scorers may disproportionally influence the linear correlation between nightmares and PTSD / anxiety. Yet, in our study, the average PTSD score still was above the common cutoff for this disorder (see Table 1), which shows that we did not exclude persons with PTSD but only the most extreme cases.

We performed additional subgroup analyses for high scorers on PTSD complaints and depression. In these subgroup analyses, no direct relationships between nightmare frequency and psychopathology measures were found; in addition to subjective sleep quality nightmare distress was now weakly related to nightmare frequency measures. As previously suggested[11] the link between nightmare frequency and psychopathology may be confounded by nightmare distress. This study suggests that this only applies to populations with higher co-morbidity. Moreover, in the current subgroup where this relationship was significant, only 5-12% of the variance in nightmare frequency could be explained by sleep quality and nightmare distress. It seems that in the full dataset consisting of a population of people looking for nightmare treatment, nightmares are relatively independent from other mental complaints and reflect an independent sleep complaint. Subjective sleep quality could be an intermediary factor explaining some of these results.[13]

No differences were found on the frequency of nights with nightmares between the questionnaire and the diary. This population of nightmare sufferers may be more focused on their nightmares and may be more able to adequately estimate their nights with nightmares retrospectively. For nightmare frequency a difference was found between the

questionnaire and diary; paradoxically in the reversed direction compared to previous studies.[12] Nightmare sufferers seeking treatment might be pre-occupied with their nightmares and overestimate their frequency, whereas university students may underestimate their nightmares retrospectively simply because these were not intense enough. However, one has to be cautious in generalizing these results to the general population. Dutch Internet penetration is high (83%; 2007),[20] but this is still a self-selected sample through public media and via Internet.

Irrespective of measurement type, nightmares appear related to sleep complaints rather than to mental complaints in a population of frequent nightmare sufferers. The still prevailing view in mental health care, which holds that nightmares typically occur as part of a larger emotional disorder, needs to be replaced by a sleep medicine perspective, in which nightmares can and should receive specific diagnosis and treatment.

References

1 Hublin C, Kaprio J, Partinen M, Koskenvuo M. Nightmares: Familial aggregation and association with psychiatric disorders in a nationwide twin cohort. *Am J Med Genet,* 1999;88:329-336.

2 Kales A, Soldatos C, Caldwell AB, Charney DS, Kales JD, Markel D, et al. Nightmares: Clinical characteristics and personality patterns. *Am J Psychiat,* 1980;137:1197-1201.

3 Berquier A, Ashton R. Characteristics of the frequent nightmare sufferer. *J Abnorm Psychol,* 1992;101:246-250.

4 Krakow B, Hollifield M, Schrader R. A controlled study of imagery rehearsal for chronic nightmares in sexual assault survivors with PTSD; a preliminary report. *J Traum Stress,* 2000;13:589-609.

5 Spoormaker VI, Montgomery P. Disturbed sleep in post-traumatic stress disorder: Secondary symptom or core feature. *Sleep Med Rev,* 2008;12:169-184.

6 American Psychiatric Association. *Diagnostic and Statistic Manual of Mental Disorders*. 4th ed. American Psychiatric Press: Washington DC, 2000.

7 Levin R, Fireman G. Nightmare prevalence, nightmare distress, and self reported psychological disturbance. *Sleep,* 2002;25:205-212.

8 Zadra AL, Donderi DO. Nightmares and bad dreams: Their prevalence and relationship to well-being. *J Abnorm Psychol,* 2000;109:273-281.

9 Koffel E, Watson D. Unusual sleep experiences, dissociation, and schizotypy: Evidence from a common domain. *Clin Psychol Rev,* 2009;29:548-559.

10 Spoormaker VI, van den Bout J. Depression and anxiety; relations with sleep disturbance. *Eur Psychiat,* 2005;20:243-245.

11 Blagrove M, Farmer L, Williams E. The relationship of nightmare frequency and nightmare distress to well-being. *J Sleep Res,* 2004;13:129-136.

12 Geniève R, Zadra A. Measuring nightmare and bad dream frequency: Impact of retrospective and prospective instruments. *J Sleep Res,* 2008;17:132-139.

13 Schredl M. Effects of state and trait factors on nightmare frequency. *Eur Arch Psychiat Clin Neurosci,* 2003;253:241-247.

14 Zadra AL, Pilon M, Donderi DC. Variety and intensity of emotions in nightmares and bad dreams. *J Nerv Ment Dis,* 2006;194:249-254.

15 American Academy of Sleep Medicine. *International Classification of Sleep Disorders: Diagnostic and Coding Manual.* 2 ed. American Academy of Sleep Medicine: Westchester, IL, 2005.

16 Brom D, Kleber RJ. De Schok Verwerkings Lijst [the Dutch version of the Impact of Event Scale]. *Nederlands Tijdschrift voor de Psychologie*, 1985;40:164-168.

17 Bouma J, Ranchor AV, Sanderman R, van Sonderen E. *Het meten van symptomen van depressie met de CES-D: Een handleiding [Dutch translation of the Epidemiological Studies-Depression scale]*. Noordelijk Centrum voor Gezondheidsvraagstukken: Groningen, 1995.

18 Neidhardt EJ, Krakow B, Kellner R, Pathak D. The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep,* 1992;15:470-473.

19 Lancee J, Spoormaker VI, van den Bout J. Cognitive-behavioral self-help treatment for nightmares: A randomized controlled trial. *Psychother Psychosom,* 2010;79:371-377.

20 Statistics Netherlands. *Statistical Yearbook 2009*. Statistics Netherlands: The Hague, 2009.

21 Spoormaker VI, Verbeek I, van den Bout J, Klip EC. Initial validation of the SLEEP-50 questionnaire. *Behav Sleep Med,* 2005;3:227-246.
22 Van der Ploeg HM, Defares PB, Spielberger CD. *Handleiding bij de Zelfbeoordelingsvragenlijst. [Dutch version of the Spielberger State Trait Anxiety Inventory]*. Swets & Zeitlinger: Lisse, 1980.
23 Zich JM, Attkisson CC, Greenfield TK. Screening for depression in primary care clinics: The CES-D and the BDI. *Int J Psychiat Med,* 1990;20:259-277.
24 Van der Ploeg E, Mooren TTM, van der Velden P, G., Kleber RJ, Brom D. Construct validation of the Dutch version of the Impact of Event Scale. *Psychol Assessment,* 2004;16:16-26.
25 Denissen JJA, Geenen R, van Aken MAG. Development and validation of a Dutch translation of the Big Five Inventory (BFI) *J Pers Assess,* 2008;90:152-157.
26 John OP, Srivastava S. The Big Five trait taxonomy: History, measurement and theoretical perspectives. In: Pervin LA, John OP, editors. *Handbook of Personality: Theory and Research.* New York: Guilford; 1999. p. 102-138.
27 Wittmann L, Schredl M, Kramer M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.
28 Spoormaker VI, Schredl M, van den Bout J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev,* 2006;10:53-59.

Chapter 4

Cognitive-behavioral self-help treatment for nightmares: A randomized controlled trial

Published as:

Lancee, J., Spoormaker, V. I., & van den Bout, J. (2010). Cognitive-behavioral self-help treatment for nightmares: A randomized controlled trial. *Psychotherapy and Psychosomatics, 79*, 371-377.

Abstract

Background

Several cognitive-behavioral techniques are effective in reducing nightmare frequency, but the therapeutic factor (e.g., cognitive restructuring, systematic desensitization) remains unclear. The aim of this study was to compare the nightmare treatments Imagery Rehearsal Therapy (IRT), exposure, and recording (keeping a diary) – in a self-help format – with a waiting-list.

Methods

Participants were recruited through a Dutch nightmare website. After completion of the baseline questionnaires, 399 participants were randomly assigned to a condition, received a 6-week self-help treatment (or were placed on the waiting-list), and filled out the post-treatment measurements 11 weeks after baseline.

Results

Compared to the waiting-list, IRT and exposure were effective in ameliorating nightmare frequency and distress, subjective sleep quality, anxiety (after imagery rehearsal), and depression (after exposure; $\Delta d = 0.25$ - 0.56; $p < .05$). Compared to recording, IRT reduced nightmare frequency while exposure reduced nightmare distress ($\Delta d = 0.20$ - 0.30; $p < .05$). The recording condition was more effective compared to the waiting-list in ameliorating nightmare frequency, nightmare distress, and subjective sleep quality ($\Delta d = 0.19$ - 0.28; $p < .05$). IRT had a more rapid reduction on the diary compared to exposure and recording.

Conclusions

IRT and exposure appear equally effective in ameliorating nightmare complaints. Exposure to nightmare imagery may function as the crucial therapeutic factor; however, cognitive restructuring may be a useful addition to increase immediate effects.

Keywords

Exposure • Cognitive-behavioral therapy • Imagery rehearsal • Nightmare treatment • Randomized controlled trial

Introduction

Nightmares are typically defined as extremely frightening dreams that lead to awakening [1], although direct awakening is not associated with increased distress [2]. Nightmares are a common sleep disorder, with a prevalence of around 2–5% [3–5], which disturb the sleep [4] and lead to daily distress [5, 6]. Nightmares are related to general psychopathology and neuroticism [6, 7] and can occur as part of posttraumatic stress disorder (PTSD) [8].

Cognitive-behavioral therapy (CBT) has gained most empirical support, with exposure and Imagery Rehearsal Therapy (IRT) as the most extensively evaluated treatments [8]. IRT consists of exposure to nightmare imagery but additionally instructs participants to change the nightmare [9, 10]. One study compared IRT to exposure and found no differences, but this relatively small study (n = 26) [11] would have needed at least 52 participants to find significant differences with the observed effect-sizes [12].

In face-to-face treatment studies, the effects of therapist-interaction cannot be excluded. To control for such factors, we designed a self-help study that did not involve any therapist-interaction. Self-help interventions might be a feasible treatment-delivery option because of their accessibility and cost-effectiveness as compared to face-to-face therapy. To date, exposure is the only treatment that has been experimentally tested in a self-help manner; it was found that exposure was more effective in ameliorating nightmares than relaxation and a waiting-list [13]. The aim of the current study was to compare IRT and exposure in a study with sufficient power. In addition to a waiting-list we employed an attention control group consisting of nightmare recording (keeping a nightmare diary), as recording has been shown to reduce nightmare frequency [14].

Methods

Participants

Participants were recruited through a Dutch popular-science nightmare website (www.nachtmerries.org). Dutch Internet penetration is high, the highest in Europe (83% in 2007 according to Statistics Netherlands). Attention was drawn to this website via public media. Inclusion criteria were: being 18 years and having one or more self-reported nightmares or bad dreams (nightmares without awakening) per week based on the SLEEP-50 [15]. To fulfill ethical obligations, exclusion criteria were: high score on posttraumatic complaints (2x *SD* above normal – Dutch translation of the Impact of Event Scale [16]), currently in treatment for PTSD, suicidal ideation, and schizophrenia. Five hundred and fifty-four participants started the online questionnaire, of which 399 (72.0%) completed the baseline measure. See Table 1 for participants' characteristics. See Figure 1 for flowchart participants. Sixty-three participants (61.2%) completed IRT, 56 (58.9%) exposure, 80 (75.5%) recording, and 83 (87.4%) completed the waiting-list. Of the 308 nightmare diaries sent out (see 'Intervention'), only 99 (32.1%) were returned, 25 (24.0%) in the IRT, 26 (25.2%) in the exposure, and 49 (45.8%) in the recording condition. See Tables 3 and 5 for baseline scores.

Table 1 - *Demographic characteristics of participants per condition*

Condition		IRT (n = 99)		Exposure (n = 95)		Recording (n = 105)		Waiting-list (n = 95)		
Mean age (*SD*)		39.2 (14.8)		39.5 (15.8)		37.9 (14.1)		40.3 (15.3)		$F(3, 395) = 0.42$, $p = .74$
Sleep duration - hour (*SD*)		6.9 (1.3)		7.1 (1.4)		7.4 (1.2)		7.3 (1.4)		$F(3, 393) = 2.80$, $p = .04$
		n	%	*n*	%	*n*	%	*n*	%	
Gender	Male	20	20.2	18	18.9	23	21.9	26	27.4	$\chi^2(3) = 2.29$,
	Female	79	79.8	77	81.1	82	78.1	69	72.6	$p = .51$
Medication*	Yes	21	21.2	19	20.0	21	20.0	19	20.0	$\chi^2(3) = 0.07$,
	No	78	78.8	76	80.0	84	80.0	76	80.0	$p = .99$
In psychological treatment	Yes	19	19.2	13	13.7	22	20.9	11	11.6	$\chi^2(3) = 4.25$,
	No	80	80.8	82	86.3	83	79.1	84	88.4	$p = .24$
Self reported Trauma	Yes	65	65.7	68	71.6	73	69.5	70	73.6	$\chi^2(3) = 1.63$,
	No	34	34.3	27	28.4	32	30.5	25	26.3	$p = .65$

Note * Mostly Selective Serotonin Reuptake Inhibitors - SSRI's (> 90%).

Procedure

The study was approved by the Medical Ethics Review Committee of the Medical Centre of Utrecht University and registered at www.clinicaltrials.gov (ID: NCT00513045). After informed consent was given and the online questionnaire was completed, participants were randomized to one of four conditions: IRT (n = 103); exposure (n = 95); recording (n = 106); or waiting-list (n = 95). Randomization was achieved by a computer generated random number table. The participants and project leader were not blind to the assigned condition. Sample size for the questionnaire data was based on the fact that 51 subjects are needed for adequate power (> 0.8) to detect an effect of Cohen's $d = 0.5$ ($p < .05$). With the expected 50% dropout [13], groups of $n = 100$ were needed. Although nightmare sufferers seem reluctant to keep a log [14], prospective data were also collected. The intervention and diary lasted six weeks, after which the diaries were returned. A post-test was conducted 11 weeks after baseline (four weeks after the intervention). Participants were considered dropouts after three unanswered reminders (two e-mails; one postal). After the post-test, participants in the two control conditions (recording; waiting-list) were sent an IRT intervention to fulfill ethical obligations.

Measures

Nightmare frequency for the past week, the amount of nights with nightmares per month, nightmare distress, and subjective sleep quality (1 'very bad' – 10 'very good') were measured by the SLEEP-50 [15]. This questionnaire has good reliability (α = .85, test-retest reliability .78). For nightmares, the sensitivity was found to be .84 and the specificity .77. Anxiety was measured by the Dutch version of the 20 item Spielberger Trait Anxiety Inventory [17]. The reliability (α, range .87 - .96; test-retest correlation is .84 - .88), and validity of this measure have been found to be strong. Depression was measured by a Dutch translation of the 20 item Centre of Epidemiological Studies-Depression scale (CES-D) [18]. This scale has good internal consistency (α, range .79 - .92; test-retest correlation is .90), and the validity of the Dutch scale is promising, as compared to the Beck Depression Inventory (e.g., correlation of .56 - .66). Posttraumatic stress complaints were measured by a Dutch translation of the 15 item Impact of Event Scale (IES) [16]. Only participants who experienced a self-reported trauma filled out the questionnaire. This scale has good internal consistency (α range: .87 - .96), and validity. The nightmare diary was kept on a daily basis for a six-week period (see Table 2).

Intervention

The IRT (50 pages) and exposure (48 pages) books contained a six-week step by step program whereby the (changed) nightmare was imagined for 10-15 minutes a day throughout four weeks. In IRT nightmares were treated using cognitive restructuring [10]. In exposure nightmares were imagined in the original format [19]. Sleep hygiene was left out in both treatments. Subjects in IRT, exposure, and recording manipulations kept a six week daily diary. See Table 2 for an overview of the treatment procedures. Participants on the waiting-list received a letter in which they were informed that they had been placed on a waiting-list.

Table 2 - *Overview of Imagery Rehearsal Therapy, exposure, and recording*

Imagery Rehearsal Therapy (IRT)	Exposure	Recording (six weeks)
- Recording - Writing down nightmares - Thinking about cognitive origin nightmare - Imaginative relaxation - Progressive muscle relaxation - Change ending nightmare - Imagining changed ending nightmare (10-15 minutes a day) - Troubleshooting	- Recording - Writing down nightmares - Progressive muscle relaxation - Tracking exercises - Imagining original nightmare (10-15 minutes a day) - Troubleshooting	- Quality of sleep - Bad dream - Awakening from dream - Intensity of dream - Type and intensity of emotion in dream - Subject of the dream.

Note. Quality of sleep = 0 'very poor' – 7 'very good'; intensity of dream/emotion = 1 'not intense' - 7 'very intense'

Statistical analysis

A multilevel regression analysis was conducted to evaluate the within-group (time), and between-group (time * condition) effects of the different interventions. Multilevel regression is an intention-to-treat (ITT) procedure which allows participants with only one measurement to be included in the analyses [20]. In dealing with missing data, likelihood based procedures (e.g., multilevel regression) are preferred to last observation carried forward (LOCF) as they make appropriate use of all the available data [21].

Five participants (four in the IRT condition; one in the recording condition) were excluded from the analyses (due to a *z*-score of above 3.29 on nightmare frequency). Nightmare frequency (questionnaire and diary) was log-transformed to meet the normality

assumption. Covariates were added when variables showed differences after randomization ($p < .05$; sleep duration) or predicted dropout (condition; self-reported trauma; age). Nightmare frequency in the diary differed marginally at the baseline measure: $F(2, 90) = 2.75$; $p = .07$. However, the log-transformed diary nightmare frequency did not differ at baseline: $F(2, 90) = 1.73$; $p = .18$. Nonetheless, baseline nightmare frequency was controlled for in diary analysis. Cohen's *d* effect sizes were calculated with $d = M_{pre} - M_{post} / \sigma_{pooled}$; where $\sigma_{pooled} = \sqrt{[(\sigma_1^2 + \sigma_2^2) / 2]}$, Δd was calculated with $((M_{pre1} - M_{post1}) - (M_{pre2} - M_{post2})) / \sigma_{pooled\text{-}pre\text{-}test}$ [22]. A significance level of $p < .05$ was used throughout the study. Regression coefficients are indicative of relative change per month for the questionnaires and per week for diaries.

Figure 1 - Flowchart of study participants

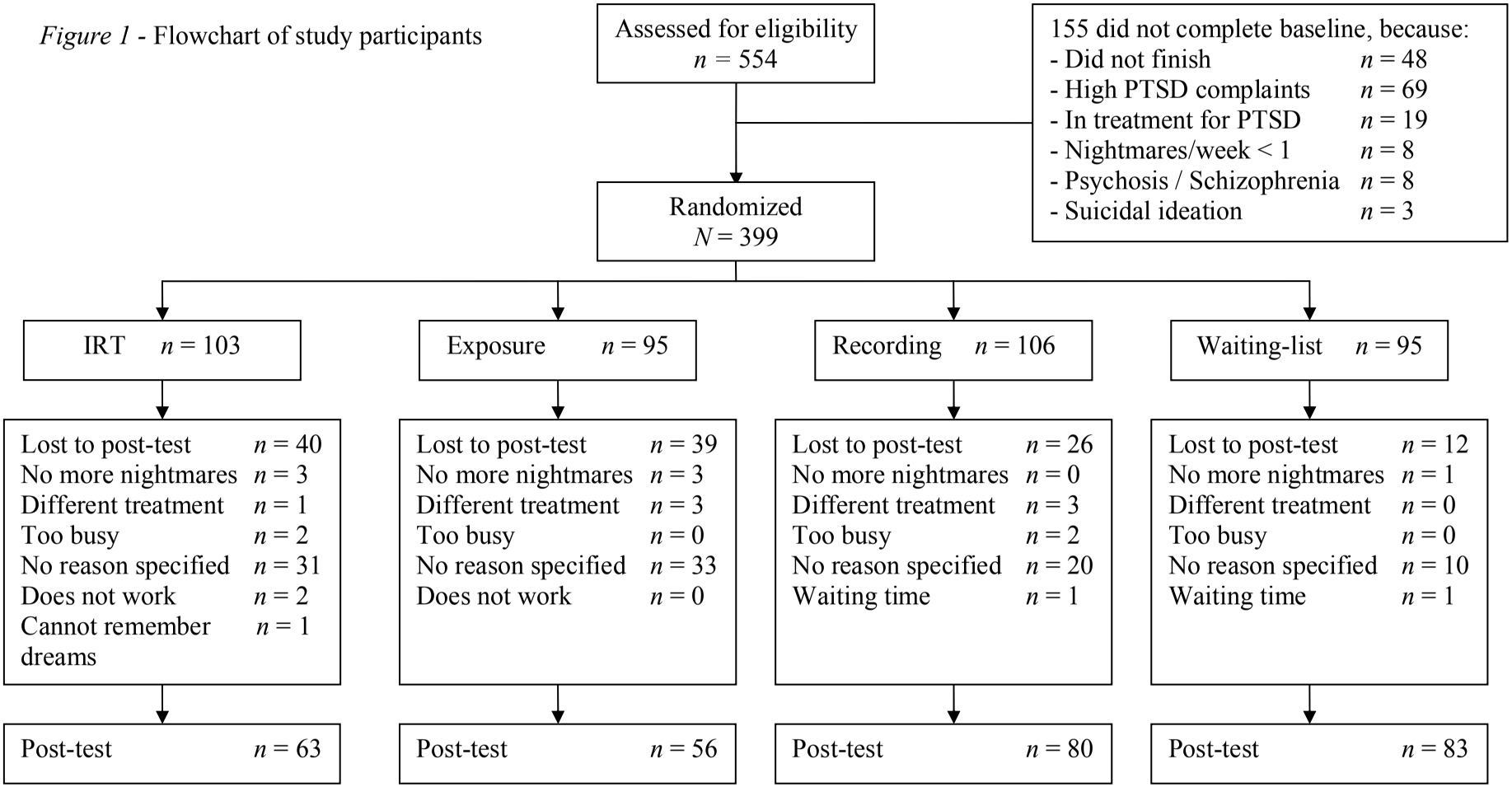


Table 3 - *Pre-post test means of nightmare and secondary variables with corresponding Cohen's d*

		Pre *M* (*SD*)	Post *M* (*SD*)	*d*
Weekly nightmare frequency	IRT	5.15 (3.57)	2.76 (2.74)	0.75***
	EXP	4.66 (3.28)	2.86 (2.67)	0.60***
	REC	5.59 (4.27)	4.03 (3.61)	0.39***
	WL	5.41 (4.23)	5.02 (4.91)	0.09*
Nights with nightmares a month	IRT	14.67 (7.97)	9.71 (8.49)	0.60***
	EXP	13.97 (7.85)	9.34 (7.61)	0.60***
	REC	15.05 (8.65)	12.19 (8.10)	0.34***
	WL	15.13 (8.92)	14.23 (9.05)	0.10 ns
Nightmare distress [15]	IRT	15.31 (4.42)	12.76 (4.67)	0.56***
	EXP	15.34 (4.10)	12.27 (3.93)	0.76***
	REC	15.61 (4.40)	14.03 (4.63)	0.35***
	WL	15.39 (4.80)	14.67 (4.27)	0.16ns
Subjective sleep quality [15]	IRT	5.64 (1.34)	6.19 (1.35)	0.41**
	EXP	5.61 (1.03)	6.20 (1.03)	0.57***
	REC	5.46 (1.59)	5.77 (1.33)	0.21**
	WL	5.68 (1.46)	5.67 (1.64)	0.01ns
Anxiety [17]	IRT	46.31 (9.75)	42.88 (9.37)	0.36**
	EXP	43.43 (11.67)	41.07 (11.82)	0.20**
	REC	46.62 (12.11)	46.60 (11.77)	0.00ns
	WL	46.40 (10.67)	45.52 (10.13)	0.08ns
PTSD complaints [16]	IRT	30.12 (17.35)	26.81 (23.50)	0.17ns
	EXP	26.50 (16.85)	23.53 (18.03)	0.17ns
	REC	30.86 (17.13)	29.38 (21.02)	0.08ns
	WL	30.04 (17.68)	28.72 (18.83)	0.07ns
Depression [18]	IRT	21.33 (6.39)	15.18 (10.19)	0.72***
	EXP	21.55 (5.59)	13.73 (10.82)	0.90***
	REC	22.53 (6.18)	16.75 (11.62)	0.62***
	WL	22.27 (6.19)	17.77 (10.41)	0.52***

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$ (one tailed); ns = not significant; EXP = Exposure; IRT = Imagery Rehearsal Therapy; REC = Recording; WL = Waiting-list.

Results

Pre-post measurements

IRT was significantly more effective than recording in reducing anxiety and weekly nightmare frequency; exposure was effective in reducing anxiety and nightmare *distress* ($p < .05$). Compared to the waiting-list, IRT and exposure ameliorated nightmare frequency and distress, subjective sleep quality, anxiety (after IRT), and depression (after exposure; $p < .05$). Recording was effective compared to waiting-list in ameliorating weekly nightmare frequency, nightmare distress, and subjective sleep quality ($p < .05$). IRT and exposure did not differ significantly on any variable ($p > .05$). Pre-post test measurements and Cohen's *d's* are depicted in Table 3, Δd's, and regression coefficients in Table 4.

A logistic regression dropout analysis showed that the condition, having experienced a traumatic event, and age predicted dropout ($p < .05$). At baseline dropouts from the IRT group ($n = 33$; 82.5%) reported a traumatic event more often than completers from the IRT group ($n = 32$; 54.2%; χ^2 (1) = 8.45; $p < .01$). At baseline, dropouts from the waiting-list group were younger than the completers from the waiting-list group: $M = 29.9$; $SD = 9.9$ versus $M = 41.7$; $SD = 15.4$; $F(1, 94) = 6.63$; $p < .05$.

Diary

IRT showed a more rapid decrease on nightmare frequency and nights with nightmares compared to exposure and recording ($p < .001$). However, the time² * intervention effect for exposure and recording ($p < .05$) left no significant differences among interventions at end point. No significant differences were found between exposure and recording. All conditions had a significant effect on nightmare intensity. This effect decreased through the quadratic function for exposure and recording ($p < .05$). Exposure was the only condition that showed a significant time effect on sleep quality ($p < .01$). Pre-post test diary measurements, Cohen's *d*'s, and regression coefficients are presented in Table 5. A logistic regression analysis showed that the intervention conditions had higher attrition rates than the recording group ($p < .05$; see 'Participants').

Table 4 - *Changes between conditions in Cohen's d and corresponding multilevel interaction effects for nightmare and secondary variables on questionnaire*

		Nightmare frequency	Nights with nightmares	Nightmare distress	Subjective sleep quality	Anxiety	Depression	PTSD complaints
IRT*EXP	Δ*d*	0.17 ^{ns}	0.09^{ns}	-0.12^{ns}	-0.03^{ns}	0.10^{ns}	-0.28^{ns}	0.02^{ns}
	b (*SE*)	0.04 (0.05)^{ns}	0.19 (0.41)^{ns}	-0.30 (0.23)^{ns}	-0.04 (0.06)^{ns}	0.14 (0.39)^{ns}	-0.34 (0.49)^{ns}	0.45 (1.23)^{ns}
IRT*REC	Δ*d*	0.21*	0.25^{ns}	0.22^{ns}	0.17^{ns}	0.31**	0.06^{ns}	0.11^{ns}
	b (*SE*)	0.10 (0.05)*	0.43 (0.40)^{ns}	0.22 (0.22)^{ns}	0.02 (0.06)^{ns}	0.90 (0.37)**	0.11 (0.47)^{ns}	0.35 (1.20)^{ns}
EXP*REC	Δ*d*	0.06^{ns}	0.21^{ns}	0.35*	0.22^{ns}	0.20*	0.34^{ns}	0.17^{ns}
	b (*SE*)	0.06 (0.05)^{ns}	0.63 (0.40)^{ns}	0.44 (0.21)*	-0.02 (0.06)^{ns}	0.76 (0.38)*	0.45 (0.47)^{ns}	-0.11 (1.14)^{ns}
IRT*WL	Δ*d*	0.51***	0.48***	0.40**	0.40*	0.25*	026^{ns}	0.11^{ns}
	b (*SE*)	0.20 (0.05)***	1.01 (0.40)**	0.50 (0.20)**	-0.10 (0.06)*	0.62 (0.37)*	0.50 (0.47)^{ns}	0.84 (1.19)^{ns}
EXP*WL	Δ*d*	0.37**	0.44***	0.53***	0.48*	0.13^{ns}	0.56*	0.09^{ns}
	b (*SE*)	0.15 (0.05)**	1.21 (0.40)***	0.76 (0.21)***	-0.14 (0.06)*	0.48 (0.38)^{ns}	0.84 (0.47)*	0.39 (1.13)^{ns}
REC*WL	Δ*d*	0.28*	0.22^{ns}	0.19*	0.22*	-0.08^{ns}	0.11^{ns}	0.01^{ns}
	b (*SE*)	0.09 (0.05)*	0.58 (0.38)^{ns}	0.32 (0.19)*	-0.12 (0.06)*	-0.28 (0.36)^{ns}	0.53 (0.99)^{ns}	0.49 (1.10)^{ns}

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$ (one tailed); ns = not significant; EXP = Exposure; IRT = Imagery Rehearsal Therapy; REC = Recording; Weekly nightmare frequency = Z log transformed; WL = Waiting-list.

Table 5 - *Diary pre-post means with corresponding Cohen's d over six weeks; multilevel regression effects corresponding to weekly change*

		Week 1		Week 6			
		Pre		Post			
		n	*M* (*SD*)	*n*	*M* (*SD*)	*d*	
Weekly	IRT	25	4.08 (2.27)	22	2.41 (2.58)	0.67	Continued
nightmare	EXP	25	2.72 (1.77)	22	1.82 (1.87)	0.49	
frequency	REC	43	4.35 (3.52)	43	3.05 (2.68)	0.41	
Nights with	IRT	25	3.76 (2.10)	23	2.35 (2.53)	0.57	
nightmares	EXP	25	2.56 (1.66)	22	1.82 (1.87)	0.42	
a week	REC	44	3.48 (2.20)	43	2.67 (2.13)	0.37	
Mean	IRT	23	3.97 (1.07)	16	3.40 (1.17)	0.51	
nightmare	EXP	24	4.44 (1.62)	17	4.48 (1.47)	+0.03	
intensity	REC	44	3.94 (1.66)	39	4.15 (1.33)	+0.14	
Mean	IRT	24	3.72 (0.92)	19	3.66 (1.23)	-0.05	
sleep	EXP	22	4.16 (0.75)	21	4.39 (0.98)	0.26	
quality	REC	40	3.98 (0.95)	39	3.99 (0.92)	0.01	

Note. EXP = Exposure; IRT = Imagery Rehearsal Therapy; Weekly nightmare frequency = Z-log transformed; REC = Recording

Table 5 – *Continued*

		Time *b* (*SE*)	Time² *b (SE)*	REC*Time versus condition *b* (*SE*)	REC*Time² versus condition *b* (*SE*)	EXP*Time versus condition *b* (*SE*)	EXP*Time² versus condition *b* (*SE*)
Weekly	IRT	-0.54 (0.12)***	0.09 (0.02)***	0.35 (0.14)**	-0.07 (0.03)**	-0.45 (0.16)**	0.10 (0.03)**
nightmare	EXP	-0.15 (0.10)^{ns}	0.02 (0.02)^{ns}	0.04 (0.13)^{ns}	-0.01 (0.02)^{ns}	-	-
frequency	REC	-0.19 (0.08)**	0.02 (0.02)^{ns}	-	-	-	-
Nights with	IRT	-1.02 (0.18)***	0.14 (0.03)***	0.71 (0.23)*	-0.12 (0.04)**	0.61 (0.26)**	0.09 (0.05)*
nightmares	EXP	-0.42 (0.18)*	0.06 (0.03)*	0.11 (0.23)^{ns}	-0.03 (0.04)^{ns}	-	-
a week	REC	-0.31 (0.14)*	0.03 (0.03)^{ns}	-	-	-	-
Mean	IRT	-0.34 (0.20)*	0.05 (0.04)^{ns}	0.03 (0.25)^{ns}	0.03 (0.05)^{ns}	-0.11 (0.29)^{ns}	0.03 (0.06)^{ns}
nightmare	EXP	-0.45 (0.20)*	0.08 (0.04)*	0.14 (0.25)^{ns}	-0.00 (0.05)^{ns}	-	-
intensity	REC	-0.31 (0.15)*	0.08 (0.03)**	-	-	-	-
Mean	IRT	0.01 (0.03)^{ns}	-	0.00 (0.04)^{ns}	-	0.06 (0.04)^{ns}	-
sleep	EXP	0.07 (0.03)**	-	-0.06 (0.04)^{ns}	-	-	-
quality	REC	0.01 (0.02)^{ns}	-	-	-	-	-

Note. *= $p < .05$; ** = $p < .01$; *** = $p < .001$ (one tailed)**;** ns = not significant; EXP = Exposure; IRT = Imagery Rehearsal Therapy; Weekly nightmare frequency = Z-log transformed; REC = Recording

Discussion

This study was the first to directly compare IRT and exposure in a large sample size, and we found that both methods were equally effective in reducing nightmare frequency. The current study extends previous findings on IRT by comparing its effects with an attention-control group (recording), showing that IRT is superior to recording in reducing nightmare frequency, whereas exposure (compared to recording) reduces nightmare *distress*. These results are in line with the supposed therapeutic mechanisms of the respective treatments; imagery rehearsal teaches people to cope with and alter their nightmares and exposure desensitizes a person to the (feared) nightmare images. The finding that both techniques are more or less equally effective further suggests that exposure to nightmare imagery, not cognitive-restructuring, is the crucial therapeutic factor.

In addition to the questionnaire data, prospective data was collected in which we observed a more rapid reduction in nightmare frequency with IRT as compared to exposure and recording. It is interesting to note that nightmare frequency at baseline showed some apparent, but non-significant differences (see 'Method'). Similarly, no significant differences between conditions were found at diary end-point. This finding may guide clinicians in their decision about which technique to use, as the immediate effects may increase treatment adherence and response. However, conclusions based on these prospective data are preliminary.

The interventions also ameliorated secondary variables such as anxiety, whereby both IRT and exposure were superior to recording, and only IRT was more effective than the waiting-list. Exposure was the only condition that improved on depression compared to the waiting-list. PTSD complaints did not differ over time for any of the conditions, probably because people with extreme scores were excluded from this study due to ethical reasons. The observed effects can thus not be generalized to PTSD patients. Moreover, participants were self-selected and recruited via the Internet and were evidently not a clinical group.

Attrition rates were in line with comparable self-help studies [13] (n = 121; 30.3%), whereby the intervention conditions (IRT/exposure) predicted dropout. In the waiting-list and recording conditions, participants received their self-help guide only if they filled out the post-test. In the intervention conditions, no such incentives were provided which may have resulted in different reasons for attrition across treatment arms [23]. Reporting a trauma predicted dropout in the IRT condition (more participants without a self-reported trauma completed the IRT treatment), which could be related to the complexity of altering

nightmare elements of events that have actually occurred. The considerably lower return rates of the diary (32.1%) might be due to the previously reported observation that nightmare sufferers are reluctant to keep a log [14].

Sleep hygiene protocols and especially support from a therapist (e.g., via e-mail) might lower dropout rates and increase compliance (e.g., stepped care) [24]. Increased compliance might enhance the small difference found in effect size between IRT/exposure and recording (as opposed to the larger but insignificant between-group differences found by Neidhardt et al. [14]). Moreover, future studies could include computer aided self-help therapy to track the exact number of completed sessions [25].

This is the first study to show an effect of IRT on nightmare reduction in a self-help format, as well as in comparison to a recording control group. Conclusions of this study should be treated cautiously because the type of control group employed can affect outcome, for instance, comparator trials can have higher response and remission rates than placebo controlled trials [26] and the waiting-list condition might improve less than participants not enlisted in a trial [23]. However, as the effects of IRT have now been shown by two research groups, IRT seems to have met criterion V for well-established treatments of the American Psychological Association (‘effects must have been demonstrated by at least two different investigators or investigatory teams’) [27]. This would make IRT the second well-established treatment for nightmares as exposure methods had already met these criteria [12]. Nightmares are a prevalent disorder with impairing consequences that are often overlooked. Easily accessible self-help methods for nightmares appear a promising method for treating nightmares, especially in the context of stepped care.

References

1 American Psychiatric Association. *Diagnostic and Statistic Manual of Mental Disorders (DSM-IV-TR)*. Washington, American Psychiatric Association, 2000.

2 Blagrove M, Farmer L, Williams E. The relationship of nightmare frequency and nightmare distress to well-being. *J Sleep Res,* 2004;13:129-136.

3 Hublin C, Kaprio J, Partinen M, Koskenvuo M. Nightmares: Familial aggregation and association with psychiatric disorders in nationwide twin cohort. *Am J Med Genet,* 1999;88:329-336.

4 Kales A, Soldatos C, Caldwell AB, Charney DS, Kales JD, Markel D, Cadieux R. Nightmares: Clinical characteristics and personality patterns. *Am J Psychiat,* 1980;137:1197-1201.

5 Berquier A, Ashton R. Characteristic of the frequent nightmare sufferer. *J Abnorm Psychol*, 1992;101:246-250.

6 Zadra AL, Donderi DO. Nightmares and bad dreams: Their prevalence and relationship to well-being. *J Abnorm Psychol,* 2000;109:273-281.

7 Spoormaker VI, Schredl M, van den Bout J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev* 2006;10:53-59.

8 Wittmann L, Schredl M, Kramer M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.

9 Krakow B, Kellner R, Pathak D, Lambert L. Imagery rehearsal treatment for chronic nightmares. *Behav Res Ther,* 1995;33:837-843.

10 Krakow B, Zadra A. Clinical management of chronic nightmares: Imagery Rehearsal Therapy. *Behav Sleep Med,* 2006;4:45-70.

11 Kellner R, Neidhardt J, Krakow B, Pathak D. Changes in chronic nightmares after one session of desensitization or rehearsal instructions. *Am J Psychiat,* 1992;149:659-663.

12 Lancee J, Spoormaker VI, Krakow B, van den Bout J. A systematic review of cognitive-behavioral treatment for nightmares – toward a well-established treatment. *J Clin Sleep Med,* 2008;4:475-480.

13 Burgess M, Gill M, Marks IM. Postal self exposure treatment of recurrent nightmares: A randomised controlled trial. *Br J Psychiat,* 1998;172:257-262.

14 Neidhardt EJ, Krakow B, Kellner R, Pathak D. The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep,* 1992;15:470-473.

15 Spoormaker VI, Verbeek I, van den Bout J, Klip EC. Initial validation of the SLEEP-50 questionnaire. *Behav Sleep Med,* 2005;3:227-246.

16 Brom D, Kleber RJ. De Schok Verwerkings Lijst [Dutch version of the Impact of Event Scale]. *Nederlands Tijdschrift voor de Psychologie,* 1985;40:164-168.

17 Van der Ploeg HM, Defares PB, Spielberger CD. *Handleiding bij de Zelfbeoordelingsvragenlijst.* [Dutch version of the Spielberger State Trait Anxiety Inventory]. Lisse, Swets & Zeitlinger, 1980.

18 Bouma J, Ranchor AV, Sanderman R, van Sonderen E. *Het meten van symptomen van depressie met de CES-D: Een handleiding* [Dutch translation of the Epidemiological Studies-Depression scale]. Groningen, Noordelijk Centrum voor Gezondheidsvraagstukken, 1995.

19 Burgess M, Marks IM, Gill M. *Self Help for Nightmares*. Witney, The Oxford Stress & Trauma Centre, 2001.

20 Hox JJ. *Multilevel Analysis: Techniques and Applications*. Mahwah, Lawrence Erlbaum Associates, 2002.
21 Molenberghs G, Thijs H, Jansen I, Beunckens C, Kenward MG, Mallinckrodt C, Carroll RJ. Analyzing incomplete longitudinal clinical trial data. *Biostatistics,* 2004;5:445-464.
22 Morris SB. Estimating effect sizes from pretest-posttest-control group designs. *Organ Res Methods,* 2008;11:364-386.
23 Mohr DC, Spring B, Freedland KE, Beckner V, Arean P, Hollon SD, Ockene J, Kaplan R. The selection and design of control conditions for randomized controlled trials of psychological interventions. *Psychother Psychosom,* 2009;78:275-284.
24 Gellatly J, Bower P, Hennessy S, Richards D, Gilbody S, Lovell K. What makes self-help interventions effective in the management of depressive symptoms? Meta-analysis and meta-regression. *Psychol Med,* 2007;37:1217-1228.
25 Baer L, Greist J, Marks IM. Computer-aided cognitive behaviour therapy. *Psychother Psychosom,* 2007;76:193-195.
26 Rutherford BR, Sneed JR, Roose, SP. Does study design influence outcome? *Psychother Psychosom,* 2009;78:172-181.
27 Chambless DL, Baker MJ, Baucom DH, Beutler LE, Calhoun KS, Crits-Cristoph P et al. Update on empirically validated therapies, II. *The Clinical Psychologist,* 1998;51:3-16.

Chapter 5

Long-term effectiveness of cognitive-behavioral self-help intervention for nightmares

In press as:

Lancee, J., Spoormaker, V. I., & van den Bout, J. (in press). Long-term effectiveness of cognitive-behavioural self-help intervention for nightmares. *Journal of Sleep Research*.

Abstract

Nightmares are a prevalent disorder leading to daily impairments. Two cognitive-behavioral self-help interventions – imagery rehearsal and exposure – recently showed short-term efficacy compared to a waiting-list and a group that recorded their nightmares. This article reports the long-term results of the imagery rehearsal (n = 103) and exposure (n = 95) interventions. Participants were assigned randomly to a condition after completing baseline measurements; they received a 6-week self-help intervention and completed questionnaires 4, 16, and 42 weeks after end of treatment. Initial effects on nightmare measures were almost completely sustained after 42 weeks (d = 0.50 - 0.70); no differences were found between exposure and Imagery Rehearsal Therapy. These results suggest that nightmares should be targeted specifically and that an Internet delivered self-help intervention seems to be a good first option in a stepped care model.

Keywords

Exposure • Imagery rehearsal • Nightmares • Self-help • Treatment

Introduction

Nightmares are a common disorder with a prevalence of around 2-5% (Bixler *et al.*, 1979; Schredl, 2010). Nightmares cause distress and are associated with other mental complaints (Spoormaker *et al.*, 2006). The high prevalence and impact has resulted in several treatment outcome studies, whereby cognitive-behavioral interventions such as Imagery Rehearsal Therapy (IRT) and exposure are the treatments of choice for nightmares (Wittmann *et al.*, 2007). Exposure instructs participants to exercise with nightmare imagery during the day; IRT is similar but uses changed nightmare imagery instead (e.g., more positive ending of the nightmare). Both IRT and exposure gained empirical support in several trials (e.g., Burgess *et al.,* 1998; Krakow *et al.*, 1995).

In a recent randomized controlled trial (RCT) we compared IRT and exposure self-help interventions to a waiting-list group and a simpler form of exposure that does not directly involve exercises with nightmare imagery: recording of one's nightmares (Lancee *et al.*, 2010). A self-help intervention was used because it controls for possible therapist effects which could influence the efficacy of the treatments (individual therapy was found to be more effective than group therapy for nightmares - Spoormaker and van den Bout, 2006). Moreover, self-help encompasses a unique option to deliver inexpensive treatment to a large public, thereby overcoming such limitations as unavailability of cognitive-behavioral therapists trained in sleep medicine (Andersson, 2009). In this trial, IRT and exposure were equally effective in ameliorating nightmares compared to recording (which was effective, but to a lesser extent) and waiting-list group (Lancee *et al.*, 2010). However, the follow-up period of the self-help study after the intervention was relatively short (four weeks after end of treatment). This article discusses the long-term effectiveness of IRT and exposure.

Methods

Participants

Participants were recruited through a Dutch popular-scientific nightmare website (www.nachtmerries.org) and via general media (all four large national newspapers published articles about nightmares with a link to the website). Dutch Internet penetration is the highest in Europe, with 83% of the Dutch households having access to the Internet in 2007 (Statistics Netherlands, 2009). Inclusion criteria were: being eighteen years or older and having self-reported nightmares based on the SLEEP-50 that has been specifically validated for nightmares (Spoormaker *et al.*, 2005). Exclusion criteria were: extreme score on posttraumatic complaints (score > 53 on Dutch translation of the Impact of Event Scale - IES; Brom and Kleber, 1985[1]), currently in treatment for posttraumatic stress disorder (PTSD), suicidal ideation, and schizophrenia. One hundred and ninety-eight participants with a mean age of 39.31 (*SD* = 15.21) including 159 women (80.3%) were randomized in IRT (*n* = 103) or exposure (*n* = 95; Figure 1). Four participants in the IRT condition were considered outliers (*Z*-score above 3.29 on nightmare frequency). Of the remaining 194 participants, 133 (68.6%) had a self-reported trauma, 32 (16.5%) were in psychological treatment, 40 were on medication (20.6%; mostly SSRI's). Seventy-seven (34.5%) participants completed all three follow-up assessments (4 weeks, 16 weeks, and 42 weeks after end of treatment).

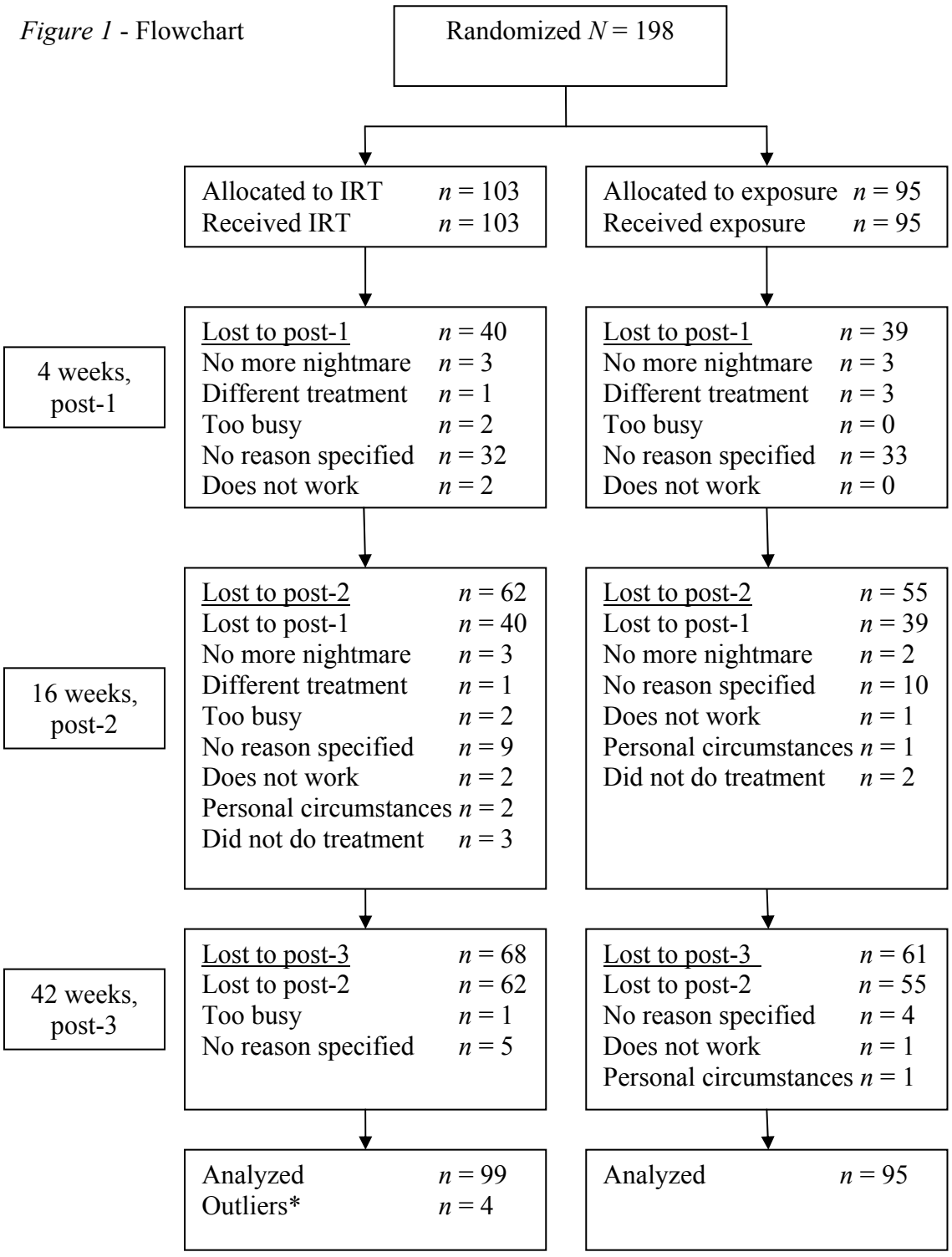
Procedure

The original study was approved by the Medical Ethics Review Committee of the Medical Centre of Utrecht University and was registered at www.clinicaltrials.gov (ID: NCT00513045). Participants received access to the digital baseline questionnaire after informed consent was provided. Participants were subsequently randomized into one of four conditions: IRT (*n* = 103); exposure (*n* = 95); recording group (*n* = 105); and waiting-list group (*n* = 95). For a description of the short-term results see Lancee *et al.* (2010). Eleven weeks after completion of the baseline measurements (four weeks after intervention) participants in all conditions completed the online post-test. After completion of the post-test participants in the two control conditions (recording group; waiting-list group) were sent an IRT intervention to fulfill ethical obligations. No data are thus available on the long-term effects of recording or waiting-list groups. Participants

[1] Score > 53 is 2x *SD* above population mean; cutoff score to indicate PTSD is 26.

completed follow-up measurements 16 weeks and 42 weeks after the end of treatment. Participants were considered dropouts after three unanswered reminders (two e-mails; one postal).

Figure 1 - Flowchart



Note. * Z-score on nightmare frequency above 3.29 (25 or more nightmares per week); for flowchart of recording and waiting-list group see Supporting Figure S1.

Measurements

The SLEEP-50 (Spoormaker *et al.*, 2005) was used to assess the nightmare frequency for the past week, the number of nights with nightmares per month, and the sleep rating (1 'very bad' – 10 'very good'). This questionnaire has good reliability (.85, test-retest reliability .78). For nightmares, the sensitivity was found to be .84 and the specificity .77. Moreover, six items (range 6 – 24) of the sleep impact subscale were used for a nightmare distress scale targeting the last seven days. In our study the sleep impact subscale was preceded by: 'Because of my nightmares…' (e.g., 'I am told that I am easily irritated'). Anxiety was measured by the Dutch version of the 20 item Spielberger Trait Anxiety Inventory (Van der Ploeg *et al.*, 1980). Depression was measured by a Dutch translation of the 20 item Centre of Epidemiological Studies-Depression scale (CES-D; Bouma *et al.*, 1995). Posttraumatic stress complaints were measured by a Dutch translation of the 15 item IES (Brom and Kleber, 1985). Only participants who experienced a trauma completed this questionnaire.

Intervention

For this study the IRT treatment (Krakow and Zadra, 2006) was transformed to a self-help treatment booklet (50 pages). The exposure treatment booklet (48 pages) was based on the self-help book used in the study by Burgess *et al.* (1998). The key components of the six-week step-by-step program are depicted in Table 1. Both booklets offered information on the fact that treatments had proved effective in earlier trials. Moreover, participants were warned about possible complications with posttraumatic nightmares. Information was provided on common difficulties with the imagery exercises in the troubleshooting section (e.g., too much anxiety; no changes in the nightmare).

Table 1 - *Overview of the interventions*

	IRT*	Exposure*
Week 1	• Psycho-education about nightmares • Explanation IRT • Writing down the nightmares	• Psycho-education about nightmares • Explanation exposure • Writing down the nightmares
Week 2	• Thinking about origin of nightmare • Mental relaxation with a 'safe place'	• Progressive muscle relaxation • Reading about and practicing with exercises
Week 3	• Progressive muscle relaxation • Create a new ending of the nightmare • Exercising with nightmare imagery (10-15 minutes a day): - In changed format	• Exercising with nightmare imagery (10-15 minutes a day): - In original format
Week 4	• Exercising with nightmare imagery (10-15 minutes a day): - In changed format	• Exercising with nightmare imagery (10-15 minutes a day): - In original format
Week 5	• Exercising with nightmare imagery (10-15 minutes a day): - In changed format	• Exercising with nightmare imagery (10-15 minutes a day): - In original format
Week 6	• Only diary	• Only diary

Note. * Participants kept a diary during the whole treatment; participants were advised to keep on practicing with the relaxation exercises.

Statistical Analysis

Multilevel regression was used to evaluate the within-group (time), and between-group (time X condition) effects (Hox, 2002). Multilevel regression is an intention-to-treat procedure, which can be considered as a sophisticated form of regression that allows participants with only one measurement to be included in the analyses (Hox, 2002). A significance level of $p < .05$ (two-sided) was used throughout the study. Dropout was predicted by trauma and age for IRT. No variable predicted dropout in the exposure group. IRT scored higher on depression on baseline measurement than exposure ($p < .05$). Attrition could have influenced post-test scores and therefore Cohen's *d* estimations. To correct for this problem multiple imputation based on the 'missing at random assumption' was employed (Sterne *et al.*, 2009). For the missing scores, ten separate data sets were generated with 'predictive mean matching'. Cohen's *d* were calculated with $(M_{pre1} - M_{pre2}) / \sigma_{pre\text{-}test}$ (Morris, 2008) on the pooled mean of these data sets.

Table 2 - *Mean, SD, and corresponding Cohen's d at baseline, 4-week, 16-week, and 42-week follow-up*

		Pre	4 weeks		16 weeks		42 weeks	
		M (*SD*)	*M* (*SD*)	*d*	*M* (*SD*)	*d*	*M* (*SD*)	*d*
Nightmare frequency week	IRT	5.15 (3.56)	2.76 (2.74)	-0.66***	2.03 (1.75)	-0.84***	2.52 (1.75)	-0.68***
	EXP	4.66 (3.28)	2.86 (2.67)	-0.58***	2.98 (2.47)	-0.58***	2.82 (2.48)	-0.62***
Nights with nightmares month	IRT	14.67 (7.97)	9.71 (8.49)	-0.69***	7.08 (6.31)	-0.84***	8.09 (6.59)	-0.64***
	EXP	13.97 (7.85)	9.34 (7.61)	-0.65***	9.67 (9.31)	-0.65***	10.55 (9.78)	-0.50***
Nightmare distress	IRT	15.31 (4.42)	12.76 (4.67)	-0.49***	12.03 (4.94)	-0.64***	11.05 (4.26)	-0.64***
	EXP	15.34 (4.10)	12.27 (3.93)	-0.71***	12.79 (4.14)	-0.61***	12.79 (4.60)	-0.70***
Anxiety	IRT	46.31 (9.75)	42.88 (9.37)	-0.25**	41.61 (10.27)	-0.36**	42.55 (10.94)	0.18ns
	EXP	43.43 (11.67)	41.07 (11.82)	-0.17**	41.53 (10.56)	-0.21ns	43.36 (11.57)	0.07ns
PTSD complaints	IRT	30.12 (17.35)	26.36 (21.34)	-0.10ns	23.75 (18.28)	-0.20ns	22.91 (18.38)	-0.36ns
	EXP	26.50 (16.85)	23.53 (18.03)	-0.16ns	19.33 (16.40)	-0.35*	20.12 (16.07)	-0.35ns
Depression	IRT	21.33 (6.39)	15.18 (10.19)	-0.64***	13.92 (11.08)	-1.06***	15.06 (11.15)	-0.76***
	EXP	21.55 (5.59)	13.73 (10.18)	-1.34***	14.82 (8.48)	-1.13***	12.85 (10.10)	-1.60***
Subjective sleep quality	IRT	5.64 (1.34)	6.19 (1.35)	0.24***	6.57 (1.37)	0.49***	6.70 (1.19)	0.71***
	EXP	5.61 (1.03)	6.20 (1.03)	0.57***	6.10 (1.30)	0.55***	6.24 (1.35)	0.77***

Note: EXP = Exposure; IRT = Imagery Rehearsal Therapy; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; significance levels are based on multilevel regression analyses and Cohen's *d* is based on the dataset imputed with multiple imputation; see Supporting Table S1 for pre-post test means of recording and waiting-list group.

$p = .06$

Results

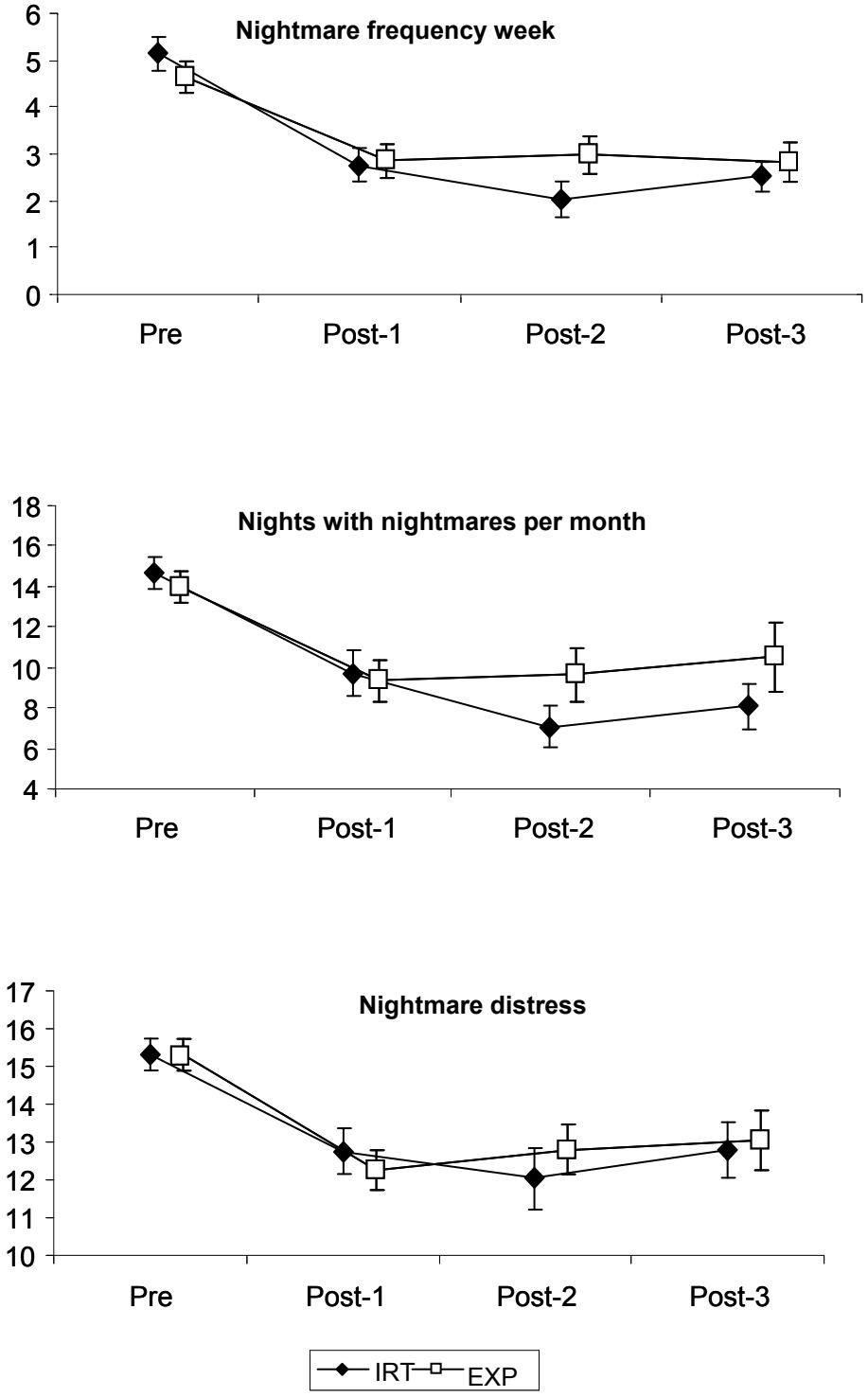
Pre-post measurements and Cohen's *d* are depicted in Table 2 and Figure 2. For both IRT and exposure the effect on nightmares, nightmare distress, depression, and sleep complaints was sustained after 42 weeks ($p < .001$). No differences were found between IRT and exposure after 42 weeks. We observed a trend for exposure being superior to IRT in ameliorating depression after 42 weeks ($b = -3.28$; $SE = 1.78$; $p = .06$). Moreover, IRT ameliorated nightmares better compared to exposure 16 weeks after the end of the treatment ($b = -0.39$; $SE = 0.18$; $p < .05$); this effect disappeared at the final measurement (see supporting Table S1 for regression coefficients). The recording and waiting-list groups (with IRT intervention after the first follow-up) showed no significant differences in effect compared to IRT and exposure at the 42 week follow-up. Pre-post measurements of the recording and waiting-list group can be found in Supporting Table S2 (with IRT after the first follow-up).

Clinical changes

In the IRT condition, nightmare frequency per week was reduced by 46.4% (4 weeks), 60.6% (16 weeks), and 51.0% (42 weeks); nights with nightmares: 33.8% / 51.7% / 44.9%; nightmare distress: 27.4% / 35.2% / 45.8%. Nightmare frequency per week < 1 was reported by: 0.0% (baseline), 16.9% (4 weeks), 24.3% (16 weeks), and 15.2% (42 weeks).

In the exposure condition, nightmare frequency per week was reduced by 38.6% (4 weeks), 36.1% (16 weeks), and 39.5% (42 weeks); nights with nightmares: 33.1% / 30.8% / 24.5%; nightmare distress: 32.9% / 27.0% / 16.6%. Nightmare frequency per week < 1 was reported by: 0.0% (baseline), 16.1% (4 weeks), 12.5% (16 weeks), and 21.2% (42 weeks).

Figure 2 - Nightmare frequency a week, nights with nightmares per month, and nightmare distress at baseline, 4 weeks (post-1), 16 weeks (post-2), and 42 weeks (post-3) after treatment



Discussion

This study showed that the reduction in nightmare frequency and the short-term improvements in sleep quality after self-help IRT as reported in Lancee *et al.* (2010) were sustained after 42 weeks; no significant differences were found between IRT and exposure. In the IRT condition, nightmare frequency was reduced by 61% at 16 week follow-up and by 51% at 42 week follow-up. The results after 16 weeks are similar to outcomes obtained in face-to-face intervention studies (e.g., Krakow *et al.* (1995) found a 67% decrease at three months). However, the effectiveness at 42-week follow-up was smaller (e.g., Krakow *et al.* (1996) found an 83% decrease after eighteen months).

Moreover, this study replicated the long-term effectiveness of self-help exposure. In the exposure condition nightmare frequency dropped by 39% four weeks after the intervention and by 40% at 42 weeks. Burgess *et al.* (1998) found a similar nightmare frequency decrease after the intervention (43%) and a larger decrease at six month follow-up (58%). In the Burgess *et al.* (1998) study, however, participants performed self-exposure up to an hour a day (in contrast to 10-15 minutes in the current study) and completed a diary as part of the follow-up, which also ameliorates nightmares (Lancee *et al.*, 2010). Similar effects were also observed in the control conditions that received IRT after the initial waiting-list or nightmare recording period; at the last follow-up we observed a decrease of 39.7% on nightmare frequency for the waiting-list and 53.6% for the recording condition. To exclude any time effects, future studies should include longer-term control conditions.

A limitation is that for a large group of participants nightmares did not disappear totally in the IRT and exposure conditions. Some form of interaction with a therapist might enhance effectiveness (e.g., e-mail support; Andersson, 2009). Moreover, for this study we did not include sleep hygiene as we aimed to strictly compare the different types of interventions. However, including this technique may result in higher effect sizes (especially for the sleep complaints). In addition, some people have different nightmares every night. Lucid Dreaming Therapy (Spoormaker and van den Bout, 2006) might be more effective for these people as in this treatment participants are taught to alter their nightmare within the dream itself.

Our results suggest that specific treatment of a sleep disorder has long-term effectiveness and it may therefore be useful to address specific sleep complaints in the mental health care. This finding is relevant for nightmares, which are viewed commonly as a symptom of an underlying affective disorder by mental health professionals. Diagnosis of

nightmares according to the DSM-IV-TR (American Psychiatric Association, 2000) is allowed only if nightmares do not occur during the course of another disorder, which may have the consequence that readily available and effective treatments are not delivered to patients. Self-help interventions (especially in a stepped-care context) seem to be a good option to deliver this treatment because of its low cost and easy-to-deliver format.

References

American Psychiatric Association. *Diagnostic and Statistic Manual of Mental Disorde*rs. 4th ed. American Psychiatric Press, Washington DC, 2000.

Andersson, G. Using the internet to provide cognitive behaviour therapy. *Behav Res Ther,* 2009;47:175-180.

Bixler, E., Kales, A., Soldatos, C., Kales, J. D. and Healey, S. Prevalence of sleep disorders in the Los Angeles metropolitan area. *Am J Psychiat,* 1979;79:1257-1262.

Bouma, J., Ranchor, A. V., Sanderman, R. and van Sonderen, E. *Het meten van symptomen van depressie met de CES-D: Een handleiding [Dutch translation of the Epidemiological Studies-Depression scale]*. Noordelijk Centrum voor Gezondheidsvraagstukken, Groningen, 1995.

Brom, D. and Kleber, R. J. De Schok Verwerkings Lijst [the Dutch version of the Impact of Event Scale]. *Nederlands Tijdschrift voor de Psychologie.* 1985;40:164-168.

Burgess, M., Gill, M. and Marks, I. M. Postal self exposure treatment of recurrent nightmares: A randomised controlled trial. *Br J Psychiat,* 1998;172:257-262.

Hox, J. J. *Multilevel analysis: Techniques and applications.* Lawrence Erlbaum Associates, Mahwah, 2002.

Krakow, B., Kellner, R., Pathak, D. and Lambert, L. Imagery rehearsal treatment for chronic nightmares. *Behav Res Ther,* 1995;33:837-843.

Krakow, B., Kellner, R., Pathak, D. and Lambert, L. Long term reduction of nightmares with Imagery Rehearsal Treatment. *Behav Cogn Psychother,* 1996;24:135-148.

Krakow, B. and Zadra, A. Clinical management of chronic nightmares: Imagery Rehearsal Therapy. *Behav Sleep Med,* 2006;4:45-70.

Lancee, J., Spoormaker, V. I. and van den Bout, J. Cognitive behavioral self-help treatment for nightmares: A randomized controlled trial. *Psychother Psychosom,* 2010;79:371-377.

Morris, S. B. Estimating effect sizes from pretest-posttest-control group designs. *Organ Res Methods,* 2008;11:364-386.

Schredl, M. Nightmare frequency and nightmare topics in a representative German sample. *Eur Arch Psychiat Clin Neurosci,* 2010;260:565-570.

Spoormaker, V. I., Schredl, M. and van den Bout, J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev,* 2006;10:53-59.

Spoormaker, V. I. and van den Bout, J. Lucid dreaming treatment for nightmares: A pilot-study. *Psychother Psychosom*, 2006;75:389-394.

Spoormaker, V. I., Verbeek, I., van den Bout, J. and Klip, E. C. Initial validation of the SLEEP-50 questionnaire. *Behav Sleep Med,* 20053:227-246.

Statistics Netherlands. *Statistical yearbook 2009*. Statistics Netherlands, The Hague, 2009.

Sterne J.A., White I.R., Carlin J.B., Spratt M., Royston P., Kenward M.G., et al. Multiple imputation for missing data in epidemiological and clinical research: potentials and pitfalls. *Br Med J,* 2009;338:b2393.

Van der Ploeg, H. M., Defares, P. B. and Spielberger, C. D. *Handleiding bij de Zelfbeoordelingsvragenlijst. [Dutch version of the Spielberger State Trait Anxiety Inventory]*. Swets & Zeitlinger, Lisse, 1980.

Wittmann, L., Schredl, M. and Kramer, M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.

Supporting Information Chapter 5

Supporting Table 1 - *Multilevel regression coefficients for IRT and exposure on baseline, 4 weeks (post-1), 16 weeks (post-2), and 42 weeks (post-3) after treatment*

	NF week		NF night		ND		Anxiety		Depression		PTSD		Subjective sleep quality	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
IRT														
ANX base	-	-	0.11	$(0.05)^{*}$	0.17	$(0.02)^{***}$	0.89	$(0.03)^{***}$	0.41	$(0.04)^{***}$	0.62	$(0.12)^{***}$	-0.04	$(0.01)^{***}$
Age base	-	-	-	-	-0.05	$(0.02)^{**}$	-	-	-0.03	$(0.03)^{ns}$	-	-	-	-
Trauma	-	-	-	-	-	-	-	-	-	-	-	-	0.00	$(0.00)^{ns}$
Constant	0.39	$(0.09)^{***}$	14.44	$(0.79)^{***}$	14.89	$(0.38)^{***}$	44.46	$(0.52)^{***}$	20.43	$(0.72)^{***}$	28.68	$(1.97)^{***}$	5.72	$(0.12)^{***}$
Post-1	-0.79	$(0.11)^{***}$	-4.38	$(0.89)^{***}$	-2.32	$(0.44)^{***}$	-2.35	$(0.77)^{**}$	-5.74	$(1.00)^{***}$	-3.52	$(2.61)^{ns}$	0.38	$(0.13)^{**}$
Post-2	-1.02	$(0.13)^{***}$	-6.01	$(1.07)^{***}$	-2.96	$(0.53)^{***}$	-2.57	$(0.92)^{**}$	-6.59	$(1.20)^{***}$	-5.15	$(3.08)^{ns}$	0.62	$(0.16)^{***}$
Post-3	-0.70	$(0.14)^{***}$	-4.58	$(1.12)^{***}$	-2.90	$(0.55)^{***}$	-1.35	$(0.97)^{ns}$	-4.99	$(1.27)^{***}$	-4.87	$(3.19)^{ns}$	0.72	$(0.17)^{***}$
EXP	-0.11	$(0.12)^{ns}$	-0.38	$(1.12)^{ns}$	0.53	$(0.55)^{ns}$	-0.31	$(0.74)^{ns}$	1.42	$(1.02)^{ns}$	-2.66	$(2.76)^{ns}$	-0.14	$(0.17)^{ns}$
EXP X post-1	0.12	$(0.16)^{ns}$	-0.53	$(1.27)^{ns}$	-0.62	$(0.63)^{ns}$	0.72	$(1.10)^{ns}$	-1.56	$(1.43)^{ns}$	2.13	$(3.56)^{ns}$	0.19	$(0.19)^{ns}$
EXP X post-2	0.39	$(0.18)^{*}$	1.15	$(1.50)^{ns}$	0.74	$(0.74)^{ns}$	0.89	$(1.29)^{ns}$	0.33	$(1.68)^{ns}$	0.27	$(4.08)^{ns}$	-0.08	$(0.22)^{ns}$
EXP X post-3	0.00	$(0.19)^{ns}$	0.63	$(1.58)^{ns}$	0.61	$(0.78)^{ns}$	1.05	$(1.36)^{ns}$	-3.28	$(1.78)^{ns}$	1.54	$(4.26)^{ns}$	0.04	$(0.24)^{ns}$
Exposure														
Constant	0.29	$(0.09)^{**}$	9.21	$(2.19)^{***}$	9.76	$(1.30)^{***}$	4.68	$(1.30)^{***}$	21.85	$(0.73)^{***}$	26.02	$(1.93)^{***}$	7.25	$(0.33)^{***}$
Post-1	-0.67	$(0.11)^{***}$	-4.90	$(0.91)^{***}$	-2.94	$(0.45)^{***}$	-1.63	$(0.79)^{*}$	-7.30	$(1.02)^{***}$	-1.39	$(2.42)^{ns}$	0.57	$(0.14)^{***}$
Post-2	-0.63	$(0.13)^{***}$	-4.86	$(1.05)^{***}$	-2.21	$(0.51)^{***}$	-1.68	$(0.90)^{ns}$	-6.25	$(1.18)^{***}$	-4.87	$(2.67)^{ns}$	0.54	$(0.16)^{***}$
Post-3	-0.71	$(0.14)^{***}$	-3.96	$(1.12)^{***}$	-2.28	$(0.55)^{***}$	-0.30	$(0.95)^{ns}$	-8.27	$(1.25)^{***}$	-3.33	$(2.83)^{ns}$	0.75	$(0.17)^{***}$

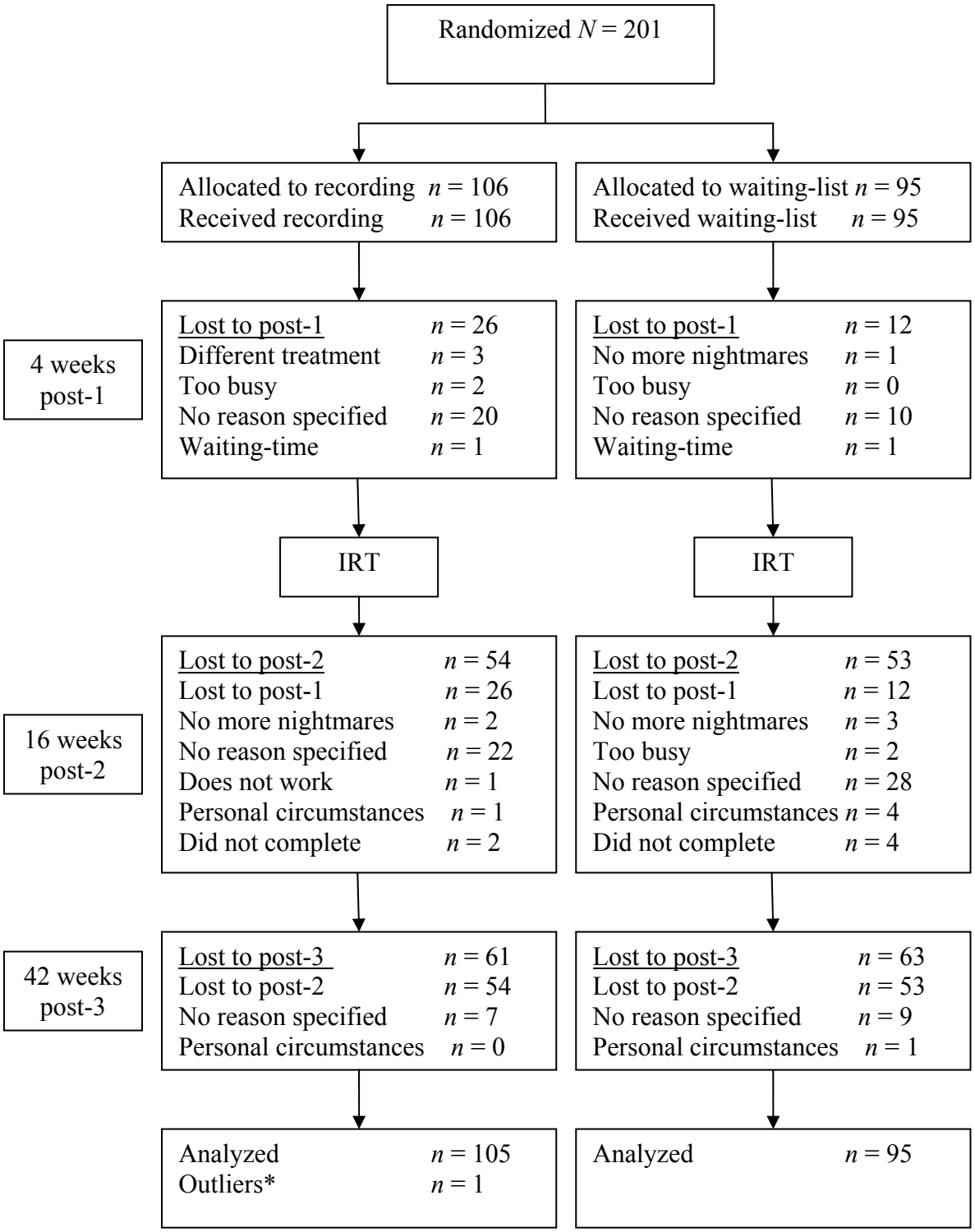
Note. For each measurement a dummy was used, the coefficients are thus indicative for the change between the pre-test and that specific measurement. ND = Nightmare distress; NF night = Nights with nightmares per month; NF week = Nightmare frequency per week; PTSD = Posttraumatic stress complains.

Supporting Table S2 - *Mean, SD, and corresponding Cohen's d for recording and waiting-list condition at baseline, 4-week, 16-week, and 42-week follow-up*

		Pre	4 weeks		16 weeks		42 weeks	
		M (*SD*)	*M* (*SD*)	*d*	*M* (*SD*)	*d*	*M* (*SD*)	*d*
Nightmare frequency week	REC	5.63 (4.28)	4.02 (3.61)	-0.37***	3.01 (3.05)	-0.57***	2.61 (3.49)	-0.65***
	WL	5.41 (4.23)	5.02 (4.91)	-0.11ns	5.36 (6.67)	-0.12ns	3.26 (4.09)	-0.51***
Nights with nightmares month	REC	15.05 (8.65)	12.19 (8.10)	-0.33**	10.06 (8.52)	-0.53***	7.09 (7.83)	-0.89***
	WL	15.13 (8.92)	14.23 (9.05)	-0.10ns	9.82 (10.19)	-0.38***	10.19 (7.90)	-0.51***
Nightmare distress	REC	15.61 (4.40)	14.03 (4.63)	-0.31***	13.24 (4.58)	-0.54***	13.98 (5.21)	-0.38***
	WL	15.39 (4.80)	14.67 (4.27)	-0.24ns	13.43 (4.88)	-0.41***	12.29 (4.22)	-0.70***
Anxiety	REC	46.62 (12.11)	46.61 (11.78)	-0.02ns	46.90 (13.18)	-0.01ns	43.59 (13.87)	-0.31**
	WL	46.40 (10.67)	45.52 (10.13)	-0.08ns	43.83 (11.70)	-0.25*	42.97 (13.14)	-0.26*
PTSD complaints	REC	30.86 (17.13)	28.79 (21.39)	-0.14ns	26.41 (18.93)	-0.28*	23.31 (18.40)	-0.41**
	WL	30.04 (17.68)	30.20 (19.46)	-0.00ns	29.12 (18.96)	-0.11ns	23.50 (14.84)	-0.58**
Depression	REC	22.53 (6.18)	16.75 (11.62)	-0.90***	18.51 (12.64)	-0.60***	15.02 (12.12)	-1.12***
	WL	22.27 (6.19)	17.77 (10.41)	-0.70***	16.90 (10.16)	-0.91***	15.94 (11.22)	-1.11***
Subjective sleep quality	REC	5.50 (1.45)	5.77 (1.33)	0.21*	6.14 (1.33)	0.51***	6.18 (1.37)	0.52***
	WL	5.68 (1.46)	5.67 (1.64)	0.01ns	5.76 (1.62)	0.12ns	5.91 (1.51)	0.35***

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; REC = Recording; WL = Waiting-list; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; significance levels are based on multilevel regression analyses and Cohen's *d* is based on the dataset imputed with multiple imputation; see Supporting Table S1 for pre-post test means of recording and waiting-list group. Sleep rating and depression predicted dropout for the waiting-list group; no variable predicted dropout in the recording group.

Supporting Figure S1 - Flowchart of recording and waiting-list group



Note. Z-score on nightmare frequency above 3.29 (25 or more nightmares per week).

Chapter 6

Expanding self-help Imagery Rehearsal Therapy for nightmares with sleep hygiene and lucid dreaming: A waiting-list controlled trial

Published as:

Lancee, J., van den Bout, J., & Spoormaker, V. I. (2010). Expanding self-help Imagery Rehearsal Therapy for nightmares with sleep hygiene and lucid dreaming: A waiting-list controlled trial. *International Journal of Dream Research*, *3,* 111-120.

Abstract

Nightmares are a common disorder with serious consequences. Recently, the cognitive-behavioral interventions Imagery Rehearsal Therapy (IRT) and exposure proved effective in a self-help format. The aim of the current study was to compare the following self-help formats to a waiting-list: IRT; IRT with sleep hygiene; and IRT with sleep hygiene and a lucid dreaming section. Two-hundred-seventy-eight participants were included and randomized into a condition. Follow-up measurements were 4, 16, and 42 weeks after treatment completion. Seventy-three participants completed all questionnaires and 49 returned the nightmare diaries. Contrary to our expectations, the original IRT was more effective than the 2 other intervention conditions. Moreover, IRT was the only intervention that convincingly proved itself compared to the waiting-list condition. However, these data should be interpreted with caution due to the low power and high dropout. Yet it seems that in a self-help format, IRT and exposure (which was validated previously) are the treatments of choice for nightmares.

Keywords

Nightmares • Self-help • Imagery Rehearsal Therapy • Lucid dreaming

Introduction

Nightmares are a common disorder affecting 2-5% of the general population (Bixler, Kales, Soldatos, Kales, & Healey, 1979; Li, Zhang, Li, & Wing, 2010; Schredl, 2010; Spoormaker & van den Bout, 2005). The DSM-IV-TR definition of nightmares is: *'extremely frightening dreams that lead to awakening'* (American Psychiatric Association., 2000), although various emotions have been reported in nightmares (Zadra, Pilon, & Donderi, 2006) and direct awakening seems not to be associated with increased distress (Blagrove, Farmer, & Williams, 2004).

Nightmares have serious nighttime consequences by disturbing the sleep (Kales et al., 1980) and also inflict daytime distress (Berquier & Ashton, 1992; Zadra & Donderi, 2000). Nightmares can be part of posttraumatic stress disorder (PTSD; Wittmann, Schredl, & Kramer, 2007) and are associated with higher psychopathology scores (Hublin, Kaprio, Partinen, & Koskenvuo, 1999; Levin & Fireman, 2002; Zadra & Donderi, 2000). However, it seems that nightmare distress rather than nightmare frequency is related to these psychopathology scores (Blagrove et al., 2004; Schredl, 2003). Moreover, a recent study found that nightmare frequency appears to be related to sleep complaints instead of mental complaints (Lancee, Spoormaker, & van den Bout, 2010b). These findings suggest that nightmares are best conceptualized as a sleep disorder that should receive specific diagnosis and treatment.

Nightmares can be adequately treated with cognitive-behavioral therapy (CBT; Spoormaker, Schredl, & van den Bout, 2006; Wittmann et al., 2007). Imagery Rehearsal Therapy (IRT) and exposure are the two most thoroughly empirically tested treatments for nightmares (e.g., Burgess, Gill, & Marks, 1998; Krakow, Kellner, Pathak, & Lambert, 1995). In both treatments the nightmares are imagined during the day. In exposure, desensitization occurs by imagining the original nightmare; IRT employs exposure as well but the nightmare is imagined in a changed format.

Nightmare sufferers rarely receive treatment, probably because of the unavailability of trained cognitive-behavior therapists. Self-help treatment might provide a solution for the low accessibility of effective treatment. Recently, we found IRT and exposure to be equally effective in a self-help format in ameliorating nightmares compared to a waiting-list and recording control group (Lancee, Spoormaker, & van den Bout, 2010a); effects of IRT and exposure were sustained 42 weeks after the intervention (Lancee, Spoormaker, & van den Bout, in press), but only 15-20% was totally nightmare free at this 42-week follow-up.

Expanding the self-help format with techniques such as Lucid Dreaming Therapy (LDT) might further enhance treatment effectiveness. Lucid dreaming is a technique whereby the dreamer is aware that he/she is dreaming (Hobson, 2009; LaBerge & Rheingold, 1990). Lucid dreaming has been physiologically verified by volitional eye movements on the electrooculogram during rapid eye movement (REM) sleep (e.g., LaBerge, Nagel, Dement, & Zarcone, 1981). Lucid dreaming frequency is moderately correlated with nightmare frequency (Schredl & Erlacher, 2004), and it seems plausible that nightmares can trigger lucid dreaming (Schredl & Erlacher, 2004). In LDT for nightmares participants imagine their (changed) nightmare during the day while thinking that they are only dreaming (thereby triggering lucidity in the real nightmare). Because LDT targets the nightmare within the dream it might be specifically beneficial for people that suffer from non-recurrent nightmares.

A few case studies (Spoormaker, van den Bout, & Meijer, 2003; Zadra & Pihl, 1997) and one randomized controlled study (Spoormaker & van den Bout, 2006) have studied LDT; all indicated that LDT was effective. In the controlled study, LDT was superior to a waiting-list on nightmare frequency but did not have an effect on secondary measures such as subjective sleep quality and PTSD complaints. LDT and IRT have a similar treatment structure which makes it possible to employ LDT as an 'add on' to IRT.

Moreover, nightmares and sleep quality have an inverse relationship (Ohayon, Morselli, & Guilleminault, 1997; Schredl, 2003; Schredl, 2009). It is possible that nightmares have a direct effect on sleep (i.e. disrupting sleep patterns) or an indirect effect on sleep by inducing fear of going (back) to sleep. Some previous (uncontrolled) studies have used a combined approach of nightmare and insomnia treatment with promising results (e.g., Krakow et al., 2001; Swanson, Favorite, Horin, & Arnedt, 2009). A section that specifically focuses on improving dysfunctional sleeping habits (sleep hygiene) could also be successful in a self-help format and have a beneficial effect as add-on to standard CBT for nightmares.

The aim of the current study was to compare the following self-help formats to a waiting-list: IRT; IRT with sleep hygiene (IRT+); and IRT with sleep hygiene and a LDT section (LDT). Expectations were:

- All treatment conditions have a beneficial effect compared to the waiting-list condition
- IRT+ ameliorates sleep quality compared to IRT
- LDT ameliorates nightmare frequency measures and nightmare distress compared to IRT and IRT+

Method

Participants

Participants were recruited from October 2007 to April 2009 through a Dutch nightmare website (www.nachtmerries.org). The Netherlands has the highest Internet penetration of Europe with 88% of the Dutch households connected to the Internet in 2008 (Statistics Netherlands, 2009). Inclusion criteria were: being eighteen years or older and having self-reported nightmares based on the SLEEP-50 (Spoormaker, Verbeek, van den Bout, & Klip, 2005). Three-hundred-ninety-eight participants started the online questionnaire which 279 (70.1%) completed. Exclusion criteria were: high score on posttraumatic complaints (score > 53 on Dutch translation of the Impact of Event Scale - IES; Brom & Kleber, 1985),[1] currently in treatment for PTSD, suicidal ideation, and schizophrenia. See Table 1 for demographic characteristics and see Figure 1 for flowchart and exclusion rates of participants.

Of the 213 nightmare diaries sent out, only 49 (23.0%) were returned: 16 (23.9%) in the IRT, 16 (21.3%) in the IRT+, and 17 (23.9%) in the LDT condition. Return rates for the diaries were low but comparable with our previous self-help intervention study (Lancee et al., 2010a); this is probably because nightmare sufferers are reluctant to keep a log (Neidhardt, Krakow, Kellner, & Pathak, 1992).

Procedure

The study was approved by the Medical Ethical Committee of the University Medical Center Utrecht. Participants could enter the baseline questionnaire after informed consent was given. Participants were subsequently randomized to one of four conditions: IRT (n = 70); IRT with sleep hygiene (IRT+; n = 76); IRT with sleep hygiene and lucid dreaming (LDT; n = 71); waiting-list (n = 62). Randomization was achieved by a computerized random number generator creating a random number table. Participants and project leader were not blind to the assigned condition. For the sample size we wanted to achieve similar power as in our former self-help study (Lancee et al., 2010a). This sample size was based on the fact that n = 51 is needed for adequate power (> 0.8) to detect significance at an effect size of d = 0.5. With a dropout of around 50% this meant that groups of around n = 100 were needed for each condition. However, due to low recruitment rates we could include fewer participants and a relatively high percentage dropped out. At 4-week follow-

[1] Cutoff score for PTSD is 26

up, we now had a sample size large enough to find an effect size of 0.6 – 0.7 with an alpha of .05 and adequate power (> 0.8).

The six week intervention and diary were sent to the intervention conditions directly after baseline questionnaires. The waiting-list condition only received a letter that the post-test would be in 11 weeks. Eleven weeks after completion of the baseline (four weeks after intervention plus one extra week due to mailing time), participants in all conditions filled out the online post-test questionnaire. If the post-test was not completed, participants received two reminders by e-mail, and one by regular mail. After completion of the post-test participants in the waiting-list condition were sent an intervention to fulfill ethical obligations. No data are thus available of the long-term effects of the waiting-list. Sixteen and 42 weeks after the intervention participants filled out post-test 2 and 3. The diary was returned directly after finishing the intervention.

Table 1 - *Demographic characteristics of participants per condition*

		Condition								
		IRT (n = 67)		IRT+ (n = 75)		LDT (n = 71)		WL (n = 62)		
Mean age (*SD*)		33.4 (12.93)		38.9 (18.0)		36.5 (14.4)		35.5 (14.9)		$F(3, 274) = 1.59$, $p = .19$
Sleep duration (*SD*) hour		7.1 (1.3)		7.5 (1.6)		7.1 (1.4)		7.1 (1.4)		$F(3, 274) = 1.23$, $p = .30$
		n	%	*n*	%	*n*	%	*n*	%	
Gender	Male	10	15.9	21	28.0	17	23.9	15	24.2	χ^2 (3) 3.62
	Female	57	85.1	54	72.0	54	76.1	47	75.8	$p = .31$
Medication*	Yes	13	19.4	23	30.7	11	15.5	15	24.2	χ^2 (3) 5.33
	No	54	80.6	52	69.3	60	84.5	47	75.8	$p = .15$
In psychological	Yes	12	17.9	15	20.0	15	21.1	3	4.8	χ^2 (3) 8.04
Treatment	No	55	82.1	60	80.0	56	78.9	59	95.2	$p < .05$
Self reported	Yes	46	68.7	51	68.0	53	74.6	39	62.9	χ^2 (3) 2.16
Trauma	No	21	31.3	24	32.0	18	25.4	23	37.1	$p = .54$

Note. * Mostly Selective Serotonin Reuptake Inhibitors - SSRI's (> 90%).

Measures

Nightmare frequency, nightmare distress, and subjective sleep quality were measured by the 50-item SLEEP-50 (Spoormaker et al., 2005), a sleep questionnaire with good reliability (α =.85, test-retest reliability .78). Compared with polysomnographic and

clinical diagnoses, the SLEEP-50 shows good predictive validity for various sleep disorders. In addition, the SLEEP-50 addresses the nightmare frequency for the past week, the amount of nights with nightmares a month, and the subjective sleep quality (1 'very bad' – 10 'very good'). For nightmares, the sensitivity was .84 and the specificity was .77 compared to clinical diagnosis. Moreover, six items (range 6 – 24) of the sleep impact subscale were used for a nightmare distress scale targeting the last seven days. In our study the sleep impact subscale was preceded by: 'Because of my nightmares…' (e.g., 'I am told that I am easily irritated').

Anxiety was measured by the Dutch version of the 20 item Spielberger Trait Anxiety Inventory (Van der Ploeg, 1980). The Trait Anxiety Inventory consists of twenty statements about how much anxiety is generally experienced (e.g., 'I feel content'; 1 = 'almost never'; 4 = 'almost always'; range: 20 - 80). Reliability is good (α, range .87 - .96; test-retest correlation is .84 - .88), and so is the validity (Van der Ploeg, 1980).

Depression was measured by a Dutch translation of the 20 item Centre of Epidemiological Studies-Depression scale (CES-D; Bouma, Ranchor, Sanderman, & van Sonderen, 1995). The CES-D scale consists of 20 items. This scale (range 0 – 60) has good internal consistency (α, range .79 - .92; test-retest correlation is .90), and the validity of the Dutch scale is promising compared to Beck Depression Inventory (e.g., correlation of .56 - .66; Bouma et al., 1995). The CES-D uses a cutoff score of 16 to indicate mild depression and 27 to indicate major depression disorder (Zich, Attkisson, & Greenfield, 1990).

Posttraumatic stress complaints were measured by a Dutch translation of the 15 item IES (Brom & Kleber, 1985). Only participants who had experienced a trauma filled out the questionnaire (n = 189; range 0 - 75). Cutoff scores to indicate PTSD is 26 in the Dutch version. This scale has good internal consistency (α range: .87 - .96), and construct validity comparable with the original IES (van der Ploeg, Mooren, van der Velden, Kleber, & Brom, 2004).

Diary

The nightmare diary was kept on a daily basis by all three intervention conditions for a six-week period. Participants filled out each day: quality of sleep (0 'very poor' – 7 'very good'); amount of nightmares; and intensity of nightmare (1 'not intense' – 7 'very intense').

Table 2 – *Overview self-help intervention*

Imagery Rehearsal Therapy (IRT)	*IRT + sleep hygiene (IRT+)*	IRT+ and *Lucid Dreaming Therapy (LDT)*
- Recording - Writing down nightmares - Thinking about cognitive origin nightmare - Imaginative relaxation - Progressive muscle relaxation - Change ending nightmare - Imagining changed ending nightmare (10-15 minutes a day) - Troubleshooting	IRT *and* If sleep quality is bad: Go to bed only when sleepy, use the bed and bedroom for sleep only, maintain a regular rising time, get out of bed and into another room when unable to fall asleep	IRT *and* Sleep hygiene *and* Imagining nightmares during the day while thinking that it is only a dream - thereby triggering lucidity in the real nightmare

Intervention

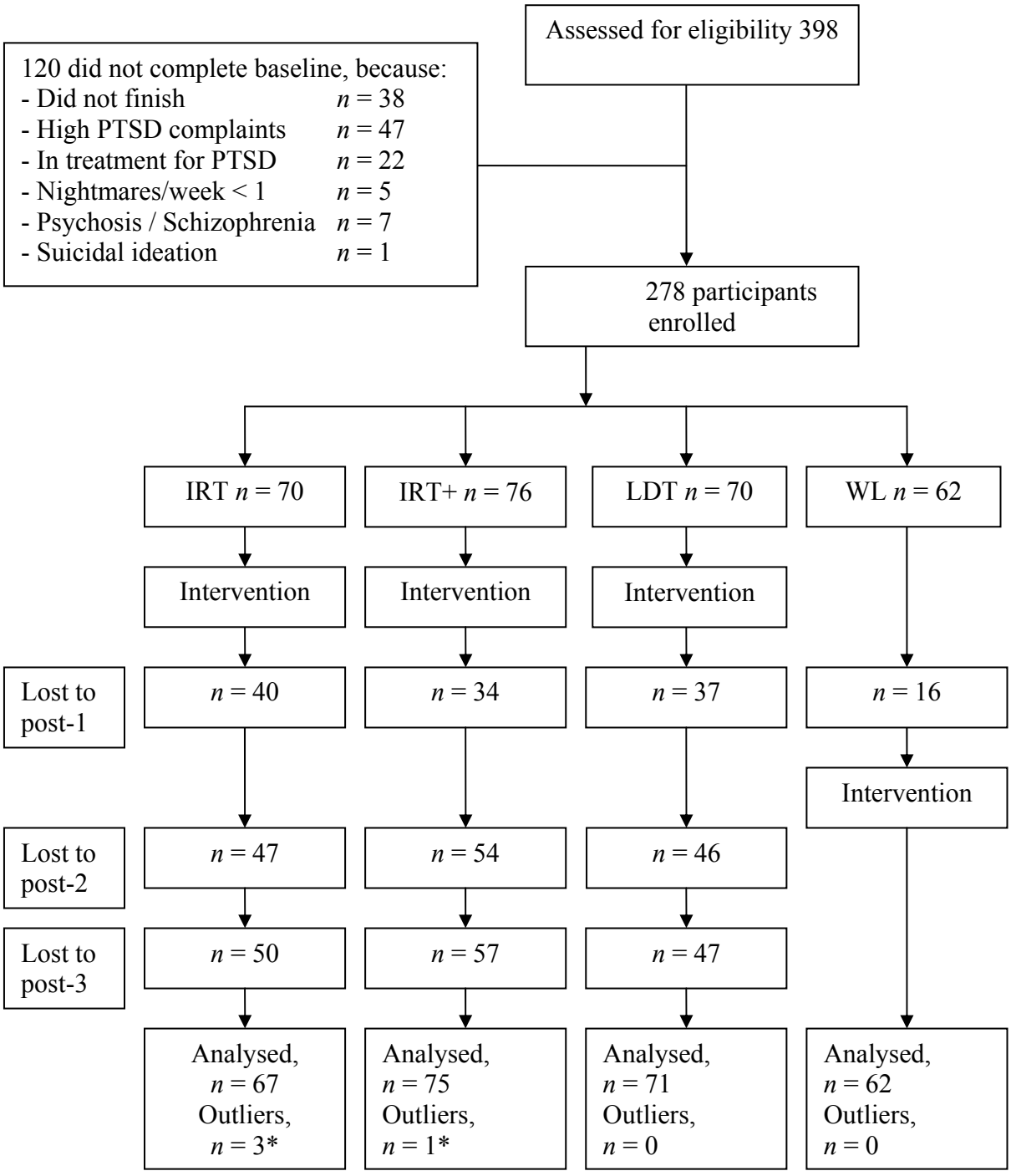
For this study the self-help IRT booklet of Lancee et al. (2010a) was used (approximately 5800 words). IRT consists of exposure to nightmare imagery and instructs participants to imagine an altered version of the nightmare (Krakow & Zadra, 2006). The IRT book was expanded for the IRT+ condition with a sleep hygiene section of approximately 800 words employing sleep hygiene and stimulus control. In this section participants were instructed to go to bed only when sleepy, use the bed and bedroom for sleep only, maintain a regular rising time, avoid daytime naps and get out of bed and into another room when unable to fall asleep. Participants were told to improve their bedroom for sleeping by optimizing external factors like mattress softness, temperature, and light. Moreover, participants received specific instructions for what to do if a nightmare would occur; participants for instance received the suggestion to perform a muscle relaxation exercise and/or imagination of a safe place. In the LDT condition the IRT+ version (that also included the sleep hygiene section) was used with an extra lucid dreaming section (approximately 900 words). Participants in the LDT condition first received IRT instructions to think about the cognitive origin of the dream, change the nightmare ending, and imagine the changed nightmare. The participants then received additional instructions to imagine the changed nightmare while thinking that it is only a dream ('this is not real, but this is only a dream'). Moreover, participants received instructions to imagine during the day how they would change their nightmare while dreaming (see Table 2). Subjects in all three intervention conditions received a diary as part of their treatment.

Statistical analysis

An intention-to-treat (ITT) multilevel regression analysis was conducted to evaluate the success of the different interventions (Hox, 2002). Multilevel regression is an ITT procedure which allows participants with only one measurement to be included in the analyses (Hox, 2002). At baseline, fewer participants in the waiting-list condition were 'in psychological treatment' than in the other conditions ($p < .05$). Dropout was analyzed with logistic regression analyses. Attrition could have influenced post-test scores and therefore Cohens'*d* estimations. To correct for this problem multiple imputation based on the 'missing at random assumption' was employed (Sterne et al., 2009). For the missing scores, ten separate datasets were generated with predictive mean matching. Changes in Cohen's *d*'s were calculated with $((M_{pre1} - M_{post1}) - (M_{pre2} - M_{post2})) / \sigma_{pooled\text{-}pre\text{-}test}$ (Morris, 2008).

In the diary the variables were originally measured per day but were transformed to a weekly period; time is thus indicative for the relative change over one week. This does not apply to nightmare frequency per week which was log-transformed to meet the assumption of normality. One diary from the IRT+ condition was excluded from the analyses because of a z-score of above 3.29 (18 nightmares in the first week of the diary); two diaries from IRT+ and three from LDT were excluded because the participants completed only the first (two) week(s). A significance level of $p < .05$ (two-sided) was used throughout the study.

Figure 1 – Flowchart



Note. * Z-score above 3.29 on nightmare frequency; IRT = Imagery Rehearsal Therapy; IRT+ = IRT with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; WL = Waiting-list.

Table 3 - *Means of questionnaire variables at baseline, 4, 16, and 42 weeks after the intervention*

		Baseline	4 weeks		16 weeks		42 weeks	
		M (*SD*)	*M* (*SD*)	*d* - 1	*M* (*SD*)	*d* - 2	*M* (*SD*)	*d* - 3
Nightmare frequency week	IRT	6.45 (5.17)	2.48 (3.41)	-0.77***	2.14 (3.15)	-0.83***	1.47 (1.26)	-0.96***
	IRT+	5.56 (4.32)	4.12 (4.60)	-0.33***	5.73 (7.94)	0.04ns	4.37 (5.28)	-0.28**
	LDT	6.08 (4.40)	4.03 (5.21)	-0.47***	4.12 (4.59)	-0.45***	4.50 (5.59)	-0.36**
	WL	6.42 (4.55)	4.78 (4.31)	-0.36**				
Nights with nightmares per month	IRT	16.01 (8.59)	8.36 (7.44)	-0.89***	7.18 (8.29)	-1.03***	4.05 (2.97)	-1.39***
	IRT+	15.97 (8.56)	11.74 (9.52)	-0.49***	12.36 (10.28)	-0.42*	11.47 (10.71)	-0.53**
	LDT	17.04 (9.19)	10.32 (8.89)	-0.73***	11.12 (9.82)	-0.64***	9.50 (9.82)	-0.82***
	WL	16.15 (8.53)	13.83 (9.26)	-0.27ns				
Nightmare distress	IRT	16.18 (4.07)	12.18 (3.95)	-0.98***	11.27 (4.08)	-1.21***	10.59 (3.48)	-1.37***
	IRT+	14.72 (4.55)	13.34 (4.87)	-0.30***	12.86 (5.09)	-0.41φ	12.22 (4.47)	-0.55**
	LDT	16.06 (4.79)	13.32 (4.40)	-0.57***	13.56 (5.13)	-0.52***	13.18 (5.00)	-0.60*
	WL	14.95 (4.40)	14.54 (4.46)	-0.09ns				

Continued

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; φ = p .05 - .06; ns = not significant; IRT = Imagery Rehearsal Therapy; IRT+ = IRT with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; WL = Waiting-list.

Table 3 – *Continued*

		Baseline *M* (*SD*)	4 weeks *M* (*SD*)	*d* - 1	16 weeks *M* (*SD*)	*d* - 2	42 weeks *M* (*SD*)	*d* - 3
Depression	IRT	19.76 (9.84)	13.96 (8.71)	-0.59***	13.24 (8.71)	-0.66***	12.68 (7.36)	-0.72**
	IRT+	19.76 (10.52)	17.41 (12.78)	-0.22**	15.68 (11.08)	-0.39**	16.79 (10.02)	-0.28ns
	LDT	19.52 (10.13)	13.44 (10.45)	-0.60**	14.20 (12.83)	-0.53ns	13.83 (12.11)	-0.56ns
	WL	20.08 (12.09)	19.28 (12.84)	-0.07ns				
Anxiety	IRT	47.19 (11.69)	42.37 (10.53)	-0.41*	41.52 (10.26)	-0.49**	41.05 (10.71)	-0.53**
	IRT+	46.77 (10.69)	43.32 (12.19)	-0.32***	40.86 (11.55)	-0.55**	42.05 (10.08)	-0.44*
	LDT	47.86 (11.92)	41.97 (12.86)	-0.49**	40.92 (13.81)	-0.58*	41.54 (13.30)	-0.53ns
	WL	46.73 (12.49)	45.76 (13.06)	-0.08ns				
PTSD	IRT	30.98 (16.11)	34.79 (17.37)	0.24ns	23.29 (21.00)	-0.48ns	23.92 (16.60)	-0.44ns
	IRT+	26.82 (15.74)	33.44 (18.56)	0.42ns	25.79 (15.64)	-0.07ns	21.64 (19.04)	-0.33ns
	LDT	25.51 (17.68)	18.74 (14.84)	-0.38ns	22.41 (15.41)	-0.18ns	25.06 (16.33)	-0.03ns
	WL	29.69 (17.99)	34.41 (19.08)	0.26ns				
Sleep quality	IRT	5.49 (1.53)	5.93 (1.77)	0.29**	6.50 (1.57)	0.66***	6.84 (1.42)	0.88***
	IRT+	5.48 (1.45)	5.79 (1.69)	0.21**	5.86 (1.64)	0.27**	6.05 (1.43)	0.40***
	LDT	5.42 (1.35)	6.15 (1.37)	0.54***	6.28 (1.43)	0.64***	6.46 (1.32)	0.77***
	WL	5.69 (1.43)	6.15 (1.07)	0.32**				

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; φ = p .05 - .06; ns = not significant; IRT = Imagery Rehearsal Therapy; IRT+ = IRT with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; WL = Waiting-list.

Results

Attrition

At 4-week follow-up, 29 (43.2%) participants in the IRT, 42 (56.0%) in the IRT+, 34 (47.9%) in the LDT, and 46 (74.2%) in the waiting-list condition completed the questionnaire. A higher percentage of participants in the waiting-list condition returned the questionnaire than in the IRT ($p < .001$), IRT+ ($p < .05$), and LDT condition ($p < .01$). No significant differences in dropout were found between the intervention conditions. In the LDT condition, older participants (39.8; *SD* = 15.7 versus 33.5; *SD* = 12.6) and females (male: $n = 6$; 35.3%; female: $n = 28$; 51.9%; $p < .05$) were more likely to complete the questionnaire.

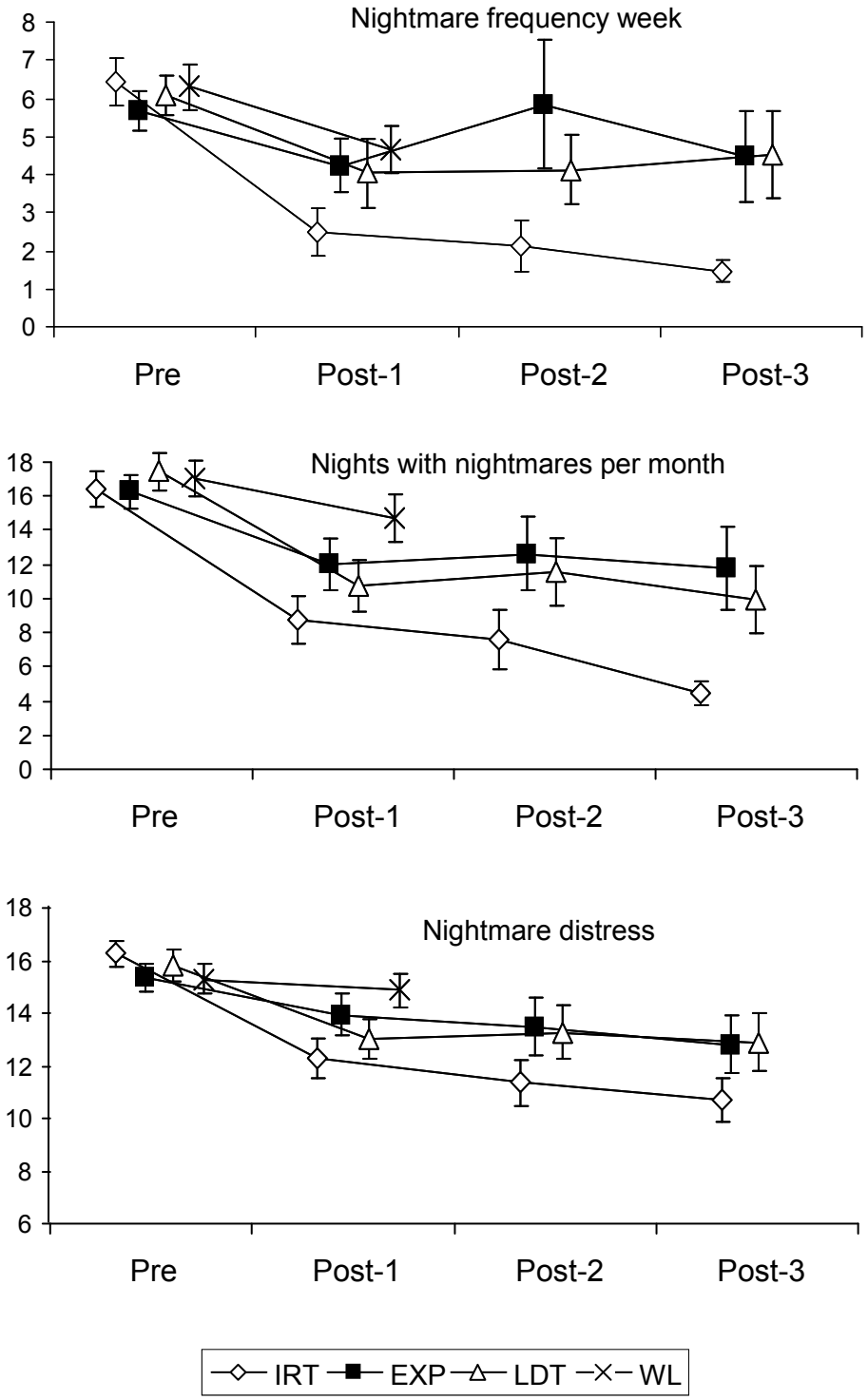
At 42-week follow-up, 19 (28.4%) participants in the IRT, 19 (25.3%) in the IRT+, and 24 (33.8%) in the LDT condition completed the questionnaire.

Table 4 - *Changes between conditions in Cohen's d for nightmare and secondary variables in questionnaire 4 (post-1) and 42 (post-3) weeks after the intervention*

	NF	Nights with nightmares	ND	Depression	Anxiety	PTSD complaints	Sleep quality
Post -1							
IRT * IRT+	0.50^{*}	0.52^{φ}	0.53^{*}	0.31^{ns}	0.12^{ns}	0.32^{ns}	-0.05^{ns}
IRT * LDT	0.42^{ns}	0.21^{ns}	0.45^{ns}	0.14^{ns}	0.13^{ns}	-0.61^{ns}	0.08^{ns}
IRT * WL	0.56^{***}	0.83^{***}	0.79^{***}	0.57^{*}	0.32^{ns}	-0.06^{ns}	-0.08^{ns}
IRT+ * LDT	-0.09^{ns}	-0.30^{ns}	-0.07^{ns}	-0.17^{ns}	0.01^{ns}	-0.93^{*}	0.14^{ns}
IRT+ * WL	0.07^{ns}	0.31^{ns}	0.24^{ns}	0.28^{ns}	0.21^{ns}	-0.37^{ns}	-0.03^{ns}
LDT * WL	0.16^{ns}	0.59^{**}	0.30^{ns}	0.44^{φ}	0.19^{ns}	0.52^{φ}	-0.17^{ns}
Post-3							
IRT * IRT+	0.80^{**}	0.89^{***}	0.43^{**}	0.21^{ns}	0.22^{ns}	0.18^{ns}	-0.41^{ns}
IRT * LDT	0.78^{**}	0.68^{**}	0.60^{***}	0.24^{ns}	0.15^{ns}	0.35^{ns}	-0.33^{ns}
IRT+ * LDT	-0.02^{ns}	-0.17^{ns}	0.16^{ns}	0.03^{ns}	-0.06^{ns}	0.17^{ns}	0.09^{ns}

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; φ = p: .05 - .06; ns = not significant; significance levels were calculated based on multilevel regression coefficients; nightmare frequency was z-log transformed; IRT = Imagery Rehearsal Therapy; IRT+ = IRT with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; ND = Nightmare distress; NF = Nightmare frequency; WL = Waiting-list.

Figure 2 - Nightmare frequency per week, nights with nightmares per month, and nightmare distress at baseline, 4 weeks (post-1), 16 weeks (post-2), and 42 weeks (post-3) after treatment



Questionnaire data

At 4-week follow-up, IRT was superior in ameliorating nightmare frequency and nightmare distress compared to IRT+ ($p < .05$) and the waiting-list ($p < .001$). Moreover, it was effective in ameliorating depression compared to the waiting-list condition ($p < .05$). At 4-week follow-up, LDT was effective on nights with nightmares compared to waiting-list condition ($p < .01$).

At 42-week follow-up IRT was superior on all nightmare variables compared to the two other conditions ($p < .05$). Pre-post test means can be found in Table 3 and Figure 2; changes in Cohen's *d* in Table 4.

Table 5 - *Pre-post measurements on diary variables with corresponding Cohen's d*

		Week 1			Week 6				Δ *d* compared to	
		n	*M*	*SD*	*n*	*M*	*SD*	*d*	IRT	IRT+
Nightmare	IRT	16	4.00	(2.25)	16	1.50	(1.71)	-1.11		
frequency	IRT+	13	3.62	(1.98)	13	1.77	(1.01)	-0.93	0.31^{ns}	
week	LDT	14	3.36	(2.44)	14	2.14	(2.88)	-0.50	0.55^{ns}	0.28^{ns}
Nights	IRT	16	3.56	(1.82)	16	1.50	(1.71)	-1.13		
with	IRT+	13	3.38	(2.06)	13	1.77	(1.01)	-0.78	0.24^{ns}	
nightmares	LDT	14	3.14	(2.14)	14	2.00	(2.54)	-0.53	0.46^{ns}	0.23^{ns}
Sleep	IRT	15	4.52	(1.21)	15	4.70	(1.19)	0.14		
quality	IRT+	13	4.78	(1.16)	12	4.79	(1.34)	0.02	-0.11^{ns}	
	LDT	14	4.71	(0.71)	13	5.10	(1.19)	0.54	0.14^{ns}	0.26^{ns}
Nightmare	IRT	15	3.88	(1.54)	11	4.62	(1.79)	0.39		
intensity	IRT+	13	4.19	(1.26)	11	4.35	(1.16)	0.24	-0.25^{ns}	
	LDT	13	4.29	(1.51)	8	2.66	(0.99)	-1.07	-2.26^{***}	-2.05^{*}

Note. IRT = Imagery Rehearsal Therapy; IRT+ = Imagery Rehearsal Therapy with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; * $p < .05$; ** $p < .01$; *** $p < .001$; ns = not significant; nightmare frequency was z-log transformed.

Diary data

Multilevel regression analyses showed that all conditions significantly decreased nightmare frequency ($p < .05$). Nights with nightmares also decreased in all conditions, but only for IRT this reduction was significant ($p < .05$; Table 5, 6). The IRT and IRT+ condition appeared superior compared to LDT in ameliorating nights with nightmares, however, between group differences were insignificant (Table 6, Figure 3). LDT seemed superior on sleep quality compared to the two other conditions; however, this increase was insignificant on all accounts ($p > .05$). LDT demonstrated superior effects ($p < .05$) in

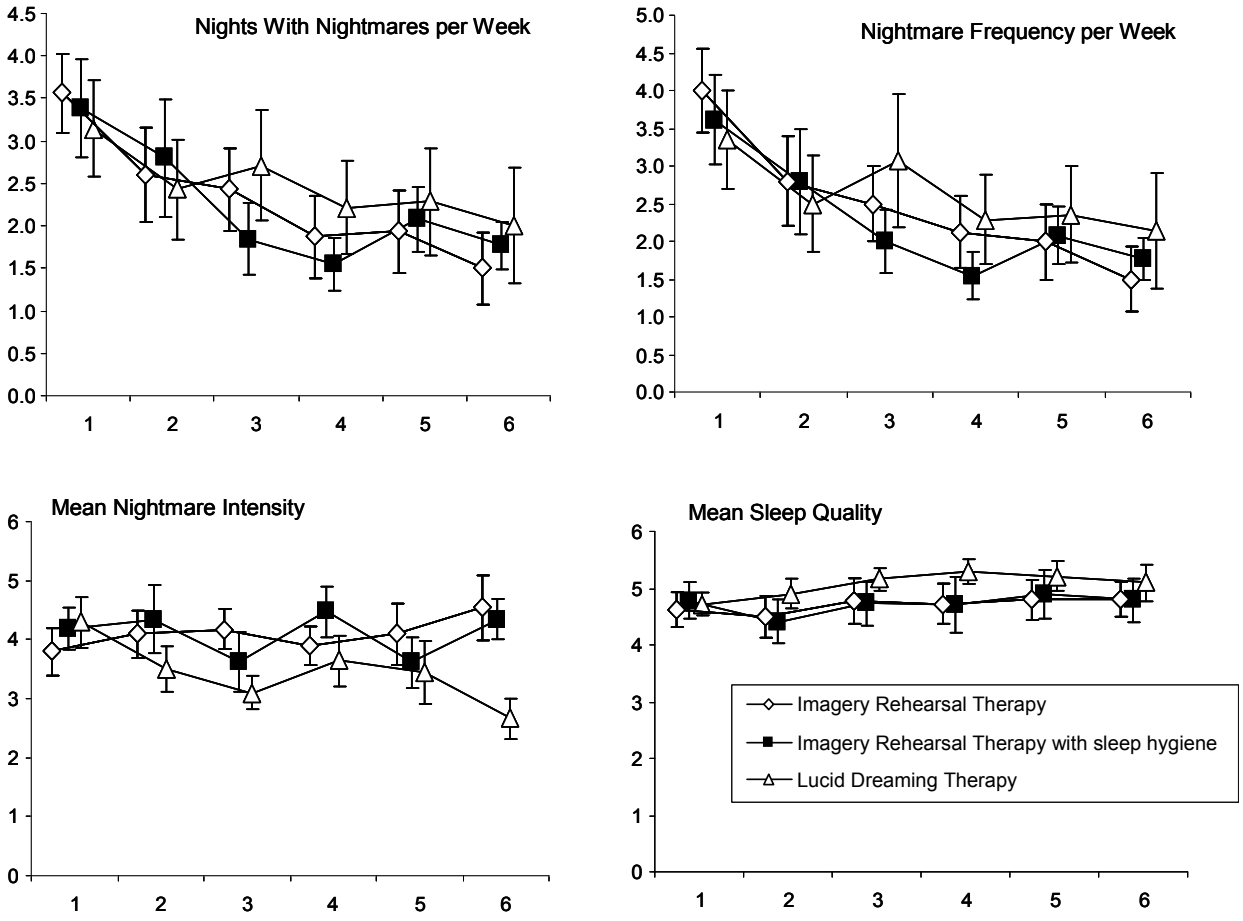
comparison to the two other conditions on mean nightmare intensity; IRT had a negative effect on mean nightmare intensity (Table 5, 6; Figure 3).

Table 6 – *Multilevel regression coefficients for diary variables*

	Nightmare frequency per week		Nights with nightmares		Mean nightmare intensity	
	B	*(SE)*	*B*	*(SE)*	*B*	*(SE)*
IRT						
Constant	-0.48	$(0.14)^{***}$	-0.85	$(0.32)^{**}$	1.63	$(0.32)^{***}$
Time	-0.20	$(0.04)^{***}$	-0.69	$(0.22)^{*}$	0.13	$(0.24)^{\varphi}$
$Time^2$	-	-	0.06	$(0.04)^{ns}$	-	-
Baseline	0.68	$(0.10)^{***}$	0.90	$(0.05)^{***}$	0.69	$(0.07)^{***}$
IRT+	ns	ns	ns	ns	-0.45	$(0.24)^{\varphi}$
IRT+ *time	ns	ns	ns	ns	ns	ns
IRT+ $*time^2$	ns	ns	ns	ns	-	-
LDT	ns	ns	ns	ns	-1.07	$(0.24)^{***}$
LDT*time	ns	ns	ns	ns	-0.36	$(0.11)^{***}$
LDT$*time^2$	ns	ns	ns	ns	-	-
IRT+						
Constant	-0.34	$(0.14)^{*}$	-0.85	$(0.30)^{***}$	1.18	$(0.35)^{***}$
Time	-0.14	$(0.04)^{***}$	-0.89	$(0.24)^{***}$	0.01	$(0.07)^{ns}$
$Time^2$	-	-	0.12	$(0.05)^{**}$		
LDT	ns	ns	ns	ns	-0.63	$(0.24)^{*}$
LDT*time	ns	ns	0.56	$(0.34)^{\varphi}$	-0.24	$(0.11)^{*}$
LDT$*time^2$	ns	ns	-0.09	$(0.06)^{ns}$	ns	ns
LDT						
Constant	-0.28	$(0.13)^{*}$	-0.38	$(0.32)^{ns}$	0.55	$(0.35)^{ns}$
Time	-0.13	$(0.04)^{***}$	-0.33	$(0.23)^{ns}$	-0.234	$(0.08)^{**}$
$Time^2$	-	-	0.03	(0.04)	-	-

Note. IRT = Imagery Rehearsal Therapy; IRT+ = Imagery Rehearsal Therapy with sleep hygiene; LDT = IRT with sleep hygiene and Lucid Dreaming Therapy; φ = $p < .1$; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; nightmare frequency was z-log transformed.

Figure 3 – Six week overview for diary variables per condition



Discussion

In this study we set out to investigate whether expanding IRT with sleep hygiene and lucid dreaming increases efficacy. To our surprise, both LDT and IRT+ showed a smaller decrease in nightmare measures compared to IRT. Moreover, IRT was the only condition that convincingly proved itself compared to the waiting-list. In contrast to our expectations, IRT seems to be the most effective self-help treatment of all intervention conditions.

Before we discuss the implications of these findings in detail we want to address some limitations of this study. Low power was probably a reason that some of the observed differences were not significant (such as the insignificant differences on the secondary measures). Moreover, this study suffered from a higher dropout rate than our former study. We think this might be because in the former study a self-help intervention for nightmares was delivered for the first time in the Netherlands; volunteers participating in that study might have been more motivated. With multiple imputation we tried to correct for these dropout effects (Sterne et al., 2009). However, measurements that are missing cannot be replaced; they can only be estimated. Therefore, the results are less reliable, particularly for the long-term measurements. This implicates that conclusions are preliminary.

Nonetheless, the general pattern in the questionnaire data was clear. On all accounts IRT performed better (however, not always significantly so) than IRT+ and LDT. In our former study (Lancee et al., 2010a), we found exposure and IRT to be equally effective, and we suggested that exposure might be the key element in treating nightmares. In this study, we found that expanding IRT with hygiene and/or LDT seems to deteriorate efficacy. This was not expected because LDT has showed to be effective in treating nightmares (Spoormaker & van den Bout, 2006) and targeting sleep has been empirically validated in people suffering from insomnia (Morin et al., 1999). Adding these elements in a self-help format might confuse participants and as a consequence they may employ only parts of the separate treatments, thereby failing to exercise the proposed key element of nightmare treatment: exposure.

Employing stand alone LDT (or the current LDT protocol without sleep hygiene) could have improved treatment outcome. The instructions of the LDT section where short and could have been too minimal, although they were in line with previous protocols that could successfully induce lucidity in a subgroup of participants (Spoormaker & van den Bout, 2006; Spoormaker et al., 2003). However, an interaction effect may have affected our results: It may be detrimental instead of additive to learn LDT in addition to IRT because of complexity and self-efficacy reasons. In any case, LDT appears more difficult

to learn than IRT, and this would suggest that a self-help format may not be the most optimal treatment delivery method for LDT because support from a therapist is essential to mastering lucid dreaming. Our recommendation is that future lucid dreaming research uses a face-to-face setting to compare original IRT with original LDT.

Another surprising finding was that adding a sleep hygiene section did not enhance treatment efficacy, not even on sleep quality. This is in contrast to uncontrolled treatment studies whereby a combined approach for insomnia and nightmares showed promising results (e.g., Krakow et al., 2001; Swanson et al., 2009). In the self-help format, the sleep hygienic guidelines (such as getting out of bed when unable to fall a sleep) might have provided a more intrusive / difficult treatment module that may have confused participants, or if adherence to this module could not be sustained, a reduced motivation to adhere to other treatment modules. It is possible that in order to improve sleep hygiene directly a more elaborate sleep intervention and/or face-to-face contact is required.

The effects observed in the questionnaire data were largely similar in the diary data: All conditions ameliorated nightmare frequency as measured by a diary. No significant improvements were found by including sleep hygiene to IRT. Moreover, The IRT and IRT+ condition were superior compared to LDT in ameliorating nightmare frequency measures; the lack of power was probably the reason that these differences remained insignificant. The opposite effect was found for the mean nightmare intensity, where LDT had a larger decrease on nightmare intensity compared to IRT and IRT+ (IRT even had an increase). IRT might only ameliorate the low intensity nightmares; leaving the high intensity nightmares unchanged. Another explanation could be that LDT has more effect on nightmare intensity, because nightmare sufferers achieve a sense of control with the lucid dreaming technique. These diary data should be handled cautiously as well, but as diaries can be seen a more objective form of measurements (Levin & Nielsen, 2007), future studies should try to find ways to limit attrition in diaries.

Nonetheless, all intervention conditions showed an effect on nightmare measures, but only IRT showed a significant effect compared to a waiting-list control condition. It seems that for self-help therapy, exposure and IRT are the currently the best available treatments for nightmares. IRT may be a treatment that is more appealing to patients as it provides a more positive, empowering manner to perform exposure. Self-help therapy for nightmares is a promising technique, especially because of its cost-effectiveness and ability to reach a large number of nightmare sufferers.

References

American Psychiatric Association. (2000). *Diagnostic and Statistic Manual of Mental Disorders* (4th ed., text rev.). Washington DC: American Psychiatric Press.

Berquier, A., & Ashton, R. (1992). Characteristics of the frequent nightmare sufferer. *Journal of Abnormal Psychology, 101*, 246-250.

Bixler, E., Kales, A., Soldatos, C., Kales, J. D., & Healey, S. (1979). Prevalence of sleep disorders in the Los Angeles metropolitan area. *American Journal of Psychiatry, 79*, 1257-1262.

Blagrove, M., Farmer, L., & Williams, E. (2004). The relationship of nightmare frequency and nightmare distress to well-being. *Journal of Sleep Research, 13*, 129-136.

Bouma, J., Ranchor, A. V., Sanderman, R., & van Sonderen, E. (1995). *Het meten van symptomen van depressie met de CES-D: Een handleiding [Dutch translation of the Epidemiological Studies-Depression scale]*. Groningen: Noordelijk Centrum voor Gezondheidsvraagstukken.

Brom, D., & Kleber, R. J. (1985). De Schok Verwerkings Lijst [the Dutch version of the Impact of Event Scale]. *Nederlands Tijdschrift voor de Psychologie, 40*, 164-168.

Burgess, M., Gill, M., & Marks, I. M. (1998). Postal self exposure treatment of recurrent nightmares: A randomised controlled trial. *British Journal of Psychiatry 172*, 257-262.

Hobson, A. (2009). The Neurobiology of consciousness: Lucid dreaming wakes up. *International Journal of Dream Research, 2*(2), 41-44.

Hox, J. J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah: Lawrence Erlbaum Associates.

Hublin, C., Kaprio, J., Partinen, M., & Koskenvuo, M. (1999). Nightmares: Familial aggregation and association with psychiatric disorders in a nationwide twin cohort. *American Journal of Medical Genetics, 88*, 329-336.

Kales, A., Soldatos, C., Caldwell, A. B., Charney, D. S., Kales, J. D., Markel, D., et al. (1980). Nightmares: Clinical characteristics and personality patterns. *American Journal of Psychiatry, 137*, 1197-1201.

Krakow, B., Kellner, R., Pathak, D., & Lambert, L. (1995). Imagery rehearsal treatment for chronic nightmares. *Behaviour Research and Therapy, 33*, 837-843.

Krakow, B., Johnston, L., Melendrez, D., Hollifield, M., Warnder, T.D., Chavez-Kennedy, D. et al. An open-label trial of evidence based cognitive behavior therapy for nightmares and insomnia in crime victims with PTSD. *American Journal of Psychiatry*, *158*, 2043-2047.

Krakow, B., & Zadra, A. (2006). Clinical management of chronic nightmares: Imagery Rehearsal Therapy. *Behavioral Sleep Medicine, 4*, 45-70.

LaBerge, S., Nagel, L. E., Dement, W. C., & Zarcone, V. P. (1981). Lucid dreaming verified by volitional communication during REM sleep. *Perceptual and Motor Skills, 52*, 727-732.

LaBerge, S., & Rheingold, H. (1990). *Exploring the world of lucid dreaming*. New York: Ballantine.

Lancee, J., Spoormaker, V. I., & van den Bout, J. (2010a). Cognitive behavioral self-help treatment for nightmares: A randomized controlled trial. *Psychotherapy and Psychosomatics, 79*, 371-377.

Lancee, J., Spoormaker, V. I., & van den Bout, J. (2010b). Nightmare frequency is associated with subjective sleep quality but not with psychopathology. *Sleep and Biological Rhythms, 8*, 187-193.

Lancee, J., Spoormaker, V. I., & van den Bout, J. (in press). Long-term effectiveness of cognitive-behavioral self-help intervention for nightmares. *Journal of Sleep Research.*

Levin, R., & Fireman, G. (2002). Nightmare prevalence, nightmare distress, and self reported psychological disturbance. *Sleep, 25*, 205-212.

Levin, R., & Nielsen, T. A. (2007). Disturbed dreaming, posttraumatic stress disorder, and affect distress: A review and neurocognitive model. *Psychological Bulletin, 133*(3), 482-582.

Li, S. X., Zhang, B., Li, A. M., & Wing, Y. K. (2010). Prevalence and correlates of frequent nightmares: A community-based 2-phase study. *Sleep, 33*(6), 774-780.

Morin, C. M., Hauri, P. J., Espie, C. A., Spielman, A. J., Buysse, D. J., & Bootzin, R. R. (1999). Nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine Review. *Sleep, 22*(8), 1-23.

Morris, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. *Organizational Research Methods, 11*(2), 364-386.

Neidhardt, E. J., Krakow, B., Kellner, R., & Pathak, D. (1992). The beneficial effects of one treatment session and recording of nightmares on chronic nightmare sufferers. *Sleep, 15*, 470-473.

Ohayon, M.M., Morselli, P.L., & Guilleminault, C. (1997). Prevalence of nightmares and their relationship to psychopathology and daytime functioning in insomnia subjects. *Sleep, 20*(5), 340-348.

Schredl, M. (2003). Effects of state and trait factors on nightmare frequency. *European Archives of Psychiatry and Clinical Neuroscience, 253*, 241-247.

Schredl, M. (2009). Nightmare frequency in patients with primary insomnia. *International Journal of Dream Research, 2*(2), 85-88.

Schredl, M. (2010). Nightmare frequency and nightmare topics in a representative German sample. *European Archives of Psychiatry and Clinical Neuroscience, 260,* 565-570.

Schredl, M., & Erlacher, D. (2004). Lucid dreaming frequency and personality. *Personality and Individual Differences, 37*, 1463-1473.

Spoormaker, V. I., Schredl, M., & van den Bout, J. (2006). Nightmares: From anxiety symptom to sleep disorder. *Sleep Medicine Reviews, 10*(1), 53-59.

Spoormaker, V. I., & van den Bout, J. (2005). The prevalence of sleep disorders in the Netherlands. *Sleep-Wake Research in the Netherlands, 16*, 155-158.

Spoormaker, V. I., & van den Bout, J. (2006). Lucid dreaming treatment for nightmares: A pilot-study. *Psychotherapy and Psychosomatics, 75*, 389-394.

Spoormaker, V. I., van den Bout, J., & Meijer, E. J. G. (2003). Lucid dreaming treatment for nightmares: A series of cases. *Dreaming, 13*, 181-186.

Spoormaker, V. I., Verbeek, I., van den Bout, J., & Klip, E. C. (2005). Initial validation of the SLEEP-50 questionnaire. *Behavioral Sleep Medicine, 3*(4), 227-246.

Statistics Netherlands. (2009). *Statistical yearbook 2009*. The Hague: Statistics Netherlands.

Sterne, J. A., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., et al. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potentials and pitfalls. *British Medical Journal, 338*(b2393).

Swanson, L.M., Favorite, T.K., Horin, E., Arnedt, J.T. A combined group treatment for nightmares and insomnia in combat veterans: A pilot study. *Journal of Traumatic Stress, 22*(6), 639-642.

Van der Ploeg, E., Mooren, T. T. M., van der Velden, P., G., Kleber, R. J., & Brom, D. (2004). Construct Validation of the Dutch Version of the Impact of Event Scale. *Psychological Assessment 16*(1), 16-26.

Van der Ploeg, H. M. (1980). Validity of the Zelf-Beoordelings-Vragenlijst (a Dutch version of the Spielberger State-Trait Anxiety Inventory). *Nederlands Tijdschrift voor de Psychologie en haar Grensgebieden, 35*(4), 243-249.

Wittmann, L., Schredl, M., & Kramer, M. (2007). Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychotherapy and Psychosomatics, 76*, 25-39.

Zadra, A. L., & Donderi, D. O. (2000). Nightmares and bad dreams: Their prevalence and relationship to well-being. *Journal of Abnormal Psychology, 109*, 273-281.

Zadra, A. L., & Pihl, R. O. (1997). Lucid dreaming as a treatment for recurrent nightmares. *Psychotherapy and Psychosomatics, 66*, 50-55.

Zadra, A. L., Pilon, M., & Donderi, D. C. (2006). Variety and intensity of emotions in nightmares and bad dreams. *The Journal of Nervous and Mental Disease, 194*(4), 249-254.

Zich, J. M., Attkisson, C. C., & Greenfield, T. K. (1990). Screening for depression in primary care clinics: The CES-D and the BDI. *International Journal of Psychiatry in Medicine, 20*(3), 259-277.

Chapter 7

Internet-delivered self-help therapy for insomnia compared to bibliotherapy: A randomized waiting-list controlled trial

In revision as:

Lancee, J., Spoormaker, V.I., van Straten, A., & van den Bout, J. (in revision). Internet-delivered self-help therapy for insomnia compared to bibliotherapy: A randomized waiting-list controlled trial. *Journal of Consulting and Clinical Psychology*

Abstract

Objective

Cognitive-behavioral therapy (CBT) is effective in reducing insomnia complaints, but the effects of self-help CBT have been inconsistent. The aim of this study was to determine the effectiveness of self-help for insomnia delivered in either book or Internet format by comparing the formats to a waiting-list, in a homogenous group with large sample size.

Method

Participants kept a diary and filled out questionnaires before they were randomized into Internet treatment (n = 216), bibliotherapy (n = 205), or waiting-list (n = 202) groups. The intervention consisted of 6 weeks of unsupported self-help CBT, and post-tests were 4, 18, and 48 weeks after intervention.

Results

Multilevel regression intention-to-treat analyses showed that, at 4-week follow-up, Internet and bibliotherapy conditions were superior ($p < .05$) compared to the waiting-list condition on daily sleep measures (Δd = 0.20–0.64), global insomnia symptoms (Δd = 0.54–1.00), depression (Δd = 0.36–0.41), and anxiety symptoms (Δd = 0.33–0.40). The Internet and bibliotherapy groups demonstrated equal effectiveness 4 weeks after treatment (Δd = 0.00–0.22; $p > .05$). Effects were sustained at 48-week follow-up, when the Internet condition minimally ameliorated global insomnia symptoms, anxiety, and depression complaints compared to bibliotherapy.

Conclusions

This large-scale insomnia unsupported self-help study shows moderate to large effects on sleep measures that were still present after 48 weeks. Self-help CBT for insomnia therefore appears to be a promising first option in a stepped care approach.

Keywords

Bibliotherapy • Insomnia • Internet • RCT • Self-help

Introduction

Chronic insomnia is a common disorder, with a prevalence of 10-15% in the adult population (Ancoli-Israel & Roth, 1999; Ford & Kamerow, 1989; Mellinger, Balter, & Ulenhuth, 1985; Morin, LeBlanc, Daley, Gregoire, & Merette, 2006). The diagnosis of insomnia requires sleep complaints for at least a month and significant impairment in daily functioning (American Psychiatric Association, 2000). Persons with insomnia often report complaints such as fatigue, distress, and impaired cognitive functioning (LeBlanc et al., 2007; Roth & Drake, 2004; Simon & Vonkorff, 1997). Additionally, insomnia is associated with mood and anxiety disorders (Ford & Kamerow, 1989; Taylor, Lichstein, Durrence, Reidel, & Bush, 2005).

Cognitive-behavioral therapy (CBT) has shown better long-term outcomes than pharmacological interventions (Jacobs, Pace-Schott, Stickgold, & Otto, 2004; Morin, Colecchi, Stone, Sood, & Brink, 1999; Sivertsen et al., 2006; Smith et al., 2002), and several meta-analyses have demonstrated the short-term and long-term effectiveness of CBT for insomnia complaints (Irwin, Cole, & Nicassio, 2006; Morin, Bootzin, et al., 2006; Morin et al., 1999; Murtagh & Greenwood, 1995). CBT for insomnia may involve several components, such as relaxation, stimulus control, sleep hygiene, sleep restriction, cognitive restructuring, and paradoxical intention (Morin, Bootzin, et al., 2006; Morin et al., 1999). A multi-component treatment has been recommended because it is more likely that such an approach addresses the various facets of insomnia (Morin, Bootzin, et al., 2006).

One disadvantage of CBT is the unavailability of trained cognitive-behavioral therapists in many healthcare settings. As a consequence, those who do seek treatment are likely to receive less-effective (and possibly addictive) pharmacological treatment (Benca, 2005). In addition, a minority of all sleep-disordered persons seek face-to-face treatment (Ancoli-Israel & Roth, 1999; Benca, 2005; Morin, LeBlanc, et al., 2006). To bridge the gap between the high prevalence of insomnia and the low accessibility of trained therapists, self-help CBT has been proposed as a first option in a stepped care model (Espie, 2009). Self-help CBT has shown promising effects for other disorders such as those concerning anxiety and mood (Cuijpers, van Straten, & Andersson, 2008; Fanner & Urquhart, 2008; Spek et al., 2007).

The effects of self-help CBT on insomnia appear to be small to moderate, as shown by a recent meta-analysis (van Straten & Cuijpers, 2009). However, only 10 randomized controlled trials (RCT) were included in the meta-analysis, and only three included moderate to large sample sizes (van Straten & Cuijpers, 2009). Since this meta-analysis,

two more Internet self-help RCTs have been published, one small-scale (Ritterband et al., 2009) and one moderate-scale study (Vincent & Lewycky, 2009).

In general, data suggests that self-help CBT for insomnia primarily works on global insomnia symptoms (i.e. subjective complaints as measured with retrospective questionnaires) instead of on daily self-report measures of sleep, such as sleep onset latency, wake after sleep onset, and total sleep time. In their meta-analysis, van Straten & Cuijpers (2009) concluded that total sleep time did not improve after self-help CBT. Only a few smaller scale studies demonstrated convincing results on these sleep measures (e.g., Mimeault & Morin, 1999; Ritterband et al., 2009). More importantly, all moderate- to large-scale RCTs on both Internet delivered CBT and bibliotherapy have reported mainly positive results on global insomnia symptoms but small or no significant effects on sleep measures (Morin, Beaulieu-Bonneau, LeBlanc, & Savard, 2005; Ström, Pettersson, & Andersson, 2004; van Straten, Cuijpers, Smit, Spermon, & Verbeek, 2009; Vincent & Lewycky, 2009). This is a critical issue because it is decisive for concluding whether CBT can really affect the primary complaint of bad sleep, or simply alters the way people think about their insomnia. It has been suggested that small-scale self-help insomnia RCTs may have suffered from a publication bias: The studies without effect may have remained unpublished (file drawer effect; van Straten & Cuijpers, 2009).

The absent or small effects on sleep measures in previous trials (e.g., Morin et al., 2005; van Straten et al., 2009) may also be attributed to the inclusion of patients with a co-morbid depression. Insomnia CBT comprises of intrusive exercises (such as sleep restriction) which might be too demanding to administer in a self-help format for patients with a co-morbid depression. This complex group may not respond well to self-help treatment for insomnia and may function as a confounding factor that masks real treatment effects in patients with insomnia and maximally mild depressive complaints.

In recent years, there has been a shift from self-help CBT delivered by paper-and-pencil to delivery via the Internet, owing to the cost-effectiveness of the latter method and increasing Internet access (Andersson, 2009). For example, in 2008, 88% of the population of the Netherlands was connected to the Internet (Statistics Netherlands, 2009). The shift toward the Internet as a delivery method for self-help CBT, however, appears to be based on practical rather than empirical grounds. No RCT has directly compared Internet-delivered self-help CBT for insomnia to bibliotherapy to investigate whether these treatment-delivery strategies are equally effective. A meta-analysis comparing web-based versus non-web-based interventions concluded that web-based interventions showed more

improvement (Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004); however, only one of their included studies on physical activity compared Internet-delivered CBT to bibliotherapy (Marshall, Leslie, Bauman, Marcus, & Owen, 2003). This study favored the non-web-based intervention but could not identify significant differences. To our knowledge, since the meta-analysis, three more studies, one on panic disorder (Klein, Richards, & Austin, 2006), one on social anxiety (Furmark et al., 2009), and on weight loss (Womble et al., 2004) have compared these two modalities with varying outcomes. In any case, the comparison of effect sizes between different RCTs that employ other treatment programs on diverse populations is suboptimal; a direct comparison is more informative.

The aim of this study was to compare self-help CBT for insomnia to a waiting-list in a homogenous group of adequate sample size ($N \approx 600$) and to directly compare Internet-delivered self-help CBT with bibliotherapy to evaluate the short-term and long-term effectiveness of the two delivery methods. We used the exact same intervention for Internet-delivered CBT and bibliotherapy, and the intervention was not tailored to individual differences.

Method

Participants

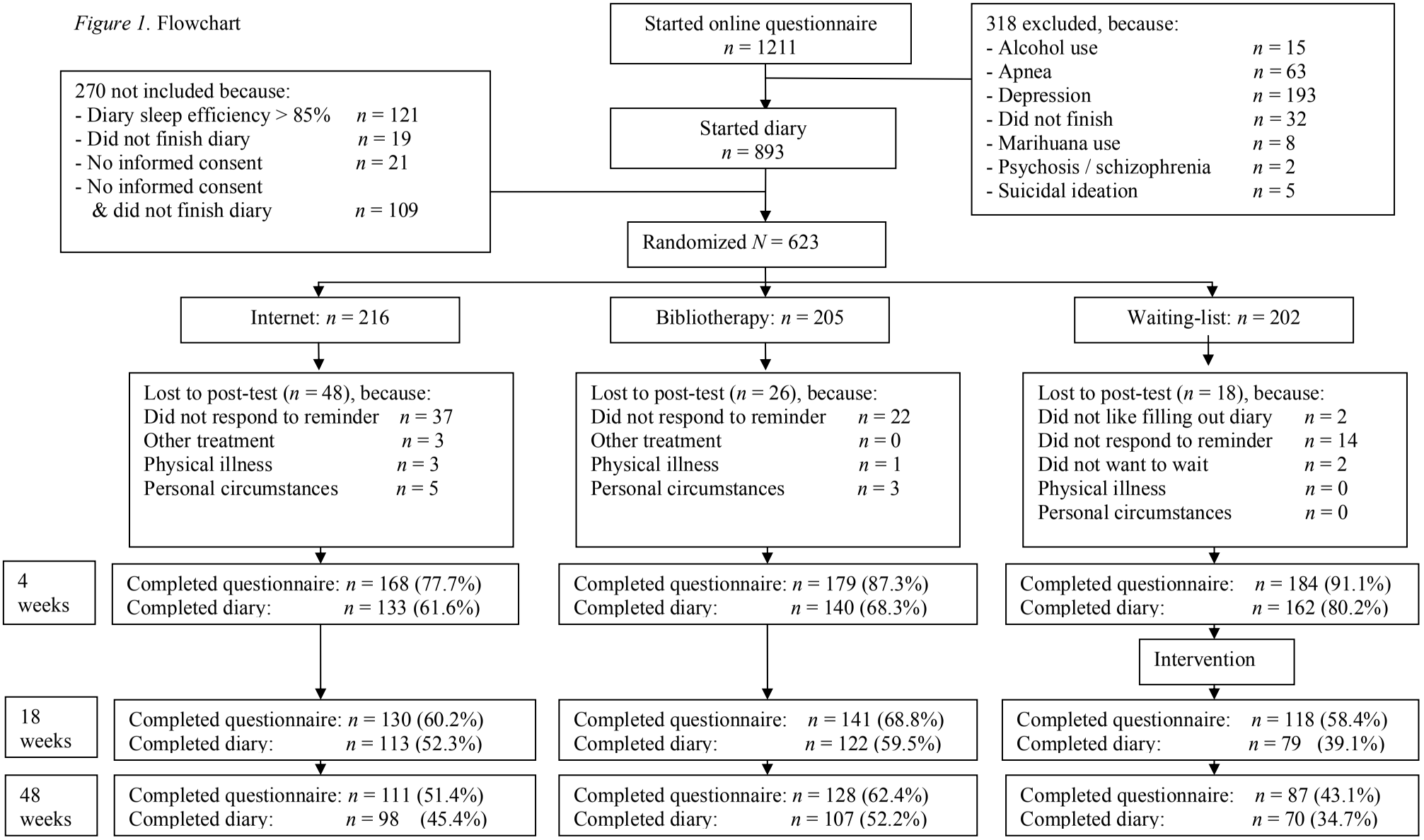
Participants were recruited from January to March 2009 via a Dutch insomnia website (www.insomnie.nl). Attention was drawn to this website via the general media. Inclusion criteria were: sleep efficiency on diary below 85%; insomnia disorder following DSM-IV-TR guidelines based on the SLEEP-50 (cutoff ≥ 19; Spoormaker, Verbeek, van den Bout, & Klip, 2005), 18 years or older, and access to a valid e-mail address. Twelve-hundred-eleven participants started the online questionnaire, 181 did not complete the baseline assessment, 121 did not meet the inclusion criteria, and 286 were excluded from the study (Figure 1). Exclusion criteria were: severe depression, n = 193 (cutoff 23 or higher on CES-D; Bouma, Ranchor, Sanderman, & van Sonderen, 1995; Radloff, 1977); sleep apnea, n = 63 (cutoff 15 or higher; Spoormaker et al., 2005); more than three glasses of alcohol a day for at least 21 days a month, n = 15; marihuana use more than once a week, n = 8; schizophrenia/psychosis, n = 2; and suicidal ideation, n = 5. See supplemental Table S1 for the exact questions asked. In the case of suicidal ideation, the general practitioner was notified by the first author at the soonest opportunity. Participants were not excluded on medication or medical grounds. The final sample (N = 623) had a mean age of 51.8 (SD = 12.1; range = 19–86 years) and included 520 (67.7%) women (Table 1).

Table 1 - *Demographic characteristics of participants per condition*

		Internet (n = 214)		Bibliotherapy (n = 203)		Waiting-list (n = 200)		
Mean age (SD)		52.2 (11.4)		51.2 (12.8)		51.9 (12.2)		F (2, 616) = .35, p = .70
		n	%	n	%	n	%	
Gender	Male	67	31.3	52	25.6	64	32.0	χ^2 (2) = 2.40,
	Female	147	68.7	151	74.4	136	68.0	p = .30
Medication*	No	194	90.7	186	91.6	189	94.5	χ^2 (2) = 2.28,
	Yes	20	9.3	17	8.4	11	5.5	p = .32
In psychological	No	192	89.7	179	88.2	183	91.5	χ^2 (2) = 1.22,
treatment	Yes	22	10.3	24	11.8	17	8.5	p = .55
Insomnia due to a	No	187	87.4	185	91.1	174	87.0	χ^2 (2) = 2.09,
physical condition	Yes	27	12.6	18	8.9	26	13.0	p = .35

Note. * = Other than for sleeping.

Figure 1. Flowchart



Procedure

The study was approved by the Medical Ethical Committee of the University Medical Center Utrecht and registered at http://clinicaltrials.gov (ID: NCT00851188). Persons with scores above the cutoff for insomnia disorder (cutoff ≥ 19; Spoormaker et al., 2005) received detailed information about the study. After completing the online baseline questionnaire, participants directly received a seven-day online diary and were mailed an informed-consent form. If written informed consent had been obtained and the diary had been returned, participants were randomized into one of three conditions: Internet-delivered self-help CBT (n = 216); paper-and-pencil self-help CBT (bibliotherapy; n = 205); and waiting-list (n = 202). Participants in the waiting-list condition were informed that they would receive an intervention, after successful completion of a post-test questionnaire and diary, in 11 weeks.

Unrestricted randomization was achieved by a computer-generated random-number table. Participants and the principal investigator (first author) were not blind to the assigned condition. For this study we wanted to have sufficient power to significantly detect effect size differences comparable to Ström et al. (2004; Δd = −0.03–0.35). The sample size was based on the fact that a group size of n = 100 is needed for sufficient power (> 0.8) to detect an effect of Cohen's d = 0.40 (p < .05; two tailed). With a 50% dropout rate from diary intervention conditions (dropout was 45% in Ström et al., 2004), groups of around n = 200 were needed. This is a conservative estimate, as the applied multilevel intention-to-treat analysis uses all baseline information (see statistical analysis); achieved power is thus likely to be higher. Eleven weeks after completion of the baseline (four weeks after completion of the six-week intervention), participants in all conditions filled out the online questionnaires and seven-day sleep diaries. Post-1 was measured four weeks after the intervention had ended, to ensure the intervention had taken full effect (and that no participants were still working on the protocol). Post-2 and post-3 measurements were 18 and 48 weeks after the intervention, respectively. Participants were considered dropouts after three unanswered reminders (two e-mails and one postal). Upon completion of post-1, participants in the waiting-list received the intervention of their choice; 88 (44.0%) chose Internet, 102 (56.0%) selected bibliotherapy: χ^2 (1) = 2.63, p = .11. Participants were not reimbursed for their participation.

Intervention

The self-help program was written by the first and second author and was based on the self-help manual used in van Straten et al. (2009) and other previously published manuals (e.g., Morin & Espie, 2003). The CBT elements are described in Table 2. The Internet and bibliotherapy intervention had identical content. Participants in the Internet condition received the intervention and the online diary via a website, whereas those in the bibliotherapy condition received a paper-and-pencil version. The total intervention was directly available and consisted of a six-week treatment program of approximately 9000 words. Each module contained instructions and an exercise. Participants were not provided with an example but were encouraged to complete the exercises offered (e.g., "*during the exercises you might be more tired than usual; this is necessary to change your sleeping patterns*"). No module for sleep medication was included; participants in the Internet and bibliotherapy conditions were advised to contact their general practitioner if they wanted to end sleep medication. E-mail support by a therapist was not offered, but participants had the opportunity to e-mail the first author. In the Internet condition, 35 content-related questions/comments were asked and answered, and 19 in the bibliotherapy condition (e.g., "*I do not understand exactly how to calculate my sleep efficiency*"; "*If I restrict my sleep I have to get up early in the morning and then my house is so empty and cold*").

Measurements

Primary measures

Our primary outcome measurement was the sleep diary. Sleep diaries are considered a standard instrument to assess sleep characteristics in intervention studies (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006), although diaries do not yield the same objective values as those obtained by polysomnography (Sateia, Doghramji, Hauri, & Morin, 2000). Diaries are considered less intrusive, more cost-effective, and easily accessible. Moreover, diaries appear more sensitive to the subjective symptoms of insomnia than to the objective measurements of sleep disturbances (Moul, Hall, Pilkonis, & Buysse, 2004).

All participants filled out a seven-day online diary at the baseline and follow-up measurements. They recorded: bed time, final wake time, sleep onset latency (SOL), number of nocturnal awakenings (NWAK), wake after sleep onset (WASO), the quality of the previous day (day rating: 1 = very bad, 10 = very good), and the daily use of any sleep medication. From these variables, the time in bed (TIB = final wake time − bed time), total

sleep time (TST = TIB − SOL − WASO), and sleep efficiency (SE = (TST/TIB) × 100) were deduced.

Table 2 - *Weekly overview intervention*

Week 1	Diary. The diary addresses the same variables as in the pre–post measurements and is filled out throughout the six weeks of the intervention. Psycho-education. Information on sleep, sleep problems, and sleep hygiene is provided.
Week 2	Diary Stimulus control / sleep hygiene. The goal of this module is to re-associate the bed with sleeping. Participants are instructed to go to bed only when sleepy, use the bed and bedroom for sleep only, maintain a regular rising time, avoid daytime naps, and move out of bed and into another room when unable to fall asleep. Moreover, participants are told to optimize their bedroom for sleeping by focusing on external factors such as the mattress, temperature, and light. Progressive muscle relaxation
Week 3	Diary Sleep restriction. Participants use their diaries to estimate their total sleeping time, their time in bed, and sleep efficiency. In the bibliotherapy condition, participants use guidelines to calculate their sleep efficiency. Participants in the Internet condition can also use a Microsoft Excel spreadsheet that automatically computes sleep efficiency. The sleep window is limited to actual sleep time (with a minimum of five hours). If sleep efficiency is > 90%, the sleep window is increased by 15–30 minutes a week. The restriction of sleep is achieved by either going to bed later or getting out of bed earlier (participants' choice). Imaginative relaxation – safe place
Week 4	Diary Sleep restriction Challenging misconceptions about sleep. Common negative thoughts and negative feelings about insomnia are addressed (e.g., "*I must sleep at least eight hours, otherwise I will be a wreck tomorrow*"), and participants learn to alter these thoughts (e.g., "*even if I sleep only six hours tonight I will be able to work quite well tomorrow*"). First, they write down an example situation, their accompanying cognition(s), and accompanying emotions. Second, they are instructed to write down a more constructive cognition and the emotions that would follow from this.
Week 5	Diary Sleep restriction Cognitive restructuring
Week 6	Diary Paradoxical intention. At the end of treatment, participants sleep fewer hours than normal for one night (with a minimum of five hours), so as to learn that partial sleep deprivation does not necessarily impair daily functioning. By combining a few hours of sleep with constructive cognitions (e.g., "*if I sleep only five hours, I will be tired, but I will be able to function normally tomorrow*"), participants are able to experience and understand that stress or fatigue is not necessarily a consequence of a small amount of sleep.

Secondary measures

Global insomnia symptoms were measured with the SLEEP-50 (Spoormaker et al., 2005). The SLEEP-50 is a questionnaire with good reliability (α = .85, test-retest reliability = .78) that assesses multiple sleep disorders such as apnea, nightmares, and insomnia. Moreover, it is the only sleep questionnaire validated in the Dutch language (compared to polysomnographic and clinical diagnoses obtained in a sleep clinic). Items of the SLEEP-50 are scored on a four-point-scale: 1 (not at all), 2 (somewhat), 3 (rather much), and 4 (very much). For this study we used two subscales of the SLEEP-50. The first subscale is the eight-item insomnia scale (range = 8–32; e.g., "*I have difficulty in falling asleep*"; "*After waking up during the night, I fall asleep slowly*"). This scale has a cutoff ≥ 19 with a sensitivity of .71 and a specificity of .75 compared to clinical diagnoses. The other six-item scale was used to measure the impact of insomnia on daily functioning (insomnia impact; range = 6–24; e.g., "*I would like to have more energy during the day*"; "*I worry whether I sleep enough*"). We also used the subjective sleep-quality variable ("*I rate my sleep as…*"; 1 'very bad' to 10 'very good'). The SLEEP-50 also includes an eight-item apnea scale (range = 8–32; e.g., "*I am told that I hold my breath when sleeping*"). This scale was used for exclusion on apnea and has a cutoff ≥ 15 with a sensitivity of .85 and a specificity of .88.

Anxiety was measured by the Dutch version of the seven anxiety items of the Hospital Anxiety and Depression Scale (HADS, range = 0–21; Spinhoven et al., 1997). The reliability of the HADS is good (α = .80–.84), as is the test-retest correlation (.89; $p <$ .001).

Depression was measured by a Dutch translation of the 20-item Centre of Epidemiological Studies Depression scale (CES-D, range = 0–60; Bouma et al., 1995; Radloff, 1977). This scale has good internal consistency (α = .79–.92; test-retest correlation is .90), and the validity of the Dutch scale is comparable to that of the original version (Bouma et al., 1995; Radloff, 1977).

At post-test, participants in both intervention conditions rated the six modules of the self-help intervention on whether they completed the exercises (1 [not completed] to 5 [fully completed]) and on how useful they perceived that exercise to be (1 [very useless] to 5 [very useful]). Modules were considered completed or useful if they were rated a four or a five.

Statistical analysis

All analyses were carried out on the intention-to-treat basis. To test for in-group (time) and between-group (time × condition) effects, a multilevel regression analysis was conducted. Multilevel regression is an intention-to-treat procedure that also allows participants with only one measurement to be included in analyses (Hox, 2002). A logistic regression analysis was performed to evaluate both questionnaire and diary dropout. If dropout predictors correlated with the dependent variables, they were taken into account by adding them as covariates in the final multilevel analysis. Six participants (two in each condition) were considered outliers (*z*-score below -3.29 on baseline sleep efficiency) and excluded from analysis. We observed no differences after randomization (chi-square and ANOVA tests, all *p*'s > .05), and baseline daily sleep measures did not correlate with anxiety and depression.

Attrition could have influenced post-test scores and therefore Cohen's *d* estimations. To correct for this problem, multiple imputation based on the 'missing at random assumption' was employed (Sterne et al., 2009). For the missing scores, ten separate datasets were generated with predictive mean matching. Differences in Cohen's *d*'s were calculated on the mean of these imputed datasets with $([M_{pre1} - M_{post1}] - [M_{pre2} - M_{post2}])/\sigma_{pooled\text{-}pretest}$ (Morris, 2008). Only Cohen's *d* estimations are based on the imputations, the displayed mean scores and *SD*'s are the observed scores (Table 3 and Table 4). Assumptions were evaluated and not violated. A significance level of $p < .05$ (two sided) was used throughout the study.

Results

Response to questionnaire and diary

Questionnaire

At 4-week follow-up, more questionnaires were returned in the bibliotherapy (n = 179; 87.3%; $p < .05$) and waiting-list condition (n = 184; 91.1%; $p < .01$) than in the Internet condition (n = 168; 77.7%). At 48-week follow-up, more questionnaires were returned in the bibliotherapy condition (n = 128; 62.4%; $p < .05$) than in the Internet (n = 111; 51.4%) and waiting-list condition (n = 87; 43.1%). In the bibliotherapy condition, women were more likely to complete the post-3 questionnaire (week 48; male: n = 25 [48.1%]; female: n = 101 [66.9%; $p < .05$]). In the Internet condition, high depression (CES-D) scores at baseline were associated with not completing the 48-week follow-up: responders: 13.60 (SD = 6.76); non-responders: 15.00 (SD = 6.10; $p < .05$).

Diary

At 4-week follow-up, more diaries were returned in the waiting-list (n = 162; 80.2%; $p < .05$) than in the bibliotherapy (n = 140; 68.3%) and Internet condition (n = 133; 61.6%). At 48-week follow-up, more diaries were returned in the Internet (n = 98; 45.5%; $p < .05$) and the bibliotherapy condition (n = 107; 52.2%; $p < .001$) than in the waiting-list condition (n = 70; 34.7%). We observed no significant differences in response to the diary between the Internet and the bibliotherapy condition. The number of nocturnal awakenings at baseline was associated with not filling out the dairy after four and 48 weeks in the Internet condition ($p < .05$). Baseline scores for post-1 responders were M = 2.70 (SD = 1.57), and non-responders were M = 2.21 (SD = 1.57); those for post-3 responders were M = 2.80 (SD = 1.65), and non-responders were M = 2.26 (SD = 1.19). Women were more likely to complete the 48-week follow-up in the bibliotherapy condition ($p < .05$; male: n = 21 [40.4%]; female: n = 86 [57.0%]).

Table 3 - *Baseline, 4, and 48- week follow-up means for the primary measures with corresponding confidence intervals and Cohen's d (diary)*

		Baseline		4 weeks		[95% CI of		48 weeks		[95% CI of	
		M	*(SD)*	*M*	*(SD)*	change]	*d*-1	*M*	*SD*	change]	*d*-3
Total sleep time	Internet	354.72	(66.16)	386.48	(59.42)	[22.97, 40.48]	-0.47***	398.11	(64.64)	[30.12, 47.73]	-0.58***
(TST) in minutes	Bibliotherapy	355.38	(58.82)	391.48	(61.00)	[27.31, 44.59]	-0.60***	392.78	(72.35)	[26.89, 46.26]	-0.61***
	Waiting-list	357.87	(60.48)	366.02	(59.50)	[0.16, 17.02]	-0.15*	387.07	(47.71)	[22.07, 40.89]	-0.53***
Sleep onset	Internet	59.36	(46.08)	35.63	(27.37)	[-29.11, -17.13]	0.50***	34.44	(28.90)	[-26.80, -15.64]	0.46***
latency (SOL)	Bibliotherapy	59.95	(41.35)	37.62	(27.11)	[-26.75, -17.12]	0.53***	38.70	(32.98)	[-26.21, -14.75]	0.50***
in minutes	Waiting-list	57.91	(38.84)	46.90	(30.98)	[-15.77, -5.25]	0.27***	42.50	(35.35)	[-18.75, -4.95]	0.30***
Wake after sleep	Internet	93.17	(50.83)	56.05	(38.41)	[-45.38, -30.52]	0.74***	58.34	(41.83)	[-44.45, -23.24]	0.68***
onset (WASO)	Bibliotherapy	91.98	(53.19)	54.74	(44.70)	[-44.45, -30.08]	0.70***	61.41	(42.25)	[-39.90, -23.53]	0.59***
in minutes	Waiting-list	91.84	(45.25)	80.88	(51.22)	[-18.86, -5.01]	0.26**	64.95	(34.45)	[-36.79, -21.13]	0.64***
Number of nocturnal	Internet	2.52	(1.45)	2.22	(1.49)	[-0.59, -0.21]	0.27***	2.13	(1.50)	[-0.71, -0.24]	0.33***
awakenings	Bibliotherapy	2.59	(1.52)	2.05	(1.13)	[-0.70, -0.37]	0.35***	2.00	(1.17)	[-0.81, -0.44]	0.42***
(NWAK)	Waiting-list	2.52	(1.32)	2.34	(1.58)	[-0.37, 0.12]	0.09ns	2.12	(1.27)	[-0.56,-0.19]	0.29***
Sleep efficiency	Internet	70.08	(11.24)	80.96	(10.07)	[9.13, 12.34]	-0.95***	81.16	(10.84)	[8.91, 12.36]	-0.94***
(SE) in percentage	Bibliotherapy	70.33	(11.15)	81.00	(11.08)	[8.82, 12.04]	-0.93***	79.66	(12.27)	[7.25, 11.23]	-0.83***
	Waiting-list	70.48	(10.36)	74.34	(11.68)	[2.24, 5.22]	-0.37***	78.49	(9.17)	[6.40, 9.87]	-0.80***
Day rating	Internet	6.31	(1.04)	6.82	(0.91)	[0.33, 0.69]	-0.48***	6.85	(0.99)	[0.26, 0.58]	-0.41***
(1-10)	Bibliotherapy	6.40	(0.87)	6.92	(0.91)	[0.34, 0.63]	-0.57***	6.75	(0.92)	[0.16, 0.51]	-0.39***
	Waiting-list	6.38	(0.94)	6.47	(1.00)	[-0.03, 0.24]	-0.11ns	6.62	(0.96)	[0.03, 0.40]	-0.23*

Note. Significance levels were calculated using multilevel regression (see Supplemental Table S2 and S4 for the full analysis-reports); * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; Cohen's *d* and confidence intervals are based on multiple imputation. Data belonging to 18-week follow-up can be found in Supplemental Tables S6 and S7.

Table 4 - *Baseline, 4, and 48- week follow-up means for the secondary measures with corresponding confidence intervals and Cohen's d (questionnaire)*

		Baseline		4 weeks		[95% CI of		48 weeks		[95% CI of	
		M	*(SD)*	*M*	*(SD)*	change]	*d-1*	*M*	*SD*	change]	*d-3*
Insomnia	Internet	23.72	(3.29)	18.86	(4.54)	[-5.42, -4.09]	-1.44***	17.78	(4.56)	[-6.50, -5.00]	-1.75***
SLEEP-50	Bibliotherapy	23.52	(3.39)	18.99	(5.02)	[-5.19, -3.79]	-1.32***	18.83	(4.82)	[-5.12, -3.51]	-1.27***
	Waiting-list	23.78	(3.22)	22.24	(3.99)	[-2.02, -1.00]	-0.47***	19.31	(4.83)	[-5.26, -3.30]	-1.33***
Insomnia impact	Internet	16.09	(3.94)	12.53	(3.88)	[-3.94, -2.84]	-0.86***	11.53	(4.02)	[-4.85, -3.50]	-1.06***
SLEEP-50	Bibliotherapy	16.07	(3.88)	12.75	(4.15)	[-3.68, -2.66]	-0.82***	12.33	(3.96)	[-3.83, -2.62]	-0.83***
	Waiting-list	15.80	(3.61)	14.58	(3.80)	[-1.58, -0.72]	-0.32***	12.29	(3.59)	[-3.54, -2.29]	-0.81***
Sleep rating	Internet	4.23	(1.09)	5.78	(1.22)	[1.31, 1.71]	1.39***	5.92	(1.24)	[1.44, 1.83]	1.50***
(1-10)	Bibliotherapy	4.32	(1.06)	5.60	(1.25)	[1.09, 1.47]	1.21***	5.74	(1.19)	[1.11, 1.56]	1.26***
SLEEP-50	Waiting-list	4.35	(1.13)	4.88	(1.17)	[0.37, 0.71]	0.48***	5.61	(1.04)	[0.96, 1.38]	1.04***
Depression	Internet	14.29	(6.47)	10.67	(7.08)	[-4.50, -2.62]	-0.55***	9.03	(7.13)	[-6.23, -3.18]	-0.73***
CES-D	Bibliotherapy	13.85	(6.24)	9.81	(6.78)	[-4.83, -2.89]	-0.62***	10.50	(6.99)	[-4.43, -2.14]	-0.53***
	Waiting-list	13.12	(6.26)	11.81	(7.08)	[-2.14, -0.44]	-0.21ns	10.71	(7.42)	[-3.20, -0.62]	-0.31***
Anxiety	Internet	5.63	(3.19)	4.26	(2.84)	[-1.83, -1.00]	-0.44***	3.68	(2.72)	[-2.35, -1.38]	-0.59***
HADS	Bibliotherapy	5.37	(3.01)	4.06	(2.65)	[-1.71, -0.86]	-0.43***	4.11	(2.96)	[-1.70, -0.67]	-0.39***
	Waiting-list	5.46	(3.23)	5.28	(3.41)	[-0.54, 0.25]	-0.04**	4.17	(3.08)	[-1.65, -0.56]	-0.34**

Note. Significance levels were calculated using multilevel regression (see Supplemental Table S3 and S5 for analyses); * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; Cohen's *d* and confidence intervals are based on multiple imputation. Data belonging to 18-week follow-up can be found in Supplemental Tables S6 and S7.

Completion and usefulness of the modules

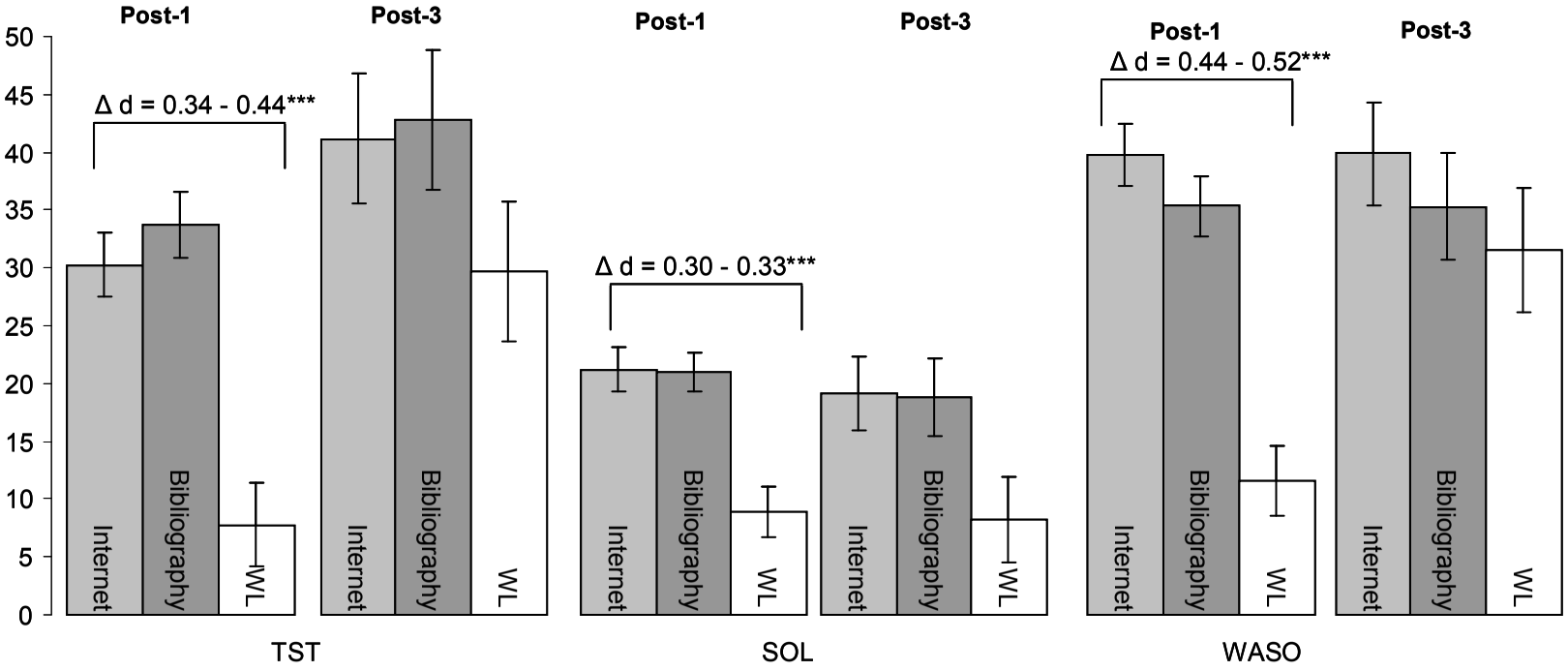
Modules were considered completed or useful if they were rated a four or a five (range = 1–5). In accordance to Dolan, Taylor, Bramoweth, & Rosenthal (2010), participants that completed at least half of the modules were considered to have received an adequate dose of insomnia CBT. No statistical differences in completion rated between the Internet and the bibliotherapy conditions were found ($p > .05$). In the Internet condition, 89 (54%) of the participants that filled out the post-test questionnaire adhered to the intervention; 27 (16.4%) participants completed all modules, 26 (15.8%) completed five, 36 (21.8%) completed four, 32 (19.4%) completed three, eight (4.8%) completed two, 18 (10.9%) completed one, and 18 (10.9%) completed none. They completed on average 3.43 (*SD* = 1.90) out of six modules and rated 4.34 (*SD* = 1.80) modules as useful.

In the bibliotherapy condition, 105 (60.1%) of the participants that filled out the questionnaire adhered to the intervention; 33 (18.9%) completed all modules, 29 (16.6%) completed five, 43 (24.6%) completed four, 30 (17.1%) completed three, 13 (7.4%) completed two, 11 (6.3%) completed one, and 16 (9.1%) completed none. They completed on average 3.67 (*SD* = 1.82) modules and rated 4.33 (*SD* = 1.80) modules useful. The sleep restriction and paradoxical intention modules had the lowest completion rates.

Effectiveness on sleep measures: Diary

Multilevel regression analyses revealed that both the Internet and the bibliotherapy condition improved significantly compared to the waiting-list condition at the 4-week follow-up ($p < .05$) on total sleep time ($\Delta d = 0.35–0.45$), sleep onset latency ($\Delta d = 0.29–0.30$), number of nocturnal awakenings ($\Delta d = 0.20–0.29$), wake after sleep onset ($\Delta d = 0.52–0.54$), sleep efficiency ($\Delta d = 0.61–0.64$), and day rating ($\Delta d = 0.40–0.43$; Figure 2; Table 3; Table 5). No significant differences were found between the Internet and bibliotherapy conditions ($p > .05$). Initial effects of Internet and bibliotherapy conditions were sustained at 18- and 48-week follow-up (Table 3; Figure 2). A drop was observed in the waiting-list condition after receiving the intervention following 4-week follow-up. In the supplemental material, the regression analyses for the full study (Table S2 and Table S4) and the mean scores of the 18-week follow-up can be found (Table S6 and Table S7).

Figure 2 - Increase for total sleep time (TST) and decrease for sleep onset latency (SOL) and wake after sleep onset (WASO) in minutes with 95% confidence intervals at 4 (post-1) and 48- week (post-3) follow-up



Note. *** = $p < .001$.

Effectiveness on global insomnia symptoms, depression, and anxiety

Multilevel regression analyses revealed that at 4-week follow-up, insomnia (Δd = 0.90–1.00; $p < .001$), insomnia impact (Δd = 0.54–0.59; $p < .001$), sleep rating (Δd = 0.68–0.88; $p < .001$) anxiety (Δd = 0.33–0.40; $p < .001$), and depression outcomes (Δd = 0.36–0.41; $p < .001$) improved significantly in both the Internet and the bibliotherapy condition compared to the waiting-list condition (Table 4; Table 5). Again, no significant differences were found between the Internet and the bibliotherapy condition at 4-week follow-up ($p > .05$).

Initial effects of Internet and bibliotherapy conditions were sustained at 48-week follow-up (Table 4). Moreover, the Internet condition now ameliorated insomnia ratings (Δd = 0.38–0.45; $p < .01$), insomnia impact (Δd = 0.21–0.28; $p < .05$), sleep rating (Δd = 0.24–0.38; $p < .05$), anxiety (Δd = 0.22; $p < .05$), and depression outcomes (Δd = 0.30–0.45; $p < .05$) compared to the bibliotherapy and waiting-list conditions. The regression analyses of the full study (Table S3 and Table S5) and the mean scores of 18-week follow-up can be found in the supplemental material (Table S6 and Table S7).

Table 5 - *Changes between conditions in Cohen's d for diary and questionnaire variables*

	Diary variables					
	TST	SOL	WASO	NWAK	SE	Day rating
4-week follow up						
Internet X bibl.	0.07^{ns}	0.03^{ns}	0.00^{ns}	-0.09^{ns}	-0.02^{ns}	-0.06^{ns}
Internet X WL	-0.35^{***}	0.30^{**}	0.54^{***}	0.20^{*}	-0.64^{***}	-0.40^{**}
Bibl. X WL	-0.45^{***}	0.29^{**}	0.52^{***}	0.29^{**}	-0.61^{***}	-0.43^{***}
48-week follow-up						
Internet X bibl.	-0.04^{ns}	0.02^{ns}	-0.11^{ns}	0.06^{ns}	-0.12^{ns}	-0.09^{ns}
Internet X WL	-0.11^{ns}	0.22^{*}	-0.07^{ns}	0.12^{ns}	-0.22^{ns}	-0.21^{*}
Bibl. X WL	-0.07^{ns}	0.22^{ns}	0.18^{ns}	0.06^{ns}	-0.09^{ns}	-0.13^{ns}

Continued

Note. Bibl. = Bibliotherapy; NWAK = Number of nocturnal awakenings; SOL = Sleep onset latency; TST = Total sleeping time; WL = Waiting-list; WASO = Wake after sleep onset. Cohen's *d* effect sizes are based on the imputed sample and significance levels are based on multilevel regression (Supplemental Table S2, S3, S4, and S5). * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = Not significant.

Table 5 - *Continued*

	Questionnaire variables				
	Insomnia	Sleep impact	Sleep rating	DEP	ANX
4-week follow up					
Internet X bibl.	0.08^{ns}	0.06^{ns}	-0.22^{ns}	-0.05^{ns}	0.04^{ns}
Internet X WL	1.00^{***}	0.59^{***}	-0.88^{***}	0.36^{***}	0.40^{***}
Bibl. X WL	0.90^{***}	0.54^{***}	-0.68^{***}	0.41^{***}	0.33^{***}
48-week follow-up					
Internet X bibl.	0.38^{**}	0.21^{*}	-0.24^{*}	0.30^{*}	0.22^{*}
Internet X WL	0.45^{*}	0.28^{**}	-0.38^{**}	0.45^{***}	0.21^{ns}
Bibl. X WL	0.07^{ns}	0.06^{ns}	-0.15^{ns}	0.15^{ns}	-0.01^{ns}

Note. ANX = Anxiety; DEP = Depression; Bibl. = Bibliotherapy; WL = Waiting-list. Cohen's *d* effect sizes are based on the imputed sample and significance levels are based on multilevel regression (Supplemental Table S2, S3, S4, and S5). * = $p < .05$; ** = $p < .01$; *** = $p < .001$. ns = Not significant.

Medication use

The number of days that participants used prescribed sleep medicine in a week decreased at 4-week follow-up for the Internet ($M = 3.15$ and $SD = 2.30$ to $M = 2.37$ and $SD = 2.14$) and the bibliotherapy condition ($M = 3.16$ and $SD = 2.08$ to $M = 2.37$ and $SD = 2.13$), but not for the waiting-list condition ($M = 3.52$ and $SD = 2.48$ to $M = 3.79$ and $SD = 2.28$). Compared to waiting-list, this difference approached significance, for Internet: $b = -0.23$, $SE = 0.14$, $p = .09$; and for bibliotherapy: $b = -0.22$, $SE = 0.14$, $p = .11$. No differences were found between conditions (including waiting-list) in the number of participants who discontinued their prescribed and over-the-counter sleep medication use at 4-week follow-up (Table 6). At 48-week follow-up the decrease in prescribed sleep medication was sustained for the Internet ($M = 2.22$; $SD = 2.00$) and the bibliotherapy condition ($M = 2.52$; $SD = 2.09$). In the waiting-list condition, we also observed a decrease at 48-week follow-up ($M = 2.67$; $SD = 1.80$).

Table 6 - *Baseline, 4-week, and 48-week follow-up percentages on sleep medication use in diary*

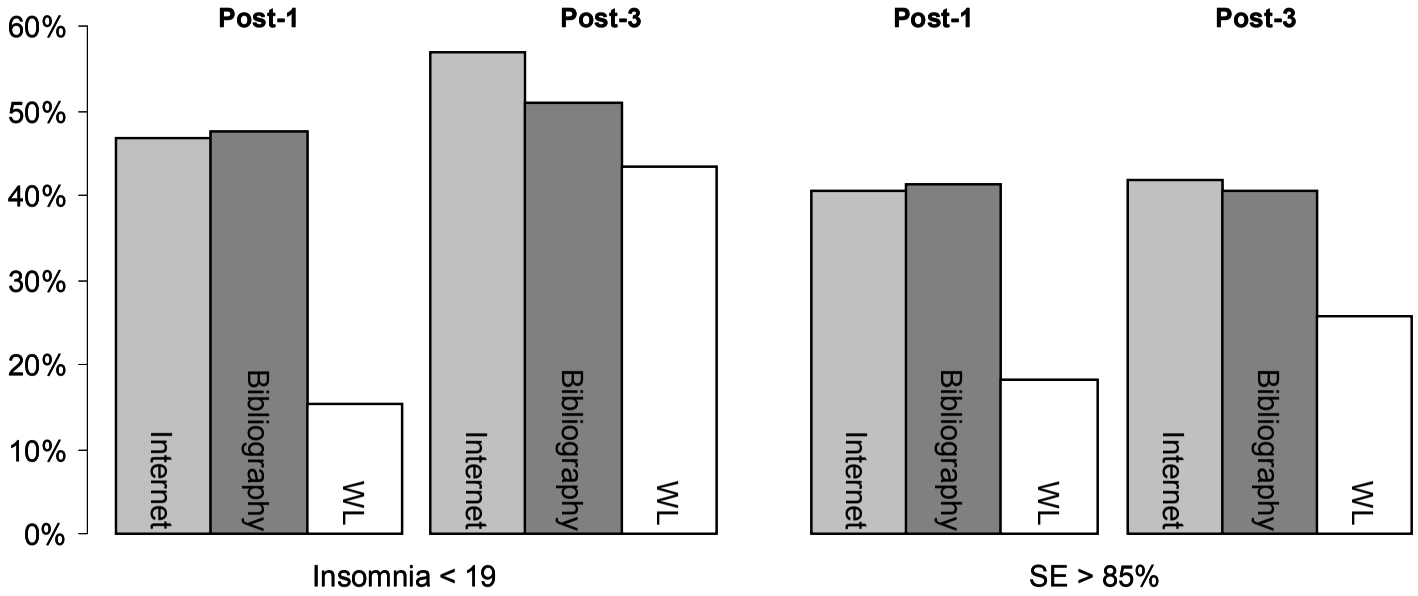
		Pre		4 weeks		48 weeks	
		n	*%*	*n*	*%*	*n*	*%*
Prescribed sleep medication	Internet	66	31.9	30	23.3	22	22.2
	Bibliotherapy	56	28.3	30	22.7	23	21.3
	Waiting-list	61	32.3	39	24.4	15	20.8
Over the counter / Melatonin	Internet	34	16.4	19	14.7	12	12.1
	Bibliotherapy	32	16.2	15	11.4	11	10.2
	Waiting-list	29	15.3	20	12.5	7	9.7
None	Internet	116	56.0	81	62.8	65	65.7
	Bibliotherapy	115	58.1	88	66.7	74	68.5
	Waiting-list	103	54.5	104	65.0	50	69.4

Note. Some participants had more than one type of sleep medication. Twenty-four scores were missing from the pre-test; eight from the 4-week follow-up. Sleep medication had no influence on dropout $F(2, 612) = .28$; $p = .87$.

Clinical changes

Of the participants that responded to the 4-week follow-up diary, a sleep efficiency of > 85% was found in 53 (40.5%) of the participants in the Internet, 57 (41.3%) in the bibliotherapy, and 29 (18.1%) in the waiting-list condition (see Figure 3). At post-1, participants in the Internet condition were 3.07 (CI: 1.80, 5.23) times more likely than those on the waiting-list to have a sleep efficiency > 85%. For bibliotherapy this was 3.18 (CI: 1.88, 5.38). Of the participants that responded to the 4-week follow-up questionnaire, a score below the cutoff for insomnia (SLEEP-50 < 19) was found in 78 (46.7%) of the participants in the Internet, 84 (47.5%) in the bibliotherapy, and 28 (15.4%) in the waiting-list condition. The odds of dropping below cutoff compared to the waiting-list condition were 4.82 (CI: 2.91, 7.98) for the Internet and 4.97 (CI: 3.02, 8.18) for the bibliotherapy condition. Clinical changes were sustained at 48-week follow-up for Internet and bibliotherapy conditions (Figure 3).

Figure 3 - Sleep efficiency (SE) and insomnia scores reaching cutoff at 4 (post-1) and 48-week (post-3) follow-up



Discussion

In this large-scale insomnia RCT, we observed that self-help CBT improved global insomnia symptoms *and* daily sleep measures four and 48 weeks after intervention. This is the first large-scale self-help study that proved that self-help CBT is effective compared to a waiting-list condition on critical sleep measures such as total sleep time, sleep onset latency, and wake after sleep onset. The improvement was clinically meaningful compared to the waiting-list: The odds of reaching cutoff scores for sleep efficiency (*OR*: 3.07–3.18) and insomnia (*OR*: 4.82–4.97) were far more favorable for the two self-help formats. Daily measures of sleep also improved in the waiting-list condition, but Internet and bibliotherapy improved more on variables such as total sleep time (22–26 min), sleep onset latency (13 min), wake after sleep onset (22–25 min), and sleep efficiency (7%). After four weeks, there were no differences in effectiveness between the two self-help formats. The effects of Internet and bibliotherapy were still present after 48 weeks.

The observed effects were almost similar to those of several face-to-face intervention studies (e.g., Edinger, Wohlgemuth, Radtke, Marsh, & Quillian, 2001; Jacobs et al., 2004; Sivertsen et al., 2006), slightly smaller than the effect sizes found in meta-analyses (Murtagh & Greenwood, 1995; Smith et al., 2002), but higher than those of previous published moderate- to large-scale self-help studies (Morin et al., 2005; Ström et al., 2004; van Straten et al., 2009; Vincent & Lewycky, 2009). The current large-scale study found similar effect sizes for daily self-report measures of sleep compared to the smaller-scale ($N < 50$) self-help CBT studies (e.g., Mimeault & Morin, 1999; Ritterband et al., 2009), making the suspected publication bias an unlikely explanatory variable for the noted differences in effect sizes.

One possible explanation for the discrepancy between the current and the previous large-scale studies is that the present study included paradoxical intention in the self-help CBT; however, only 44.4% of the participants completed this module. A more probable explanation for the discrepancy may be that, in the current study, people with severe depression scores were excluded, while most other moderate- to large-scale studies included them (e.g., Morin et al., 2005; van Straten et al., 2009). Participants with high depression might be better off with a (self-help) protocol that combines depression and insomnia treatment and this complex group of patients may have functioned as a confounding factor that masked real treatment effects in patients with primary insomnia (or with mild depression).

Interestingly, even with the exclusion on high depression scores, self-help CBT also moderately improved symptoms of depression and anxiety compared to the waiting-list. Overall, the current results on anxiety and depression were similar to the effects found in the self-help meta-analysis (van Straten & Cuijpers, 2009). In the meta-analysis, however, the effects on depression were very heterogeneous: Some studies found no effects (Morin et al., 2005), whereas other studies found large effects (Mimeault & Morin, 1999).

Another observation is that these large effects were found with *unsupported* self-help CBT. This is surprising because it has been suggested that some rudimentary form of support is essential in self-help (Palmqvist, Carlbring, & Andersson, 2007; Spek et al., 2007). This could mean that patients with primary insomnia do not need support in order for self-help to succeed (with considerable lower costs involved). If this is the case, the very cost-effective unsupported format can be an interesting first option in a stepped care model. Another possibility is that adding support further enhances the effectiveness (Andersson, 2009; Spek et al., 2007; van Straten & Cuijpers, 2009); it might encourage patients to complete the possible most intrusive modules of sleep restriction and paradoxical intention. In this study we refrained from employing support, in order to obtain a 'clearer' comparison between the delivery methods.

As mentioned above, Internet-delivered self-help and bibliotherapy were equally effective at 4-week follow-up, with no significant differences on any of the primary or secondary variables. The only difference was that the Internet condition had a lower response rate on the questionnaire compared to bibliotherapy (77.7% versus 87.3%). This may indicate lower treatment adherence. A post-test directly after treatment might have given more specific information about these response rates. However, the post-test was four weeks after the intervention to ensure self-help CBT had its full effect; because self-help studies are vulnerable to dropout we did not want two post-tests in such a short time interval. If adherence is indeed lower in the Internet condition it might be that that participants do not like to read from their computer screens and that a physical booklet encourages greater commitment. The fact that the Internet condition yielded more questions from participants may indicate that this condition was more ambiguous; however, more probable is that the threshold to e-mail is lower if participants are already online.

The effects of the Internet and the bibliotherapy condition were maintained after 48 weeks on daily sleep measures, insomnia symptomatology, and secondary complaints. In the waiting-list condition, we also observed a drop in insomnia symptoms and sleep

measures at 48-week follow-up. However, the effects were slightly smaller and dropout was much higher in the waiting-list condition, which may be owing to a possible lower involvement in the waiting-list. To our surprise, at the 48-week follow-up, insomnia symptomatology and secondary complaints decreased more in the Internet compared to the bibliotherapy condition. This difference may be attributed to the lower rate of questionnaires completed and the fact that depression predicted dropout at 48-week follow-up for the Internet condition. However, correcting for this influence with multilevel and multiple imputation intention-to-treat procedures did not yield different outcomes. Alternatively, participants in the Internet condition may find it easier to re-read their interventions (as opposed to the paper-and-pencil format, which could become misplaced).

Advantages of Internet-delivered treatment are high accessibility and the possibility of tailoring the treatment to individual needs (Wantland et al., 2004). We were interested in comparing self-help formats and therefore did not use individual tailoring, but doing so may reduce the higher dropout rate in the Internet condition. With equal dropout, the Internet may constitute a preferable method because of its cost-effectiveness and greater long-term effectiveness on global insomnia symptoms, depression, and anxiety.

A limitation to waiting-list control designs is that one cannot state conclusively that the observed effects are due to the specific treatment rather than to other non-specific factors. Moreover, the external validity of this study is limited because the participants were self-selected to a large extent via the Internet and because high scorers on depression were excluded. As we argued above, unsupported self-help CBT might fall short for people with a co-morbid major depression but seems to be effective for patients with primary insomnia and maximal mild depression. In addition, self-help CBT for insomnia could be successful in the prevention of depression, as insomnia is a risk factor to develop a major depression (Taylor, Lichstein, & Durrence, 2003). Moreover, including cost-effectiveness and treatment satisfaction measures would provide further insight to self-help CBT for insomnia. In a stepped care model, unsupported self-help for insomnia appears to be a promising first option.

References

American Psychiatric Association. (2000). *Diagnostic and Statistic Manual of Mental Disorders* (4th ed., text rev.). Washington DC: Author.

Ancoli-Israel, S., & Roth, T. (1999). Characteristics of insomnia in the United States: Results of the 1991 National Sleep Foundation Survey I. *Sleep, 22 (Suppl. 2)*, 347-353.

Andersson, G. (2009). Using the internet to provide cognitive behaviour therapy. *Behavior Research and Therapy, 47*, 175-180. doi: 10.1016/j.brat.2009.01.010

Benca, R. M. (2005). Diagnoses and treatment of chronic insomnia: A review. *Psychiatric Services, 56*, 332-343. doi: 10.1176/appi.ps.56.3.332

Bouma, J., Ranchor, A. V., Sanderman, R., & van Sonderen, E. (1995). *Het meten van symptomen van depressie met de CES-D: Een handleiding [Dutch translation of the Epidemiological Studies-Depression scale]*. Groningen: Noordelijk Centrum voor Gezondheidsvraagstukken.

Buysse, D. J., Ancoli-Israel, S., Edinger, J. D., Lichstein, K. L., & Morin, C. M. (2006). Recommendations for a standard research assessment of insomnia. *Sleep, 29*(9), 1155-1173.

Cuijpers, P., van Straten, A., & Andersson, G. (2008). Internet-administered cognitive behavior therapy for health problems: A systematic review. *Journal of Behavioral Medicine, 31*, 169-177. doi: 10.1007/s10865-007-9144-1

Dolan, D. C., Taylor, D. J., Bramoweth, A. D., & Rosenthal, L. D. (2010). Cognitive-behavioral therapy of insomnia: A clinical case series study of patients with co-morbid disorders and using hypnotic medications. *Behaviour Research and Therapy, 48*, 321-327. doi: 10.1016/j.brat.2009.12.004

Edinger, J. D., Wohlgemuth, W. K., Radtke, R. A., Marsh, G. R., & Quillian, R. E. (2001). Cognitive behavioral therapy for treatment of chronic primary insomnia: A randomized controlled trial. *Journal of the American Medical Association, 285,* 1856-1864. doi: 10.1001/jama.285.14.1856

Espie, C. A. (2009). "Stepped Care": A health technology solution for delivering cognitive behavioral therapy as a first line insomnia treatment. *Sleep, 32*(12), 1549-1558.

Fanner, D., & Urquhart, C. (2008). Bibliotherapy for mental health service users part 1: A systematic review. *Health Information and Libraries Journal, 25*, 237-252. doi: 10.1111/j.1471-1842.2008.00821.x

Ford, D.E., & Kamerow, D.B. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *Journal of the American Medical Association*, *262*, 1479-1484. doi: 10.1007/BF01001167

Furmark, T., Carlbring, P., Hedman, E., Sonnenstein, A., Clevberger, P., Bohman, B., et al. (2009). Guided and unguided self-help for social anxiety disorder: Randomised controlled trial. *British Journal of Psychiatry, 195*, 440-447. doi: 10.1192/bjp.bp.108.060996

Hox, J. J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah: Lawrence Erlbaum Associates.

Irwin, M. R., Cole, J. C., & Nicassio, P. M. (2006). Comparative meta-analysis of behavioral interventions for insomnia and their efficacy in middle-aged adults and in older adults 55+ years of age. *Health Psychology, 25*, 3-14. doi: 10.1037/0278-6133.25.1.3

Jacobs, G. D., Pace-Schott, E. F., Stickgold, R., & Otto, M. W. (2004). Cognitive behavior therapy and pharmacotherapy for insomnia: A randomized controlled trial and

direct comparison. *Archives of Internal Medicine, 164*, 1888-1896. doi: 10.1001/archinte.164.17.1888

Klein, B., Richards, J. C., & Austin, D. W. (2006). Efficacy of internet therapy for panic disorder. *Journal of Behavioural Therapy and Experimental Psychiatry, 37*, 213-238. doi: 10.1016/j.jbtep.2005.07.001

LeBlanc, M., Beaulieu-Bonneau, S., Merette, C., Savard, J., Ivers, H., & Morin, C. M. (2007). Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *Journal of Psychosomatic Research, 63*, 157-166. doi: 10.1016/j.jpsychores.2007.03.004

Marshall, A. L., Leslie, E. R., Bauman, A. E., Marcus, B. H., & Owen, N. (2003). Print versus website physical activity programs: A randomized trial. *American Journal of Preventive Medicine, 25*(2), 88-94.

Mellinger, G. D., Balter, M. D., & Ulenhuth, E. H. (1985). Insomnia and its treatment: Prevalence and correlates. *Archives of General Psychiatry, 42*(3), 225-232.

Mimeault, V., & Morin, C. M. (1999). Self-help treatment for insomnia: Bibliotherapy with and without professional guidance. *Journal of Consulting and Clinical Psychology, 67*(4), 511-519.

Morin, C. M., Beaulieu-Bonneau, S., LeBlanc, M., & Savard, J. (2005). Self-help treatment for insomnia: A randomized controlled trial. *Sleep, 28*(10), 1319-1327.

Morin, C. M., Bootzin, R. R., Buysse, D. J., Edinger, J. D., Espie, C. A., & Lichstein, K. L. (2006). Psychological and behavioral treatment of insomnia: Update of the recent evidence (1998-2004). *Sleep, 29*(11), 1398-1414.

Morin, C. M., Colecchi, C., Stone, J., Sood, R., & Brink, D. (1999). Behavioral and pharmacological therapies for late-life insomnia: A randomized controlled trial. *Journal of American Medical Association, 281*, 991-999. doi: 10.1001/jama.281.11.991

Morin, C. M., & Espie, C. A. (2003). *Insomnia. A clinical guide to assessment and treatment*. New York: Springer.

Morin, C. M., Hauri, P. J., Espie, C. A., Spielman, A. J., Buysse, D. J., & Bootzin, R. R. (1999). Nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine Review. *Sleep, 22*(8), 1-23.

Morin, C. M., LeBlanc, M., Daley, M., Gregoire, J. P., & Merette, C. (2006). Epidemiology of insomnia: Prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep Medicine, 7*, 123-130. doi: 10.1016/j.sleep.2005.08.008

Morris, S. B. (2008). Estimating effect sizes from pretest-posttest-control group designs. *Organizational Research Methods, 11*, 364-386. doi: 10.1177/1094428106291059

Moul, D. E., Hall, M., Pilkonis, P. A., & Buysse, D. J. (2004). Self-report measures of insomnia in adults: Rationales, choices, and needs. *Sleep Medicine Reviews, 8*, 177-198. doi: 10.1016/S1087-0792(03)00060-1

Murtagh, D., & Greenwood, K. (1995). Identifying effective psychological treatments for insomnia: A meta analysis. *Journal of Consulting and Clinical Psychology, 63*(1), 79-89.

Palmqvist, B., Carlbring, P., & Andersson, G. (2007). Internet-delivered treatments with or without therapist input: Does the therapist factor have implications for efficacy and cost? *Expert Review of Pharmacoeconomics & Outcomes Research, 7*, 291-297. doi: 10.1586/14737167.7.3.291

Radloff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385-401. doi: 10.1177/014662167700100306

Ritterband, L. M., Thorndike, F. P., Gonder-Frederick, L. A., Magree, J. C., Bailey, E. T., Saylor, D. K., et al. (2009). Efficacy of an internet-based behavioral intervention for adults with insomnia. *Archives of General Psychiatry, 66*, 692-698. doi: 10.1001/archgenpsychiatry.2009.66

Roth, T., & Drake, C. (2004). Evolution of insomnia: Current status and future direction. *Sleep Medicine, 5 (Suppl. 1)*, S23-30. doi: 10.1016/S1389-9457(04)90004-4

Sateia, M. J., Doghramji, K., Hauri, P. J., & Morin, C. M. (2000). Evaluation of chronic insomnia. An American Academy of Sleep Medicine review. *Sleep, 23*(2), 243-308.

Simon, G. E., & Vonkorff, M. (1997). Prevalence, burden, and treatment of insomnia in primary care. *American Journal of Psychiatry, 154*(10), 1417-1423.

Sivertsen, B., Omvik, S., Pallesen, S., Bjorvatn, B., Havik, O. E., Kvale, G., et al. (2006). Cognitive behavioral therapy vs zopiclone for treatment of chronic primary insomnia in older adults: A randomized controlled trial. *Journal of the American Medical Association, 295*, 2851-2858. doi: 10.1001/jama.295.24.2851

Smith, T. S., Perlis, M. L., Park, A., Smith, M. S., Pennington, J. Y., Giles, D. E., et al. (2002). Comparative meta-analysis of pharmacotherapy and behavior therapy for persistent insomnia. *American Journal of Psychiatry, 159*(1), 5-11.

Spek, V., Cuijpers, P., Nylklicek, I., Riper, H., Keyzer, J., & Pop, V. (2007). Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta analysis. *Psychological Medicine, 37*, 319-328. doi: 10.1017/S0033291706008944

Spinhoven, P., Ormel, J., Sloekers, P. P., Kempen, G. I., Speckens, A. E., & Van Hemert, A. M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychological Medicine, 27*(2), 363-370.

Spoormaker, V. I., Verbeek, I., van den Bout, J., & Klip, E. C. (2005). Initial validation of the SLEEP-50 questionnaire. *Behavioral Sleep Medicine, 3*, 227-246. doi: 10.1207/s15402010bsm0304_4

Statistics Netherlands. (2009). *Statistical yearbook 2009*. The Hague: Statistics Netherlands. Retrieved from http://cbs.nl

Sterne, J. A., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., et al. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potentials and pitfalls. *British Medical Journal, 338,* b2393. doi: 10.1136/bmj.b2393

Ström, L., Pettersson, & Andersson, G. (2004). Internet-based treatment for insomnia: A controlled evaluation. *Journal of Consulting and Clinical Psychology, 72*, 113-120. doi: 10.1037/0022-006X.72.1.113

Taylor, D. J., Lichstein, K. L., & Durrence, H. H. (2003). Insomnia as a health risk factor. *Behavioral Sleep Medicine, 1*, 227-247. doi: 10.1207/S15402010BSM0104_5

Taylor, D. J., Lichstein, K. L., Durrence, H. H., Reidel, B. W., & Bush, A. J. (2005). Epidemiology of insomnia, depression and anxiety. *Sleep, 28*(11), 1457-1464.

Van Straten, A., & Cuijpers, P. (2009). Self-help therapy for insomnia: A meta-analysis. *Sleep Medicine Reviews, 13*, 61-71. doi: 10.1016/j.smrv.2008.04.006

Van Straten, A., Cuijpers, P., Smit, F., Spermon, M., & Verbeek, I. (2009). Self-help treatment for insomnia through television and book: A randomized trial. *Patient Education and Counseling, 74*, 29-34. doi: 10.1016/j.pec.2008.07.050

Vincent, N., & Lewycky, S. (2009). Logging on for better sleep: RCT on the effectiveness of online treatment for insomnia. *Sleep, 32*(6), 807-815.

Wantland, D. J., Portillo, C. J., Holzemer, W. L., Slaughter, R., & McGhee, E. M. (2004). The effectiveness of web-based vs. non-web-based interventions: A meta analysis

of behavioral change outcomes. *Journal of Medical Internet Research, 6*, e40. doi: 10.2196/jmir.6.4.e40

Womble, L. G., Wadden, T. A., McGuckin, B. G., Sargent, S. L., Rothman, R. A., & Krauthamer-Ewing, E. S. (2004). A randomized controlled trial of a commercial weight loss program. *Obesity Research, 12*, 1011-1018. doi: 10.1038/oby.2004.124

Supplemental information – Chapter 7

Supplemental Table S1- *Questions for the exclusion on alcohol, marihuana, schizophrenia/psychosis, and suicidal ideation*

• Alcohol
Do you drink alcohol?
If yes: How many days of the month do you drink three or more glasses containing alcohol?
• Marihuana
Do you smoke marihuana/hashish?
If yes: How often do you smoke marihuana/hashish?
• Schizophrenia
Do you currently have schizophrenia or a psychosis?
• Suicidal ideation
In the last few days have you thought about committing suicide?
If yes: Have you planned specific steps to commit suicide?

Supplemental Table S2 - *Multilevel regression analyses effects for time, condition, and time * condition on the diary variables*

	TST		TIB		SOL		NWAK		WASO		SE		Day rating	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
Internet														
Constant	365.23	(4.17)***	497.56	(3.19)***	51.33	(2.62)***	2.40	(0.05)***	81.02	(3.21)***	73.68	(0.75)***	6.47	(0.06)***
Time	8.73	(1.35)***	-8.86	(1.01)***	-6.28	(0.85)***	-0.13	(0.03)***	-11.40	(1.17)***	3.11	(0.26)***	0.13	(0.02)***
NWAK baseline	-		3.13	(1.24)*	-3.12	(0.99)**	0.88	(0.02)***	6.41	(1.22)***	-		-	
Bibl.	0.33	(6.09)^{ns}	-0.00	(4.65)^{ns}	1.20	(3.75)^{ns}	0.02	(0.08)^{ns}	-1.30	(4.70)^{ns}	0.17	(1.09)^{ns}	0.08	(0.09)^{ns}
WL	3.28	(6.13)^{ns}	1.72	(4.68)^{ns}	-0.85	(3.77)^{ns}	0.03	(0.08)^{ns}	-0.53	(4.73)^{ns}	0.34	(1.10)^{ns}	0.05	(0.10)^{ns}
Bibl. * time	1.85	(1.91)^{ns}	2.09	(1.43)^{ns}	-0.24	(1.20)^{ns}	-0.02	(0.04)^{ns}	0.43	(1.65)^{ns}	0.06	(0.36)^{ns}	0.02	(0.03)^{ns}
WL * time	-6.05	(1.87)***	4.68	(1.41)***	3.20	(1.17)**	0.08	(0.03)*	7.80	(1.62)***	-1.90	(0.35)***	-0.10	(0.03)**
Bibliotherapy														
Constant	365.61	(4.23)***	497.64	(3.24)***	52.50	(2.60)***	2.41	(0.05)***	79.76	(3.24)***	73.85	(0.78)***	6.55	(0.07)***
Time	10.62	(1.35)***	-6.74	(1.01)***	-6.51	(0.85)***	-0.15	(0.03)***	-10.99	(1.17)***	3.17	(0.25)***	0.15	(0.02)***
WL	2.99	(6.19)^{ns}	1.74	(4.73)^{ns}	-2.03	(3.80)^{ns}	0.01	(0.08)^{ns}	0.75	(4.78)^{ns}	0.17	(1.11)^{ns}	-0.03	(0.10)^{ns}
WL * time	-7.94	(1.87)***	2.56	(1.40)^{ns}	-3.43	(1.17)**	0.10	(0.04)**	7.38	(1.62)***	-1.97	(0.35)***	-0.12	(0.03)***
WL														
Constant	368.18	(4.26)***	499.46	(3.26)***	50.61	(2.62)***	2.43	(0.05)***	80.87	(3.26)***	73.93	(0.76)***	6.51	(0.07)***
Time	2.73	(1.29)*	-4.16	(0.97)***	-3.08	(0.81)***	-0.05	(0.03)^{ns}	-3.63	(1.12)**	1.21	(0.24)***	0.03	(0.02)^{ns}

Note. The non-standardized regression coefficients are indicative of the relative change over one month; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; Day rating = 1 – 10; NWAK = Number of nocturnal awakenings; Bibl. = Bibliotherapy; SE = Sleep efficiency; TST = Total sleep time (min); TIB = Time in Bed (min); SOL = Sleep onset latency (min); WASO = Wake after sleep onset; WL = Waiting-list.

Supplemental Table S3 - *Multilevel regression analyses effects for time, condition, and time* condition on the questionnaire variables*

	Insomnia		Insomnia impact		Sleep rating		Depression		Anxiety	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
Internet										
Constant	22.03	(0.26)***	14.86	(0.26)***	4.75	(0.08)***	12.89	(0.44)***	5.19	(0.20)***
Time	-1.44	(0.10)***	-1.02	(0.08)***	0.45	(0.03)***	-1.04	(0.15)***	-0.42	(0.07)***
Bibliotherapy	-0.16	(0.38)^{ns}	0.04	(0.38)^{ns}	0.07	(0.11)^{ns}	-0.38	(0.65)^{ns}	-0.25	(0.30)^{ns}
WL	0.16	(0.38)^{ns}	-0.23	(0.38)^{ns}	0.09	(0.11)^{ns}	-1.03	(0.65)^{ns}	-0.13	(0.30)^{ns}
Bibliotherapy * time	0.05	(0.14)^{ns}	0.01	(0.11)^{ns}	-0.06	(0.04)^{ns}	-0.16	(0.21)^{ns}	0.04	(0.09)^{ns}
WL * time	0.95	(0.14)***	0.66	(0.11)***	-0.29	(0.04)***	0.63	(0.21)***	0.35	(0.09)***
Bibliotherapy										
Constant	21.87	(0.26)***	14.90	(0.27)***	4.82	(0.08)***	12.50	(0.45)***	4.94	(0.21)***
Time	-1.39	(0.10)***	-1.01	(0.08)***	0.40	(0.03)***	-1.21	(0.15)***	-0.39	(0.07)***
WL	0.33	(0.39)^{ns}	-0.27	(0.39)^{ns}	0.03	(0.11)^{ns}	-0.64	(0.66)^{ns}	0.12	(0.31)^{ns}
WL * time	0.90	(0.14)***	0.65	(0.11)***	-0.23	(0.04)***	0.79	(0.21)***	0.31	(0.09)***
WL										
Constant	22.20	(0.26)***	14.63	(0.27)***	4.84	(0.08)***	11.86	(0.45)***	5.05	(0.21)***
Time	-0.49	(0.10)***	-0.36	(0.08)***	0.17	(0.03)***	-0.41	(0.14)**	-0.07	(0.06)^{ns}

Note. The non-standardized regression coefficients are indicative of the relative change over one month; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant; WL = Waiting-list.

Supplemental Table S4 - *Multilevel regression analyses effects for the full study on the diary variables*

	TST		SOL		WASO	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
Internet						
Constant	354.55	(4.33)***	59.08	(2.56)***	93.74	(3.21)***
Gender	-		-		-	
NWAK base	-		-2.85	(0.96)**	5.74	(1.16)***
Post-1	30.82	(4.29)***	-22.15	(2.48)***	-39.17	(3.56)***
Post-2	30.81	(4.55)***	-19.68	(2.63)***	-34.07	(3.78)***
Post-3	39.91	(4.77)***	-19.68	(2.75)***	-37.95	(3.95)***
Bibliotherapy	0.97	(6.18)^{ns}	0.79	(3.66)^{ns}	-1.60	(4.58)^{ns}
Bibl. X post-1	2.58	(6.00)^{ns}	1.30	(3.46)^{ns}	3.83	(4.99)^{ns}
Bibl. X post-2	-1.29	(6.33)^{ns}	3.11	(3.66)^{ns}	5.04	(5.26)^{ns}
Bibl. X post-3	-1.00	(6.64)^{ns}	1.07	(3.83)^{ns}	5.93	(5.51)^{ns}
WL	4.02	(6.22)^{ns}	-1.47	(3.69)^{ns}	-1.30	(4.61)^{ns}
WL X post-1	-23.11	(5.85)***	12.65	(3.38)***	28.18	(4.86)***
WL X post-2	-5.63	(6.95)^{ns}	7.35	(4.02)^{ns}	6.19	(5.77)^{ns}
WL X post-3	-8.03	(7.28)^{ns}	8.82	(4.20)*	5.18	(6.03)^{ns}
Bibliotherapy						
Constant	355.52	(4.41)***	59.87	(2.61)***	92.14	(3.27)***
Post-1	33.39	(4.20)***	-20.85	(2.42)***	35.34	(3.49)***
Post-2	29.52	(4.40)***	-16.57	(2.54)***	29.02	(3.66)***
Post-3	38.91	(4.62)***	-18.61	(2.67)***	32.03	(3.84)***
WL	3.06	(6.23)^{ns}	-2.25	(3.72)^{ns}	0.30	(4.66)^{ns}
WL X post-1	-25.69	(5.79)***	11.35	(3.34)***	24.35	(4.81)***
WL X post-2	-4.34	(6.85)^{ns}	4.24	(3.96)^{ns}	1.14	(5.69)^{ns}
WL X post-3	-7.02	(7.18)^{ns}	7.75	(4.15)^{ns}	0.74	(5.96)^{ns}
Waiting-list						
Constant	358.58	(4.77)***	57.62	(2.65)***	92.44	(3.32)***
Post-1	7.70	(3.98)*	-9.50	(2.30)***	-10.99	(3.31)***
Post-2	25.18	(5.25)***	-12.33	(3.04)***	-27.88	(4.36)***
Post-3	31.89	(5.50)***	-10.85	(3.17)***	-32.77	(4.55)***

Note. The non-standardized regression coefficients are indicative for the relative change between measurements; * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = Not significant; Bibl. = Bibliotherapy; Day rating = 1 – 10; NWAK = Number of nocturnal awakenings; SE = Sleep efficiency; TST = Total sleep time (min); TIB = Time in bed (min); SOL = Sleep onset latency (min); WASO = Wake after sleep onset; WL = Waiting-list.

Supplemental Table S4 - *Continued*

	NWAK		SE		Day rating	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
Internet						
Constant	2.60	(0.05)***	70.05	(0.77)***	6.31	(0.07)***
Gender	-		-		-	
NWAK base	0.83	(0.02)***	-		-	
Post-1	-0.47	(0.09)***	10.82	(0.78)***	0.47	(0.08)***
Post-2	-0.48	(0.08)***	9.71	(0.83)***	0.50	(0.08)***
Post-3	-0.60	(0.08)***	10.61	(0.87)***	0.47	(0.08)***
Bibliotherapy	0.01	(0.07)^{ns}	0.34	(1.09)^{ns}	0.10	(0.09)^{ns}
Bibl. X post-1	-0.03	(0.12)^{ns}	-0.72	(1.09)^{ns}	-0.02	(0.11)^{ns}
Bibl. X post-2	0.05	(0.11)^{ns}	-1.46	(1.15)^{ns}	-0.16	(0.11)^{ns}
Bibl. X post-3	-0.01	(0.11)^{ns}	-1.19	(1.21)^{ns}	-0.15	(0.12)^{ns}
WL	0.00	(0.07)^{ns}	0.55	(1.10)^{ns}	0.07	(0.10)^{ns}
WL X post-1	0.28	(0.12)*	-7.14	(1.06)***	-0.39	(0.10)***
WL X post-2	0.00	(0.12)^{ns}	-2.22	(1.26)^{ns}	-0.18	(0.12)^{ns}
WL X Post-3	0.15	(0.12)^{ns}	-2.09	(1.32)^{ns}	-0.27	(0.13)*
Bibliotherapy						
Constant	2.61	(0.05)***	70.39	(0.78)***	6.41	(0.07)***
Post-1	-0.49	(0.08)***	10.11	(0.76)***	0.46	(0.07)***
Post-2	-0.43	(0.08)***	8.25	(0.80)***	0.34	(0.08)***
Post-3	-0.61	(0.08)***	9.42	(0.84)***	0.31	(0.08)***
WL	-0.01	(0.07)^{ns}	0.21	(1.11)^{ns}	-0.03	(0.10)^{ns}
WL X post-1	0.31	(0.12)**	-6.42	(1.05)***	-0.37	(0.10)***
WL X post-2	-0.05	(0.12)^{ns}	-0.76	(1.25)^{ns}	-0.02	(0.12)^{ns}
WL X Post-3	0.16	(0.12)^{ns}	-0.90	(1.30)^{ns}	-0.12	(0.13)^{ns}
Waiting-list						
Constant	2.60	(0.05)***	70.60	(0.79)***	6.38	(0.07)***
Post-1	-0.19	(0.08)*	3.69	(0.72)***	0.08	(0.07)^{ns}
Post-2	-0.48	(0.09)***	7.49	(0.95)***	0.33	(0.09)***
Post-3	-0.45	(0.09)***	8.52	(1.00)***	0.19	(0.10)*

Note. The non-standardized regression coefficients are indicative for the relative change between measurements * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = Not significant; Bibl. = Bibliotherapy; Day rating = 1 – 10; NWAK = Number of nocturnal awakenings; SE = Sleep efficiency; TST = Total sleep time (min); TIB = Time in bed (min); SOL = Sleep onset latency (min); WASO = Wake after sleep onset; WL = Waiting-list.

Supplemental Table S5 - *Multilevel regression analyses effects for the full study on the questionnaire variables*

	Insomnia		Insomnia impact		Sleep rating	
	b	*(SE)*	*b*	*(SE)*	*b*	*(SE)*
Internet						
Constant	23.61	(0.22)***	15.88	(0.24)***	4.25	(0.08)***
Gender	-		-		-	
CES-D base	0.14	(0.02)***	0.27	(0.02)***	-0.02	(0.01)***
Post-1	-4.81	(0.32)***	-3.46	(0.25)***	1.52	(0.09)***
Post-2	-5.09	(0.36)***	-3.92	(0.27)***	1.50	(0.10)***
Post-3	-5.79	(0.39)***	-4.29	(0.29)***	1.61	(0.10)***
Bibliotherapy	-0.14	(0.31)ns	0.10	(0.35)ns	0.07	(0.11)ns
Bibl. X post-1	0.30	(0.45)ns	0.23	(0.35)ns	-0.24	(0.12)*
Bibl. X post-2	1.26	(0.50)*	0.69	(0.38)ns	-0.30	(0.14)*
Bibl. X post-3	1.45	(0.54)**	1.01	(0.40)*	-0.29	(0.14)*
WL	0.22	(0.31)ns	0.02	(0.35)ns	0.09	(0.11)ns
WL X post-1	3.32	(0.45)***	2.30	(0.35)***	-0.99	(0.12)***
WL X post-2	1.32	(0.52)*	1.46	(0.40)***	-0.36	(0.14)*
WL X post-3	1.39	(0.58)*	1.38	(0.44)**	-0.41	(0.15)**
Bibliotherapy						
Constant	23.47	(0.22)***	16.03	(0.24)***	4.32	(0.08)***
Post-1	-4.51	(0.32)***	-3.34	(0.18)***	1.28	(0.09)***
Post-2	-3.83	(0.35)***	-3.28	(0.25)***	1.19	(0.09)***
Post-3	-4.34	(0.37)***	-3.34	(0.26)***	1.32	(0.10)***
WL	0.36	(0.32)ns	-0.13	(0.34)ns	0.02	(0.12)ns
WL X post-1	3.02	(0.45)***	2.18	(0.30)***	-0.75	(0.12)***
WL X post-2	0.06	(0.51)ns	0.83	(0.38)*	-0.05	(0.14)ns
WL X post-3	-0.06	(0.56)ns	0.43	(0.42)ns	-0.12	(0.15)ns
Waiting-list						
Constant	23.83	(0.23)***	15.90	(0.25)***	4.34	(0.08)***
Post-1	-1.49	(0.31)***	-1.16	(0.24)***	0.53	(0.09)***
Post-2	-3.76	(0.37)***	-2.45	(0.29)***	1.14	(0.10)***
Post-3	-4.40	(0.43)***	-2.91	(0.32)***	1.20	(0.11)***

Note. The non-standardized regression coefficients are indicative for the relative change between measurements. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant. Bibl. = Bibliotherapy; WL = Waiting-list.

Supplemental Table S5 - *Continued*

	Depression		Anxiety	
	b	*(SE)*	*b*	*(SE)*
Internet				
Constant	13.70	(0.33)***	5.46	(0.18)***
Gender	-		-	
CES-D base	0.75	(0.02)***	0.22	(0.01)***
Post-1	-3.61	(0.47)***	-1.40	(0.21)***
Post-2	-4.27	(0.49)***	-1.59	(0.23)***
Post-3	-4.60	(0.52)***	-1.80	(0.25)***
Bibliotherapy	-0.11	(0.47)ns	-0.16	(0.26)ns
Bib. X post-1	-0.32	(0.66)ns	0.14	(0.30)ns
Bib. X post-2	0.56	(0.69)ns	0.63	(0.33)ns
Bib. X post-3	1.63	(0.72)*	0.72	(0.34)*
WL	-0.29	(0.47)ns	0.08	(0.26)ns
WL X post-1	2.40	(0.66)***	1.23	(0.30)***
WL X post-2	2.12	(0.71)**	0.45	(0.34)ns
WL X post-3	2.91	(0.78)***	0.71	(0.37)ns
Bibliotherapy				
Constant	13.59	(0.34)***	5.30	(0.19)***
Post-1	-3.93	(0.46)***	-1.26	(0.21)***
Post-2	-3.71	(0.48)***	-0.96	(0.23)***
Post-3	-2.97	(0.50)***	-1.07	(0.24)***
WL	-0.18	(0.48)ns	0.24	(0.27)ns
WL X post-1	2.72	(0.65)***	1.08	(0.29)***
WL X post-2	1.56	(0.71)*	-0.18	(0.33)ns
WL X post-3	1.28	(0.76)ns	-0.01	(0.36)ns
Waiting-list				
Constant	13.41	(0.34)***	5.54	(0.19)***
Post-1	-1.21	(0.46)**	-0.17	(0.21)ns
Post-2	-2.15	(0.52)***	-1.14	(0.24)***
Post-3	-1.69	(0.58)**	-1.09	(0.28)***

Note. The non-standardized regression coefficients are indicative for the relative change between measurements. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant.

Supplemental Table S6 - *Eighteen- week follow-up means for the primary and secondary measures with corresponding confidence intervals and Cohen's d*

Diary		18 week			
		M	*(SD)*	[95% CI of change]	*d*-2
Total sleep time (TST) in minutes	Internet	388.69	(56.35)	[22.76, 40.64]	0.48***
	Bibliotherapy	383.70	(67.17)	[19.76, 38.00]	0.48***
	Waiting-list	383.31	(64.55)	[13.12, 37.80]	0.43***
Sleep onset latency (SOL) in minutes	Internet	35.13	(25.11)	[-26.32, -15.82]	-0.46***
	Bibliotherapy	42.03	(34.24)	[-22.10, -12.14]	-0.41***
	Waiting-list	41.29	(32.36)	[-21.13, -8.94]	-0.38***
Number of nocturnal awakenings (NWAK)	Internet	2.29	(1.56)	[-0.56, -0.27]	-0.29***
	Bibliotherapy	2.13	(1.19)	[-0.70, -0.33]	-0.34***
	Waiting-list	2.04	(1.22)	[-0.65, -0.19]	-0.32***
Wake after sleep onset (WASO) in minutes	Internet	62.00	(38.37)	[-41.13, -26.61]	-0.66***
	Bibliotherapy	63.75	(47.11)	[-35.85, -19.59]	-0.52***
	Waiting-list	67.28	(44.44)	[-36.08, -18.52]	-0.60***
Sleep efficiency (SE) in percentage	Internet	80.13	(9.56)	[7.94, 11.10]	0.84***
	Bibliotherapy	78.48	(12.05)	[6.43, 9.81]	0.73***
	Waiting-list	77.92	(11.10)	[5.27, 9.58]	0.73***
Day rating (1-10)	Internet	6.87	(0.99)	[0.30, 0.68]	0.47***
	Bibliotherapy	6.78	(0.90)	[0.18, 0.47]	0.38***
Wake after sleep onset	Waiting-list	6.77	(0.88)	[0.18, 0.48]	0.35***
Questionnaire					
Insomnia SLEEP-50	Internet	18.56	(4.45)	[-5.75, -4.36]	-1.54***
	Bibliotherapy	19.26	(4.55)	[-4.68, -3.09]	-1.15***
	Waiting-list	19.87	(5.00)	[-4.39, -2.99]	-1.14***
Insomnia impact SLEEP-50	Internet	12.06	(3.92)	[-4.43, -3.18]	-0.96***
	Bibliotherapy	12.47	(4.05)	[-3.84, -2.58]	-0.83***
	Waiting-list	12.82	(3.82)	[-3.13, -2.05]	-0.72***
Sleep rating (1-10) SLEEP-50	Internet	5.76	(1.08)	[1.29, 1.68]	1.36***
	Bibliotherapy	5.60	(1.23)	[0.96, 1.32]	1.08***
	Waiting-list	5.53	(1.25)	[0.94, 1.37]	1.02***
Depression CES-D	Internet	9.81	(7.47)	[-5.84, -3.35]	-0.71***
	Bibliotherapy	9.64	(6.97)	[-4.86, -2.48]	-0.59***
	Waiting-list	10.32	(7.15)	[-3.67, -1.17]	-0.39***
Anxiety HADS	Internet	3.98	(3.01)	[-2.06, -1.01]	-0.48***
	Bibliotherapy	4.17	(2.81)	[-1.59, -0.50]	-0.35***
	Waiting-list	4.16	(2.77)	[-1.71, -0.72]	-0.38***

Supplemental Table S7 - C*hanges between conditions on 18-week follow-up in Cohen's for diary and questionnaire variables*

	Diary variables					
	TST	SOL	WASO	NWAK	SE	Day rating
Post-2						
Internet X bibl.	-0.05^{ns}	0.09^{ns}	-0.07^{ns}	0.12^{ns}	-0.12^{ns}	-0.17^{ns}
Internet X WL	-0.09^{ns}	0.15^{ns}	0.00^{ns}	0.13^{ns}	-0.18^{ns}	-0.16^{ns}
Bibl. X WL	-0.05^{ns}	0.06^{ns}	0.06^{ns}	0.01^{ns}	-0.05^{ns}	0.01^{ns}

	Questionnaire Variables				
	Insomnia	Sleep impact	Sleep rating	DEP	ANX
Post-2					
Internet X bibl.	0.35**	0.15*	-0.32*	0.15*	0.16*
Internet X WL	0.42*	0.32**	-0.30*	0.34***	0.10^{ns}
Bibl. X WL	0.06^{ns}	0.17^{ns}	-0.01^{ns}	0.20^{ns}	-0.05^{ns}

Note. * = $p < .05$; ** = $p < .01$; *** = $p < .001$; ns = not significant. ANX = Anxiety; DEP = Depression; Bibl. = Bibliotherapy; NWAK = Number of nocturnal awakenings; SOL = Sleep onset latency; TST = Total sleeping time; WL = Waiting-list; WASO = Wake after sleep onset. Cohen's *d* effect sizes based on the imputed sample and significance levels based on multilevel regression (Supplemental Table S1-4).

Chapter 8

Discussion

Discussion

This dissertation described three randomized controlled trials (RCTs) on self-help treatment for sleep problems; two RCTs focused on nightmare treatment, and one RCT on insomnia treatment. Both the nightmare and insomnia self-help studies had as primary goal to evaluate whether these sleep problems could be adequately treated with self-help cognitive-behavioral therapy (CBT). First, we will give a summary and discussion of the nightmare studies. Second, we will address the insomnia study. The chapter ends with a general discussion.

Nightmares

The main research objective was to assess whether nightmares could be adequately treated with self-help CBT. Moreover, of clinical and theoretical interest was which CBT technique was most effective. Furthermore, the current state of empirical evidence on nightmare treatment and associations between psychopathology measures and nightmares were evaluated.

Summary

To date, the amount of published nightmares treatment studies is relatively modest. For this dissertation, all controlled nightmare intervention studies prior to May 2008 have been addressed in a systematic review (Chapter 2); only nine controlled nightmare CBT studies had been performed. The methodological quality of these studies varied; almost all studies had small sample sizes.

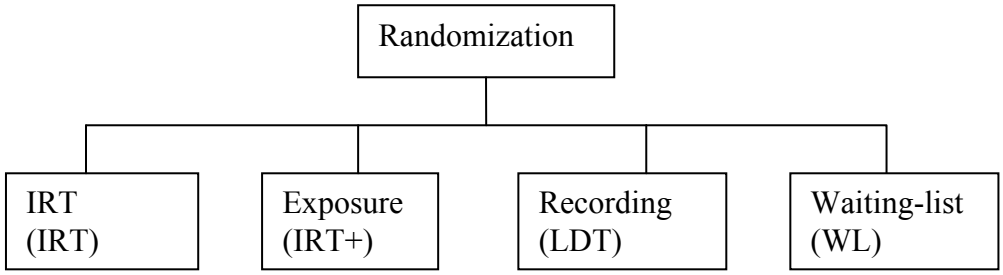
This systematic review could reveal that two intervention types, Imagery Rehearsal Therapy (IRT) and exposure, demonstrated the largest effects. However, exposure and IRT were only once compared in a comparative trial, with a small sample size.[1] Another problem was that the efficacy of IRT was only demonstrated by one research group and therefore did not meet the APA criteria for a well-validated treatment. Although two reviews[2, 3] concluded that IRT is currently the treatment of choice for nightmares, a direct comparison with sufficient statistical power was needed.

The design of the two RCTs carried out in this thesis was primarily based on the conclusions of the systematic review (Chapter 2) and on the cognitive model for recurrent nightmares.[4] According to the cognitive model, nightmares are represented in a fixed expectation pattern called a script. Cognitive avoidance is thought to prevent the emotional normalization of the script. Desensitization through exposure (prolonged imagination of

the feared image) is supposed to break through this cognitive avoidance. Moreover, techniques that break through the cognitive avoidance *and* change the fixed expectation pattern by introducing new nightmare elements are supposed to work even better (e.g., IRT).

We therefore aimed to examine the hypothesis that IRT would be superior to exposure, which in turn would be superior to simple recording of nightmares (with some but very few exposure elements). Moreover, of clinical interest was whether self-help CBT for nightmares is an appropriate treatment-delivery method (Chapter 4-5). This is important because very few psychologists are properly trained to give nightmare treatment. If effective, self-help could be a low-cost and easy-to-deliver method to address this disorder (see Figure 1). The second RCT was a logical consequence from this comparison by including two other familiar interventions types (addressing sleep hygiene; lucid dreaming; Chapter 6).

Figure 1 – Design nightmare study



Note. Between brackets are the conditions of the RCT of Chapter 6.

The baseline data of the two RCTs were used to evaluate the associations between nightmares and psychopathology measures. According to the literature (e.g., [5, 6]), nightmares are correlated with general psychopathology in clinical samples and samples of college students. However, in a previous study on the general population,[7] no such correlations were found, which suggests that these associations might be different within subsamples. In this study (Chapter 3), we found that nightmare frequency is not associated with psychopathology but with sleep quality. This supports the idea that nightmares are a

relatively independent mental disorder[8] and that nightmares should be specifically targeted from a sleep medicine perspective.

In the first nightmare RCT (Chapter 4-5), 399 participants were randomized into IRT (*n* = 103), exposure (*n* = 95), recording (*n* = 106) or waiting-list condition (*n* = 95). Results showed that nightmares can indeed be treated with self-help and that effectiveness is sustained in the long run. Moreover, IRT has now been tested by a second research group, so it meets the criteria for a well established treatment.[9] IRT alleviated nightmare frequency faster, but, unexpectedly, was equally effective to exposure. It seems thus that the desensitization to the feared image is the crucial element in nightmare treatment.

In the second nightmare RCT (Chapter 6), 278 participants were randomized into IRT (*n* = 70), IRT+ (with sleep hygiene; *n* = 76), Lucid Dreaming Therapy - LDT (*n* = 70), or waiting-list condition (*n* = 62). Results showed that in addition to IRT, sleep hygiene or lucid dreaming did not have a beneficial effect. Contrary to our expectations, the original IRT was more effective than the treatment conditions with additional sleep hygiene and LDT sections. It seems therefore that –at least in a self-help format- diversifying the treatments confuses nightmare sufferers.

Discussion of the nightmare trials

The results of both RCTs showed that self-help CBT for nightmares is a promising treatment option. Although not all patients benefitted from this treatment, it seems that self-help for nightmares, in the future, could be incorporated into currently available treatments. This would allow offering nightmare treatment to large groups bypassing issues such as ever growing waiting-lists and increasing costs.

Contrary to the expectations, IRT did not perform better than exposure. From the cognitive model of recurrent nightmares[4] it was predicted that by breaking through cognitive avoidance, emotional normalization of the nightmare can take place. Both IRT and exposure consists of desensitization by imagining the original or changed nightmare. According to the cognitive model for nightmares,[4] IRT additionally serves the function of rescripting the fixed expectation pattern. Since exposure and IRT are found to be equally effective, it seems that the key element in treating nightmares is not cognitive restructuring, but breaking through the negative cycle of cognitive avoidance. The observation that IRT alleviates nightmare frequency more rapidly might be because rescripting the nightmare helps to break through the cognitive avoidance faster.

There may be another explanation for the absence of differences. In self-help IRT for nightmares, introduction of new nightmare elements might indeed serve the function of restructuring; however, it might also serve as avoidance from the desensitization to the feared image. Participants in the IRT condition might find distraction from the desensitization by fantasizing about new endings and/or scripts (and only partly carrying out the desensitization and rescripting). This problem can especially apply to unguided self-help because there is no therapist to monitor whether or not the participant imagines the feared image. In the exposure condition, less diversion from fear extinction is allowed. It is therefore easier to apply the hardest part of the nightmare treatment: imagining your feared images.

From this perspective, the participants in the IRT condition possibly did not carry out the IRT protocol fully. The exposure protocol is easier and participants might have been less distracted from the imagination process. Support for the proposition that simpler protocols are more effective can be found in the second nightmare RCT (Chapter 6) as the empirical study indicated that adding stimulus control/sleep hygiene and/or lucid dreaming to the therapy made treatment less effective. An explanation for this might be that lucid dreaming is more difficult to learn. Furthermore, it might be confusing for participants to combine all elements of IRT and LDT.

Hence, although exposure seems to be the key element in nightmare treatment, more research is needed. The elements necessary for IRT and/or LDT might not optimally be employed in a self-help format. For instance, the only previous direct comparison between IRT and exposure found considerably larger effect sizes for IRT.[1] However, this face-to-face study found no significant differences; possibly because of a small sample size.

Limitations

Overall, the nightmare treatments tested in this thesis were found to be effective. A rather large part of the studied sample did not benefit (enough) from this treatment, leaving considerable room for improvement. An explanation might be that we used a format that did not motivate the participants sufficiently. Previous studies concluded that providing feedback to the self-help enhances efficacy;[10, 11] future studies should consider including support. Because of the paper & pencil format, there was also no information as to what extent and how often the exercises were carried out. For the nightmare studies it neither was measured on a subjective scale. In the subsequent insomnia trial it was implemented.

A second limitation is that in both nightmare RCTs participants were excluded from the study when they scored extremely high on posttraumatic complaints. Although only extreme scores on posttraumatic complaints (compared to the general population) were excluded, this still comprised of 12.5% of the interested volunteers. An explanation for this high percentage could be that nightmares are one of the key symptoms of posttraumatic stress disorder (PTSD). Hence, by definition, people that suffer from nightmares score higher on this scale. The problem, however, is that this group of people may need nightmare treatment the most. More studies are needed to address the research question whether this group would benefit from self-help or whether they need specialized treatment.

A limitation specific to the lucid dreaming study is that no stand alone LDT was used. In this study, lucid dreaming was added as a section to IRT because we aimed to compare both treatments in the most equal format as possible. As our hypothesis that the addition of LDT would improve the efficacy was falsified, future studies should employ stand alone LDT as a comparison to stand alone IRT. Keeping the treatment as simple as possible may enhance the treatment response and comparability. Another open question is whether a combined exposure / IRT protocol could enhance efficacy. However, our initial hypothesis was that exposure and IRT are not equally effective.

One also has to be cautious to generalize the results to the Dutch population. Dutch Internet penetration is high (83%, 2007; 88%, 2008[12]), but the current studies are still based on a self-selected sample through public media and via Internet. Moreover, with a waiting-list control design one cannot state conclusively that the observed effects are due to the specific treatment rather than to other non-specific factors, although both CBT techniques were superior to a recording condition, which functioned as an attention-control group. A further methodological consideration is that we incorporated diary data within the treatment, but did not use prospective measurements in the pre- and post-tests. Differences have been found on nightmare frequency measures for the diary and questionnaire.[13, 14] Because the diary is considered a more objective form type of measurement,[15] it is recommended that future studies include a diary.

Future directions

Although results for the nightmare treatment are promising, the majority of the participants still had some degree of nightmares after treatment. We hoped to find an extra effect with the addition of a sleep hygiene or LDT section, but in the self-help format these beneficial

effects were not observed. Future research is needed to further investigate treatment options.

If participants in the IRT condition indeed (partly) avoid desensitization, IRT might have more success compared to exposure in a face-to-face setting. In a face-to-face setting, the avoidance of the participants can be addressed, allowing both systematic desensitization and cognitive restructuring to take place. However, face-to-face therapy is expensive and has a high threshold. An option to use cost-effective treatment *and* overcome avoidance behavior might lie in a self-help format with support from a therapist who can monitor the progress and step in on key moments of the treatment (e.g., choosing the new ending / imagining the nightmare). Whether cognitive restructuring is beneficial, theoretically the most interesting design would be to replicate the IRT and exposure comparison in a supported self-help setting.

Clinically, it would be more interesting to assess if the treatment protocol can be further enhanced. It seems that for self-help therapy exposure and IRT are the currently best available treatments for nightmares. It can be suggested that a combination of these two treatments such as employed in Davis & Wrights[16] Exposure, Relaxation, and Rescripting Therapy (ERRT) is beneficial because it employs both. However, our data suggest that combining treatments might deteriorate the effect. Moreover, the proposed key element of nightmare treatment (desensitization) is probably exercised equally in all three treatments (exposure; IRT; ERRT). One alleged advantage of the combination of IRT and exposure in self-help therapy is the opportunity for the patients to choose the treatment that fits them best (although this can also be confusing).

Clinically, more important than comparisons between protocols is whether self-help treatment for nightmares benefits from support on progress and exercises. Self-help research in disorders such as anxiety and depression suggests that some rudimentary form of support is essential in the treatment efficacy.[10, 11] Moreover, in Chapter 7 we found that Internet delivered self-help is equally effective as bibliotherapy. Internet has the advantage that it can be tailored more easily to individual needs and that the amount of completed exercises can be tracked online. Hence, in future studies we suggest to use Internet delivered self-help.

Self-help CBT for nightmares is promising and with the proposed combined treatment types, treatment could possibly be enhanced, which would eventually allow implementation of nightmare self-help treatment into general healthcare.

Insomnia

The main goal was to assess whether insomnia could be adequately treated with unsupported self-help CBT and whether Internet and paper-and-pencil delivered CBT were equally effective.

Summary

Self-help has been proposed as a good first option for insomnia in a stepped care model.[17] The problem was that the effectiveness of self-help CBT for insomnia appears only small to moderate.[18] Moreover, large-scale self-help studies found no effect on diary sleep measures (e.g., sleep duration). For Chapter 7, a self-help CBT protocol for insomnia was developed and its effectiveness was evaluated in a large RCT (N = 623) which compared Internet delivered self-help CBT to bibliotherapy and a waiting-list condition.

In this RCT, we found that insomnia can effectively be treated with unsupported self-help CBT. Internet and bibliotherapy were equally effective at 4-week follow-up. However, the Internet condition had a higher dropout. Effects were sustained at 48-week follow-up, but surprisingly, symptoms of insomnia and secondary complaints decreased more in the Internet compared to the bibliotherapy condition.

Discussion of the insomnia trial

This large-scale RCT showed that insomnia can be effectively treated through self-help CBT. Observed effects were larger than previously published moderate- to large-scale self-help studies,[19-22] comparable to the most effective smaller scale (N < 50) self-help CBT studies (e.g., [23, 24]), and almost similar to several face-to-face intervention studies (e.g., [25-27]). Furthermore, long-term outcomes were better than sleep medication.[28-30] This study showed that self-help CBT for insomnia is not only effective on global insomnia symptoms (such as an insomnia rating scale), but also on diary sleep measures (such as total sleep time, sleep onset latency, etc.). This means that insomnia self-help now proved to be effective in a large trial on primary outcome measures. The results in this thesis moved insomnia research one step forward into the direction of implementing this type of treatment into the general healthcare.

Interestingly, these large effects were found with unsupported self-help CBT. This is surprising because it has been suggested that some rudimentary form of support is essential in self-help.[10, 11] The current findings suggest that a majority of persons suffering from insomnia do not need support in order for self-help to have positive effects. The

unsupported self-help CBT is very cost-effective and might be an interesting option to employ in large groups for prevention purposes (e.g., insomnia is a predictor for developing major depression and other health problems in later life[31]).

Notwithstanding the positive results, the fact remains that after treatment, 50-60% still fulfilled the diagnostic criteria for an insomnia disorder. Unsupported self-help may have been sufficient for large parts of the sample but might have been too complicated for other participants. Especially the intrusive and difficult-to-perform method of sleep restriction could have been too challenging. So although unsupported self-help showed good results, providing additional therapist support on progress and the actual exercises might encourage more patients to complete the most intrusive modules of sleep restriction and paradoxical intention.[10, 11]

Another important finding is that Internet delivered self-help can be at least as effective as bibliotherapy. Our data suggests that Internet may be even more effective in the long-term (however, this finding should first be replicated). Until now, the decision for using the Internet as a delivery method was based on practical rather than empirical grounds. This study validated that decision. Internet might be a more preferable method because of its cost-effectiveness and high accessibility. Moreover, because of the flexibility of computerized programs, Internet can more easily be tailored to individual needs.[32]

By using more advanced Internet-delivered self-help CBT, individual tailoring might help absolve the higher non-response that was found in the Internet condition (which is an indication for intervention dropout). For this study, we used a very simple form of computerized self-help. We did so in order to optimize the comparability of the two delivery methods. However, in general health care, this Internet protocol can be further enhanced. By using a sophisticated digital environment preferably tailored to individual needs, compliance might increase (and non-response may decrease). Moreover, by measuring which treatment modules are completed and when and how often patients are online, valuable information about the patient's response to the intervention can be acquired.

Limitations

The general problems that were already mentioned for the nightmare RCT also apply to this RCT. One has to be cautious in generalizing these results to the general population. Dutch Internet penetration is high (88% in 2008[12]), but this is still a self-selected sample

through public media and via Internet. Moreover, with a waiting-list control design one cannot state conclusively that the observed effects are due to the specific treatment rather than to other non-specific factors.

One further consideration is that 16% of the interested volunteers were excluded from the study because of high depression scores. The currently observed effects on sleep measures (e.g., sleep duration) might be attributed to the exclusion of high scores on depression. Participants with a co-morbid depression may not respond well to unsupported self-help treatment for insomnia (masking factor) and the inclusion of this group may be the reason that previous large-scale studies found no effects on sleep measures. Now the effectiveness is shown in an isolated sample (high depression excluded / self-selected sample), the question remains whether this unsupported self-help is also effective if participants with high depression scores are included.

Another issue concerns the non-response. In the intervention conditions, 13 - 22 % did not fill out the first post-test questionnaire (and an even larger proportion did not complete the diary). Although we used state-of-the-art statistical methods such as multilevel regression[33] and multiple imputation[34] to correct for this dropout, it is only a simulation in the case that these participants would have completed the post-tests. These statistical methods generally assume that the data is missing at random, which might not be the case for self-help treatment studies (non-response might occur because of the severity of the complaints or mismatch to the exercises). Moreover, non-response is not the same as incompliance, as there is no information on whether these participants completed the intervention. It is likely that part of the non-responders completed the intervention but did not feel like completing the questionnaire. More importantly, it is undoubtedly the case that part of the non-responders did not carry out this intervention. In our current protocol, we had no information about when patients were online, and no objective information how much modules were completed. In a new study, this information is needed to better account for attrition.

Currently there is little knowledge available for the reasons of why participants do not comply. It is therefore hard to plan adequate countermeasures. For self-help CBT to succeed within the stepped care model, limiting dropout should be a priority. A first step would be to identify reasons that are associated with dropout. Of the larger trials to date, two studies found symptom severity as a reason for dropout,[20, 35] and one found psychiatric comorbidty.[35] Others studies did not identify any variables associated with dropout.[19, 21]

The same applies for our large RCT, where we found no predictors for dropout (other than treatment condition).

Future directions

Further improving and validating the self-help method is needed: The modest positive effects warrant ongoing improvement. Because of its benefits the Internet is the most preferable delivery method. As argued above, further enhancing the delivery method by using a sophisticated digital environment (as was for instance used in the study of Ritterband et al.[24]) would be a next logical step. With such an environment, valuable information about the patient flow can be attained.

Another issue is that a large portion of the participants did not improve above a clinically meaningful threshold. Because of its unsupported format, this self-help treatment might be too complicated for specific subsamples. In order to improve the efficacy of this protocol, some general knowledge about treatment effects per subgroup need to be acquired. For this reason, we are currently working on a trial in which persons scoring high on depression are also included and in which we try to evaluate whether specific characteristics are associated with treatment success or dropout. If participants with high depression scores are not helped by unsupported self-help, they might benefit from stepping up to supported self-help. However, this group might be better off with a (self-help) protocol that combines insomnia treatment with CBT for depression specifically.

The currently most pressing issue is whether support would also be beneficial for self-help CBT for insomnia. Research on self-help for disorders such as anxiety and depression has suggested that some rudimentary form of support is essential in the treatment efficacy.[10, 11] In insomnia research very few self-help studies have been performed that included support from a therapist.[18] No study directly compared these two modalities; a study that directly compares unguided with guided treatment is needed. This study would preferably use large sample sizes so that subgroup analyses can be done (such as high-low depression scores). Predictions would be that guided treatment enhances efficacy and lowers dropout.

General discussion

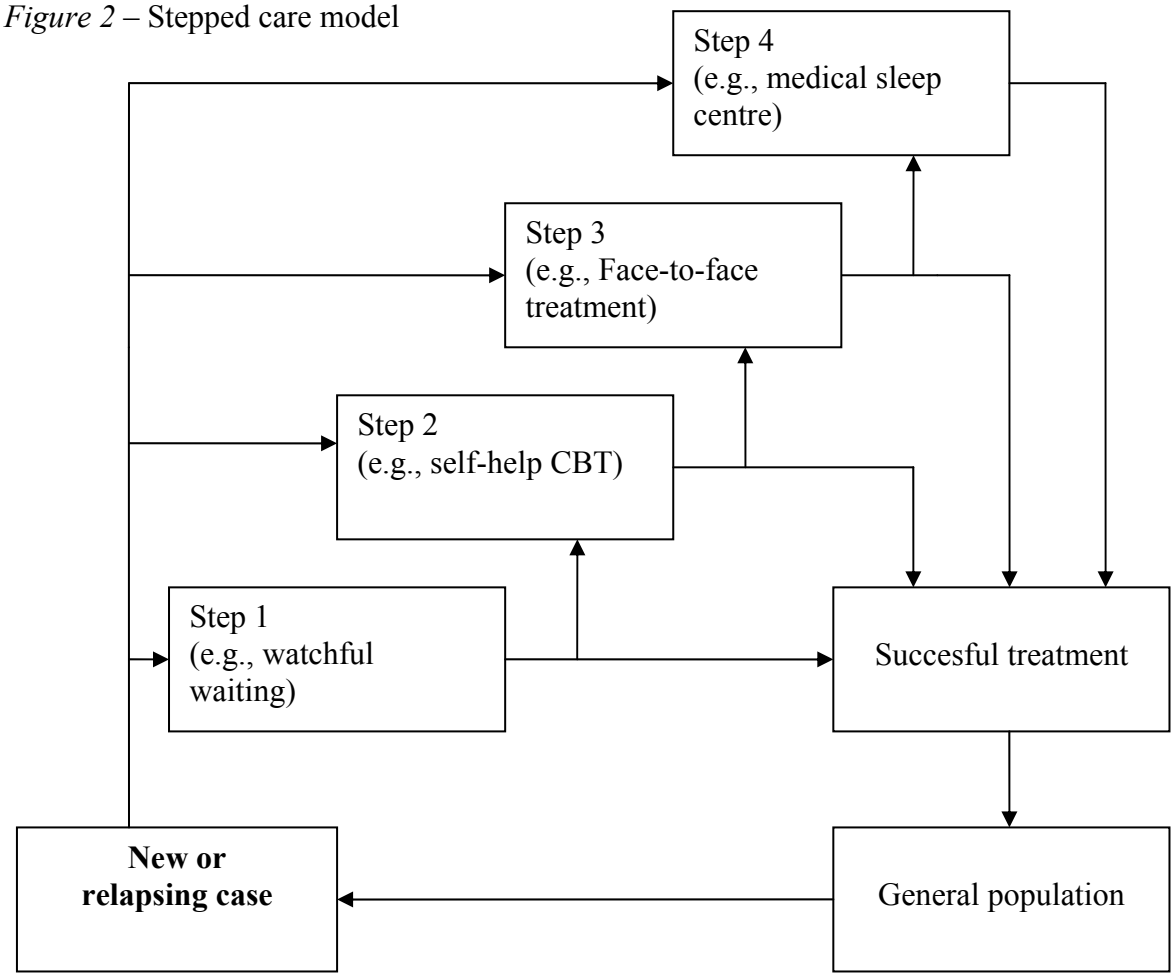
The starting point of this dissertation was whether nightmares and insomnia can be adequately treated with self-help CBT. This dissertation showed that self-help treatments for nightmares and insomnia are effective. It therefore seems that in the future they can have their part in the treatment of sleep disorders. Before implementation, the self-help protocols for insomnia and nightmares still need to be developed further. The question remains whether unsupported or supported self-help CBT for sleep problems should be used and whether advanced Internet programming (with the opportunity to track patients) will show beneficial effects. Nonetheless, based on this dissertation there appears sufficient evidence to conclude that the use of self-help protocols is promising in the management of the sleep disorders. It furthermore seems likely that it might be a useful intervention in the prevention of other disorders (such as depression[36]). The stepped care model seems the most appropriate framework for the deliverance of these interventions; this model provides a way to deliver appropriate treatment and manage the ever increasing cost of the mental health care.

Stepped care

The stepped care model has been developed to fit the patient's needs and takes the cost-effectiveness into account. In stepped care a patient first receives the least restrictive treatment currently available that is still likely to provide significant health gain (see Figure 2). If the first treatment does not provide enough health gain, a patient can be moved up to more intensive types of treatment.[37] This model is elegant in that it gives people what they need; in theory, all patients eventually receive the care they need with the least possible costs. Recently, some studies found promising results by assessing a full stepped care model (e.g.,[38, 39]).

The stepped care model has already been proposed as a model for the treatment of insomnia,[17] but might also be beneficial for the treatment of nightmares. For both disorders, few properly trained therapists are available. This model provides a way to fit to the patient's need, but also to distribute the therapist's time more efficiently. If sleep disordered people get well from low intensity treatments such as self-help, more time remains for the therapist for patients that need it most.

Figure 2 – Stepped care model



Note. The model is based on Bower & Gilbody.[37]

Cost-effectiveness and support

One of the alleged advantages of self-help CBT is the low costs involved in the treatment, which is very interesting in an era where healthcare costs are rising above the affordable. However, the cost-effectiveness of self-help protocols for sleep problems has yet to be assessed. Moreover, when advanced Internet based interventions are used, considerably more costs may be involved with developers that need to earn back their investments (with for instance licenses). The same holds for adding support to an intervention; using a therapist to give support raises the costs considerably. From a cost-efficiency perspective, open source applications or unsupported interventions such as used in this dissertation are a promising option.

Additions to the protocol (support / advanced architecture) may enhance the treatment efficacy and provide information about the patient flow. This is the reason why

in stepped care models self-help with some form of support is generally the first treatment step (sometimes after watchful waiting). In the current studies we found that unsupported self-help can be effective for a part of the population. The question arises whether one should offer unsupported or supported self-help as a first step. The challenge would be to decide beforehand for each individual patient whether he/she benefits enough from unsupported self-help or whether a patient should start directly with supported self-help. This would also apply for the decision whether or not to use self-help or face-to-face therapy. Because patients might get unmotivated after an unsuccessful first step, the estimation of the correct entry level for a stepped-care model is crucial.

Currently, an intelligent stratification is not (yet) possible and if this remains the case, from a cost-efficiency perspective, it might be better to offer everyone a supported self-help format directly. This supported format is still less expensive than the face-to-face therapies and is expected to generate better results than unsupported self-help. Moreover, if people receive inadequate unsupported self-help they might get unmotivated for the next step. Especially if this step comprises of the same exercises that now involves (minimal) support on doing the exercises. These people might dropout or only accept face-to-face therapy (with considerable more costs involved). Studies that address these issues, either within a full stepped care model or in comparator trials are much needed.

Conclusion

In this dissertation we found that unsupported self-help CBT can successfully ameliorate nightmares and insomnia. Sleep disorders can be specifically targeted and self-help treatments have an effect on primary sleep complaints. The nightmare studies demonstrated that self-help CBT decreased nightmare frequency; the insomnia study showed that CBT increased total sleep time, decreased sleep onset latency, and waking time after sleep onset. Moreover, indirect effects were found on affective complaints such as depression and anxiety. The effects were sustained in the long run, suggesting that not only face-to-face but also self-help CBT has better long-term effects than sleep medication.[28-30]

As argued above, as long as no information is available to predict the correct entry level, supported self-help CBT might be a better first option in stepped care. The unsupported format might replace the supported format as the first option in stepped care, if it is possible to identify the correct entry level. In addition, the unsupported format might be used for the prevention of sleep disorders or even depression (as insomnia is a predictor

for developing depression in later life[31]). In any case, the unsupported format is promising because it appears to be a cost-effective way to reach a large number of people with nightmares and insomnia.

References

1. Kellner R, Neidhardt J, Krakow B, Pathak D. Changes in chronic nightmares after one session of desensitization or rehearsal instructions. *Am J Psychiat,* 1992;149:659-663.
2. Wittmann L, Schredl M, Kramer M. Dreaming in posttraumatic stress disorder: A critical review of phenomenology, psychophysiology and treatment. *Psychother Psychosom,* 2007;76:25-39.
3. Spoormaker VI, Schredl M, van den Bout J. Nightmares: From anxiety symptom to sleep disorder. *Sleep Med Rev,* 2006;10:53-59.
4. Spoormaker VI. A cognitive model of recurrent nightmares. *Int J Dream Res,* 2008;1:15-22.
5. Levin R, Fireman G. Nightmare prevalence, nightmare distress, and self reported psychological disturbance. *Sleep,* 2002;25:205-212.
6. Zadra AL, Donderi DO. Nightmares and bad dreams: Their prevalence and relationship to well-being. *J Abnorm Psychol* 2000;109:273-281.
7. Spoormaker VI, van den Bout J. Depression and anxiety; relations with sleep disturbance. *Eur Psychiat,* 2005;20:243-245.
8. Spoormaker VI, Montgomery P. Disturbed sleep in post-traumatic stress disorder: Secondary symptom or core feature. *Sleep Med Rev,* 2008;12:169-184.
9. Chambless DL, Baker MJ, Baucom DH, Beutler LE, Calhoun KS, Crits-Cristoph P, et al. Update on empirically validated therapies, II. *The Clinical Psychologist,* 1998;51:3-16.
10. Spek V, Cuijpers P, Nylklicek I, Riper H, Keyzer J, Pop V. Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta analysis. *Psychol Med,* 2007;37:319-328.
11. Palmqvist B, Carlbring P, Andersson G. Internet-delivered treatments with or without therapist input: Does the therapist factor have implications for efficacy and cost? *Expert Rev Pharmacoecon Outcomes Res,* 2007;7:291-7.
12. Statistics Netherlands. *Statistical yearbook 2009*. The Hague: Statistics Netherlands; 2009.
13. Robert G, Zadra A. Measuring nightmare and bad dream frequency: Impact of retrospective and prospective instruments. *J Sleep Res,* 2008;17:132-139.
14. Lancee J, Spoormaker VI, van den Bout J. Nightmare frequency is associated with subjective sleep quality but not with psychopathology. *Sleep Biol Rhythms,* 2010;8:187-193.
15. Levin R, Nielsen TA. Disturbed dreaming, posttraumatic stress disorder, and affect distress: A review and neurocognitive model. *Psychol Bull,* 2007;133:482-582.
16. Davis JL, Wright DC. Randomised Clinical Trial for Treatment of Chronic Nightmares in Trauma-Exposed Adults. *J Trauma Stress,* 2007;20:123-133.
17. Espie CA. "Stepped Care": A health technology solution for delivering cognitive behavioral therapy as a first line insomnia treatment. *Sleep,* 2009;32:1549-1558.
18. van Straten A, Cuijpers P. Self-help therapy for insomnia: A meta-analysis. *Sleep Med Rev,* 2009;13:61-71.
19. Morin CM, Beaulieu-Bonneau S, LeBlanc M, Savard J. Self-help treatment for insomnia: A randomized controlled trial. *Sleep,* 2005;28:1319-1327.
20. Ström L, Pettersson, Andersson G. Internet-based treatment for insomnia: A controlled evaluation. *J Consult Clin Psychol,* 2004;72:113-120.
21. van Straten A, Cuijpers P, Smit F, Spermon M, Verbeek I. Self-help treatment for insomnia through television and book: A randomized trial. *Patient Educ Couns,* 2009;74:29-34.

22. Vincent N, Lewycky S. Logging on for better sleep: RCT on the effectiveness of online treatment for insomnia. *Sleep,* 2009;32:807-815.
23. Mimeault V, Morin CM. Self-help treatment for insomnia: Bibliotherapy with and without professional guidance. *J Consult Clin Psychol,* 1999;67:511-519.
24. Ritterband LM, Thorndike FP, Gonder-Frederick LA, Magree JC, Bailey ET, Saylor DK, et al. Efficacy of an internet-based behavioral intervention for adults with insomnia. *Arch Gen Psychiat,* 2009;66:692-698.
25. Edinger JD, Wohlgemuth WK, Radtke RA, Marsh GR, Quillian RE. Cognitive behavioral therapy for treatment of chronic primary insomnia: A randomized controlled trial. *JAMA,* 2001;285:1856-1864.
26. Jacobs GD, Pace-Schott EF, Stickgold R, Otto MW. Cognitive behavior therapy and pharmacotherapy for insomnia: A randomized controlled trial and direct comparison. *Arch Intern Med,* 2004;164:1888-1896.
27. Sivertsen B, Omvik S, Pallesen S, Bjorvatn B, Havik OE, Kvale G, et al. Cognitive behavioral therapy vs zopiclone for treatment of chronic primary insomnia in older adults: A randomized controlled trial. *JAMA,* 2006;295:2851-8.
28. Rieman D, Perlis ML. The treatments of chronic insomnia: A review of benzodiazepine receptor agonists and psychological and behavioral therapies. *Sleep Med Rev,* 2009;13:205-214.
29. Smith TS, Perlis ML, Park A, Smith MS, Pennington JY, Giles DE, et al. Comparative meta-analysis of pharmacotherapy and behavior therapy for persistent insomnia. *Am J Psychiat,* 2002;159:5-11.
30. Holbrook AM, Crowther R, Lotter A, Cheng C, King D. Meta-analysis of benzodiazepine use in the treatment of insomnia. *CMAJ,* 2000;162:225-233.
31. Taylor DJ, Lichstein KL, Durrence HH. Insomnia as a health risk factor. *Behav Sleep Med,* 2003;1:227-47.
32. Wantland DJ, Portillo CJ, Holzemer WL, Slaughter R, McGhee EM. The effectiveness of web-based vs. non-web-based interventions: A meta analysis of behavioral change outcomes. *J Med Internet Res,* 2004;6:e40.
33. Hox JJ. *Multilevel analysis: Techniques and applications*. Mahwah: Lawrence Erlbaum Associates; 2002.
34. Rubin D. *Multiple imputation for nonresponse*. New York: Wiley; 1987.
35. Hebert EA, Vincent N, Lewycky S, Walsh K. Attrition and adherence in the online treatment of chronic insomnia. *Behav Sleep Med*;8:141-50.
36. Ford D, Kamerow D. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *JAMA,* 1989;262:1479-1485.
37. Bower P, Gilbody S. Stepped care in psychological therapies: Access, effectiveness and efficiency. Narrative literature review. *Br J Psychiat,* 2005;186:11-17.
38. van 't Veer-Tazelaar PJ, van Marwijk HW, van Oppen P, van Hout HP, van der Horst HE, Cuijpers P, et al. Stepped-care prevention of anxiety and depression in late life: A randomized controlled trial. *Arch Gen Psychiat,* 2009;66:297-304.
39. van Straten A, Tiemens B, Hakkaart L, Nolen WA, Donker MC. Stepped care vs. matched care for mood and anxiety disorders: A randomized trial in routine practice. *Acta Psychiatrica Scand,* 2006;113:468-76.

Samenvatting

(Summary in Dutch)

Samenvatting

De slaapstoornissen nachtmerries en insomnie (chronische slapeloosheid) zijn veelvoorkomend en hebben negatieve gevolgen. Desondanks wordt er relatief weinig aandacht aan deze slaapstoornissen besteed in de geestelijke gezondheidszorg (GGZ): slechts een minderheid van alle mensen met een slaapstoornis zoekt en krijgt professionele hulp. Dit is waarschijnlijk te wijten aan te weinig kennis van effectieve behandelingen bij zowel de bevolking als de professionals in de GGZ - en aan te weinig beschikbare therapeuten. Dit is betreurenswaardig omdat beide slaapstoornissen goed te verbeteren zijn met cognitieve gedragstherapie (CGT).

Omdat de oefeningen voor het verhelpen van deze slaapstoornissen voornamelijk bestaan uit psycho-educatie en gedragsregels om de slaap te verbeteren, lijkt zelfhulp een veelbelovende optie. Deze breed inzetbare en toegankelijke zelfhulp zou wellicht goed passen binnen een 'stepped care' model. Het doel van deze dissertatie *was om te bepalen of zelfhulp op basis van CGT effectief is in de behandeling van nachtmerries en insomnie*.

Nachtmerries

De definitie van nachtmerries is: 'Buitengewoon angstaanjagende dromen waaruit de persoon wakker schrikt. Na een nachtmerrie weet de dromer snel dat het een droom was, en heeft deze een gedetailleerde herinnering aan de nachtmerrie zelf, waarin doorgaans het overleven, de veiligheid of de (lichamelijke) integriteit bedreigd wordt.'

Nachtmerries zijn een veelvoorkomende stoornis met een prevalentie van 2-5% in de algemene bevolking. Voor degenen die meerdere nachtmerries per week hebben, geldt dat nachtmerries de slaap verstoren (en soms insomnie als gevolg hebben), het dagelijks functioneren belemmeren en het psychisch en fysiek welbevinden verminderen. Nachtmerries kunnen gerelateerd zijn aan een posttraumatische stress stoornis (PTSS), maar soms is er geen duidelijke oorzaak aanwijsbaar.

Nachtmerries kunnen behandeld worden met CGT. Indirecte methodes zoals het bijhouden van nachtmerries in een dagboek kunnen al positieve effecten hebben, maar methodes die direct ingrijpen op de nachtmerries - zoals exposure en cognitieve herstructureringstechnieken - lijken beter te werken. Bij exposure wordt de nachtmerrie overdag ingebeeld totdat de angst afneemt. Bij de herstructureringstechnieken wordt de nachtmerrie overdag ook ingebeeld, maar nu wordt er een nieuw (vaak positief) einde gebruikt. Voorbeelden hiervan zijn 'Imagery Rehearsal Therapy' (IRT) en 'Lucid Dreaming Therapy' (LDT). Bij IRT worden de dromen overdag veranderd en ingebeeld,

bij LDT worden de dromen ook overdag ingebeeld, maar daarnaast wordt er bij de laatstgenoemde techniek ingezet op het 'lucide' worden *in* de nachtmerrie zelf, zodat er direct in de droom invloed uitgeoefend kan worden.

Door een gebrek aan kennis over nachtmerries en een tekort aan therapeuten wordt de meerderheid van de mensen die last heeft van nachtmerries niet behandeld. Omdat de oefeningen voor het verhelpen van nachtmerries relatief eenvoudig zijn, lijkt zelfhulp voor nachtmerries een geschikte optie. Zelfhulp is in één studie eerder onderzocht; hieruit bleek dat exposure effectiever is dan ontspanningstechnieken en een wachtlijst. Het doel van de nachtmerriestudies in deze dissertatie was om verder te onderzoeken of zelfhulp voor nachtmerries werkzaam is en tegelijkertijd te achterhalen welke techniek het meest effectief is.

Volgens het cognitieve model voor herhalende nachtmerries worden nachtmerries weergegeven in een vast verwachtingspatroon, een script genoemd. Omdat mensen vermijden terug te denken aan dit script, kan er geen emotionele normalisatie optreden. Desensitisatie van het script door exposure zou een manier zijn om door deze vermijding heen te breken. Als de vermijding wordt doorbroken, kan er wel normalisatie optreden waardoor de nachtmerrie verdwijnt. Volgens deze theorie moeten technieken die door de vermijding breken en ook het verwachtingspatroon veranderen (zoals IRT), nog effectiever zijn.

Om een beeld te krijgen van alle gecontroleerde nachtmerrie interventiestudies werd in Hoofdstuk 2 een systematisch overzicht gegeven van de literatuur. Er konden negen gecontroleerde studies geïdentificeerd worden in de wetenschappelijke literatuur tot mei 2008. De methodologische kwaliteit van deze studies was wisselend en bijna alle studies hadden kleine steekproeven. Uit dit overzichtsartikel bleek dat exposure en IRT de grootste effecten hadden op nachtmerries. Opmerkelijk was dat exposure en IRT slechts eenmaal met elkaar vergeleken waren, waarbij geen significante verschillen gevonden werden (waarschijnlijk door een te kleine steekproef). Een ander belangrijk punt was dat de effecten van IRT slechts door één onderzoeksgroep aangetoond waren en dat IRT daarom nog niet voldeed aan de APA-criteria van een goedgevalideerde behandeling. Hoewel eerdere overzichtsartikelen concludeerden dat IRT de eerste keus was in de behandeling van nachtmerries, concludeerde dit overzichtsartikel dat een directe vergelijking tussen IRT en exposure door een andere onderzoeksgroep nodig was.

In Hoofdstuk 3 zijn de data van de voormeting van de interventiestudies (zie hieronder) gebruikt om verbanden tussen nachtmerries en psychopathologie te achterhalen. In eerdere studies in klinische populaties en in studentenpopulaties werden verbanden gevonden tussen nachtmerries en algemene psychopathologie. In een studie in de algemene populatie werden deze verbanden echter niet gevonden. Uit Hoofdstuk 3 bleek dat nachtmerriefrequentie geen verband had met psychopathologie, en alleen kleine verbanden met slaapkwaliteit. Dit onderbouwt het idee dat nachtmerries in de algemene populatie relatief onafhankelijk zijn van andere klachten en dat nachtmerries specifieke behandelmethoden verdienen.

Voor het design van de interventiestudies werd gebruik gemaakt van het bovengenoemde cognitieve model en de conclusies van het overzichtsartikel. In de eerste gecontroleerde studie werd IRT met exposure, dagboek en een wachtlijst vergeleken (Hoofdstuk 4-5). De hypothese was dat IRT effectiever is dan exposure en dat exposure weer effectiever is dan alleen het bijhouden van een dagboek (met slechts weinig exposure). In de tweede gecontroleerde studie (Hoofdstuk 6) werd de IRT methode uitgebreid met een sectie die direct inging op slaapproblemen (slaaphygiëne) en een lucide dromensectie. Hier werden IRT met IRT+ (inclusief slaaphygiëne), LDT (IRT inclusief slaaphygiëne en lucide dromen technieken) en een wachtlijst vergeleken. De verwachting was dat de uitbreiding van het IRT protocol betere resultaten zou opleveren.

In de eerste nachtmerrie RCT van dit proefschrift (Hoofdstuk 4-5) werden 399 participanten gerandomiseerd in IRT (n = 103), exposure (n = 95), dagboek (n = 106) of een wachtlijstconditie (n = 95). In dit onderzoek werd gevonden dat zelfhulp inderdaad effectief is in de behandeling van nachtmerries en dat deze effecten ook op lange termijn blijven bestaan. Zowel IRT als exposure werkten beter dan dagboek en wachtlijst. Met dit onderzoek is door een tweede onderzoeksgroep aangetoond dat IRT effectief is. Hierdoor voldoet IRT nu ook aan de APA criteria van een goedgevalideerde behandeling. Uit de data bleek dat nachtmerries sneller afnamen door IRT, maar verrassend genoeg was IRT uiteindelijk net zo effectief als exposure. De desensitisatie van de negatieve beelden lijkt het cruciale element te zijn in nachtmerriebehandeling.

In de tweede RCT (Hoofdstuk 6) werden 278 participanten gerandomiseerd in IRT (n = 70), IRT+ (met slaaphygiëne; n = 76), LDT (IRT + slaaphygiëne + LDT; n = 70), of een wachtlijstconditie (n = 62). In tegenstelling tot onze verwachtingen was de originele IRT effectiever dan de condities waarbij het protocol was uitgebreid (IRT+ / LDT). Het

lijkt er op dat (in elk geval met zelfhulp) het uitbreiden van de behandeling zorgt voor verwarring.

De resultaten van deze trials laten zien dat nachtmerries adequaat behandeld kunnen worden met zelfhulp op basis van cognitieve gedragtherapie. Bij een groot gedeelte van de participanten nam het aantal nachtmerries af na de interventie. Verrassend genoeg was IRT niet effectiever dan exposure. Het lijkt er op dat de desensitisatie het voornaamste element is en niet de cognitieve herstructurering. Een andere verklaring kan zijn dat mensen in de IRT conditie de oefeningen niet volledig hebben uitgevoerd omdat dit te ingewikkeld is binnen een zelfhulpprotocol zonder ondersteuning.

Hoewel uiteindelijk een groot gedeelte van de participanten baat had bij dit protocol, was er toch ook een groep die niet of te weinig vooruit ging na het doen van deze oefeningen. Voordat deze zelfhulptechnieken geïmplementeerd kunnen worden in de GGZ, is het wenselijk om de technieken verder te onderzoeken. Een voor de hand liggende aanvulling is het aanbieden van deze protocollen met ondersteuning door een therapeut. Hierdoor kunnen de mensen die last hebben van nachtmerries gestimuleerd worden om de oefeningen af te maken en tot een beter einde brengen. Al met al is zelfhulp een interessante optie voor het verhelpen van nachtmerries.

Insomnie

Met een prevalentie van rond de 10-15% is chronische slapeloosheid – insomnie – de meest voorkomende slaapstoornis. Insomnie wordt gekarakteriseerd door problemen bij het inslapen ’s avonds of het doorslapen ’s ochtends, of niet uitgerust zijn overdag. Voor chronische slapeloosheid dienen de klachten minimaal een maand aan te houden. Chronische slapeloosheid verstoort niet alleen de slaap maar ook het dagelijkse functioneren.

Insomnie krijgt niet veel aandacht in de GGZ en relatief weinig mensen worden hiervoor behandeld. Als chronische slapeloosheid al aandacht krijgt, worden er in de praktijk vaak nog slaapmiddelen voorgeschreven. Dit terwijl CGT betere langetermijneffecten heeft en de meest geschikte optie is voor behandeling van insomnie. Een reden voor het uitblijven van de behandeling is dat er te weinig getrainde therapeuten beschikbaar zijn voor het behandelen van insomnie. Zelfhulp als eerste stap binnen de context van de ‘stepped care’ is geopperd als een mogelijke oplossing voor dit probleem.

Er zijn al verscheidene studies gedaan naar zelfhulp voor insomnie. De effecten lijken positief, maar zijn tot dusver slechts klein tot middelgroot. Belangrijker is dat er in

de studies met een grote steekproef geen effecten zijn gevonden op essentiële variabelen zoals totale slaaptijd en inslaapduur. Het uitblijven van deze effecten in eerdere studies is mogelijk te wijten aan het includeren van mensen met hoge depressie scores. Een alternatieve verklaring is dat CGT alleen de cognitieve en emotionele respons op slapeloosheid en slaaptekort verandert, en niet de slaap zelf verbetert.

Voor de studie van Hoofdstuk 7 is een zelfhulpprotocol geschreven op basis van cognitieve gedragtherapie. In deze gecontroleerde studie werden 623 participanten gerandomiseerd in: een zelfhulpinterventie aangeboden via het Internet (n = 216), een schriftelijke versie (n = 205) en een wachtlijst (n = 202). Uit de resultaten bleek dat insomnie effectief behandeld kan worden met zelfhulp zonder ondersteuning. Er waren effecten op insomnie symptomen en secundaire klachten (angst / depressie), en ook op essentiële slaapvariabelen zoals de totale slaaptijd. Deze effecten bleven ook bestaan op de lange termijn. Er werden bij de 4-weken follow-up geen verschillen gevonden tussen de internetmethode of de schriftelijke methode, hoewel de internetconditie wel een hogere uitval had. Bij 48-weken follow-up bleven de effecten intact. Verrassend was dat insomnie symptomen en secundaire klachten in de internetconditie bij deze follow-up nog iets afnamen ten opzichte van de schriftelijke conditie.

De effecten in deze trial zijn ten opzichte van eerdere studies goed te noemen en zijn bijna net zo groot als de face-to-face interventiestudies. Interessant is dat deze effecten gevonden zijn met zelfhulp zonder ondersteuning op vooruitgang en inhoud. Dit is verrassend omdat studies naar (bijvoorbeeld) depressie en angst er op wijzen dat enige vorm van ondersteuning essentieel is bij zelfhulp. Een mogelijke verklaring dat het effect in deze studie zo groot was, is dat participanten met hoge scores op depressieklachten werden uitgesloten (in andere studies konden deze mensen wel deelnemen aan het onderzoek). Deze groep mensen reageert wellicht niet goed op zelfhulp voor insomnie.

Uit de huidige studie blijkt dat insomnie effectief behandeld kan worden met zelfhulp zonder ondersteuning. Toch is er ook in deze studie een grote groep mensen die niet of niet genoeg vooruitging. Het is dus belangrijk om het protocol te verbeteren. Een logische stap zou zijn om het protocol te voorzien van ondersteuning van een therapeut. In ieder geval lijkt dit protocol veelbelovend te zijn, niet alleen voor de behandeling van insomnie, maar wellicht ook voor preventie.

Conclusie

Uit deze dissertatie blijkt dat zelfhulp effectief is voor het verminderen van zowel nachtmerries als insomnie. Als gevolg van de interventie nam de frequentie van nachtmerries af en bij mensen met insomnie werden de klachten minder en nam de totale slaaptijd toe. Daarbij werden ook effecten gevonden op secundaire klachten zoals depressie en angst. Een groot gedeelte van de participanten ging vooruit, maar ook een aanzienlijk gedeelte niet. Voordat deze protocollen daadwerkelijk geïmplementeerd worden in de GGZ is er nog verder onderzoek nodig. De meest voor de hand liggende uitbreiding van beide protocollen is het toevoegen van therapeutische ondersteuning bij de oefeningen. Op basis van de resultaten in deze dissertatie kan geconcludeerd worden dat zelfhulp voor zowel nachtmerries als insomnie een veelbelovende optie is.

Dankwoord

(Acknowledgements)

Om te beginnen wil ik alle participanten en het Fonds Psychische Gezondheid bedanken, zonder hen was dit proefschrift nooit mogelijk geweest.

Jan, ik vind het ontzettend prettig dat jij mijn promotor bent. Ik kan goed met je samenwerken en wat ik het meeste in je waardeer is dat je altijd achter mij staat. Geweldig dat we deze samenwerking gaan voortzetten! Marjolijn, fijn dat we samen gaan werken aan een online programma voor insomnie.

Victor, aan jou heb ik echt heel veel te danken. Ik vind je een supersterke onderzoeker en scherp met teksten. Van jou heb ik ongetwijfeld het meest geleerd. Ik waardeer het ontzettend dat je me naast je drukke werkzaamheden altijd hebt begeleid. Ik vind het nog steeds jammer dat je niet in Nederland woont, anders hadden we nóg beter onderzoek kunnen doen en ook wat vaker in de kroeg kunnen zitten!

Van KGP wil ik graag iedereen en speciaal de S&R-groep bedanken. Het was een fijne groep om als beginnende docent in terecht te komen. Adriaan, jou wil extra bedanken; ik vind het geweldig dat jij altijd voor iedereen klaarstaat. Ook de mensen van het Ambulatorium wil ik noemen. Het is heel bijzonder om in zo'n prettige groep mijn eerste stappen te zetten als therapeut.

Dan wordt het nu tijd voor de belangrijkste collega's, namelijk de aio's. Aan het begin was het wat kleinere groep. Veel zijn er al weg / gepromoveerd, degenen die ik zeker nog niet vergeten ben: Karolijne, Marieke, Elske en Patricia. Jullie maakten de tijd de moeite waard!

De laatste tijd is de aio-groep uitgegroeid tot monsterlijke proporties. Omdat ik het belangrijk vind om jullie allemaal bij naam te noemen, heb ik even getwijfeld om dit in een mooie tabel te zetten (daar heb ik mij van weten te weerhouden). Jullie waren allemaal op je eigen manier belangrijk voor mij. Het was heel erg prettig om zo'n vriendelijke, behulpzame en vooral leuke groep aio's om mij heen hebben, dus bij deze…. de aio's: Karin, Miriam, Eliane, Maarten, Marijn, Floor, Jessie, Arne, Charlotte, Lisa, Pieter, Ninke, Tamara, Josje, Aukje en Cécile.

En niet te vergeten de aio's waar ik mijn kamer mee deelde. David, jou wil ik bedanken voor je onnavolgbare maar oh zo treffende humor. Marianne, met jou heb ik bijna mijn hele aio-periode een kamer gedeeld. Een ideale kamergenoot. We kunnen altijd erg goed praten over werk en over van alles. Ik vind het heel fijn dat je mijn paranimf wil zijn.

Dat brengt mij meteen op mijn andere paranimf. Arjen, een hele eer dat ik getuige was op je bruiloft! Echt super om zo'n vriend te hebben. Laten we snel naar Hawaï gaan (of een kraslot kopen en er over dromen).

Verder in willekeurige volgorde: Winni en Leendert, laten we nog snel een keer een spelletje spelen of met Harmen en Judith een hersentouwtje doen. Raymond, hopelijk zie ik jou de komende tijd weer meer (dan kunnen we samen eindelijk een professor met een vogelnestje tekenen!). Lutger, een van mijn beste herinneringen van het afgelopen jaar was samen met jou pastis drinken en jeux de boules spelen. Aernout, jij betekent veel voor mij en al weet ik niet of ik moet kiezen voor biefstuk of sushi, ik weet wel dat er een slechte film bij hoort! En over films gesproken. Ik wil toch eigenlijk ook alle slechte films en in het bijzonder alle slechte horrorfilms bedanken. Karlijn en Judith, bedankt voor alle mooie poortjes bij de vierdaagse. Hans, jij staat altijd voor iedereen klaar, super om jou als vriend te hebben en Indra dit geldt natuurlijk ook voor jou, ik vind hoe jij in het leven staat echt geweldig.

Ook het goa-groepje wil ik noemen. Ik zie jullie niet altijd even vaak, maar vind jullie een bijzonder groep mensen. En hoe je het wendt of keert, ik ben nog nooit een groep mensen tegen gekomen die zo goed kan feesten! Pitrik, ik wil jou speciaal noemen, gezellig dat je zo vaak over de vloer komt. En nu ik toch bezig ben. Floor en Jorie, komen jullie nog vaker langs? Misschien weer een keer Thais eten?... of toch Indiaas?

En dan nog de familie Laurant. Jullie zijn allemaal altijd hartstikke aardig voor mij! Heel gezellig om steeds weer bij jullie op bezoek te komen. En Charlie & Kristian, als jullie een beetje kunnen lopen, neem ik jullie samen met Benjamin mee naar de dierentuin!

Al mijn ooms en tantes, neven en nichten wil ik bedanken voor de leuke kerst en vooral voor hemelvaart. Ton en Ank: fijn dat jullie mijn ouders zijn. Een warm nest is niet iedereen gegeven, maar mij wel. Bram, mijn medeonderzoeker: ik vind het heerlijk om met jou te praten over multilevel of gewoon over het leven. Theresa, nice that you live in Amsterdam now; it is only sad (for me) that you two will move to Berlin. Lotte, jij bent een superzusje. Ik kan altijd heerlijk met je lachen en ik vind het bijzonder dat onze band het afgelopen jaar sterker is geworden.

En Lonnie… jij bent gewoon geweldig… en ontzettend leuk…. en …lief… en…. alles!

Jaap

Curriculum Vitae

Curriculum Vitae

Jaap Lancee was born on January 21st 1980. He finished his master thesis about nightmares at Utrecht University in 2005. In April 2006, Jaap started a research project about nightmares financed by the 'Fonds Psychische Gezondheid', which was continued in 2007 for an additional two years. From February 2009 until April 2011, he was a PhD student at Utrecht University. From February 2006 until February 2009 he supervised bachelor theses and was teaching courses in psychology at Utrecht University. In September 2009 he started the VGCt traject for cognitive-behavioral therapist and since January 2010 he is working as a cognitive-behavioral therapist at the Ambulatorium of the Faculty of Social Sciences at Utrecht University. Recently he acquired funding (together with Prof. dr. Jan van den Bout & Prof. dr. Marjolijn Sorbi) that covers a two-year post-doc position concerning an advanced internet application for the treatment of insomnia.

Personal website: www.jaaplancee.com

Publications

Lancee, J. Spoormaker, V.I., & van den Bout. (in press). Long-term effectiveness of cognitive-behavioural self-help treatment for nightmares. *Journal of Sleep Research*

Lancee, J., van den Bout, J., & Spoormaker, V.I. Expanding self-help Imagery Rehearsal Therapy for nightmares with sleep hygiene and lucid dreaming: A waiting-list controlled trial (2010). *International Journal of Dream Research 3,* 111-120.

Lancee, J., Spoormaker, V. I., & van den Bout, J. (2010). Cognitive-behavioral self-help treatment for nightmares: A randomized controlled trial. *Psychotherapy and Psychosomatics*, 79, 371-377.

Lancee, J., Spoormaker, V.I., & van den Bout, J. (2010). Nightmare frequency is associated with subjective sleep quality but not with psychopathology. *Sleep and Biological Rhythms*, 8, 187-193.

Lancee, J., Spoormaker, V. I., Krakow, B., & van den Bout, J. (2008). A systematic review of cognitive-behavioral treatment for nightmares – toward a well-established treatment. *Journal of Clinical Sleep Medicine*, 4, 475-480.

Lancee, J., Spoormaker, V. I., Peterse, G., & van den Bout, J. (2008). Measuring nightmare frequency: Retrospective questionnaires versus prospective logs. *The Open Sleep Journal*, 1, 26-28.

In revision

Lancee, J., Spoormaker, V.I., van Straten, A., & van den Bout, J. (in revision). Internet-delivered self-help therapy for insomnia compared to bibliotherapy: A randomized waiting-list controlled trial. *Journal of Consulting and Clinical Psychology.*

Participation in successful grant applications

2011 The development of an advanced internet application for the treatment of insomnia
Innovatiefonds Zorgverzekeraars (€49.947)

2011 An advanced internet application for the treatment of insomnia: A randomized controlled trial
Fonds Psychische Gezondheid (€50.000)

2006 Self-help treatment for nightmares: A randomized controlled trial
Fonds Psychische Gezondheid (€50.000)

2006 Development of a nightmare protocol and nightmare website
Fonds Psychische Gezondheid (€15.000)

Popular-scientific websites

www.nachtmerries.org (Dutch website about nightmares)
www.allesoverdromen.nl (Dutch website about dreaming)
www.insomnie.nl (Dutch website about insomnia)
www.slaapproblemen.org (Dutch website about sleep disorders)