Available online at www.sciencedirect.com

ScienceDirect

Behavior Therapy xxx (2022) xxx–xxx

Behavior Therapy

www.elsevier.com/locate/bt

The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism

Anna F. Johann
University of Freiburg

Bernd Feige
University of Freiburg

Elisabeth Hertenstein
Christoph Nissen
University of Bern

Fee Benz
Lisa Steinmetz
Chiara Baglioni
Dieter Riemann
Kai Spiegelhalder [1]
University of Freiburg

Umair Akram [1]
Sheffield Hallam University, University of Lincoln

Perfectionism is related to insomnia and objective markers of disturbed sleep. This study examined whether multidimensional perfectionism is related to dysfunctional beliefs about sleep, sleep-effort, pre-sleep arousal, and polysomnography-determined markers of sleep among individuals with insomnia. The effects of cognitive behavioral therapy for insomnia (CBT-I) on perfectionism was also examined. This was a secondary analysis of a randomized controlled trial on CBT-I. Forty-three insomnia patients were randomized to treatment (receiving CBT-I) or waitlist control groups. Sleep was recorded using polysomnography at baseline. Participants completed measures of perfectionism, dysfunctional beliefs about sleep, sleep-effort and pre-sleep arousal at baseline and posttreatment. Total perfectionism scores and doubts about action, concern over mistakes and personal standards were each significantly related to increased sleep effort, pre-sleep arousal and dysfunctional beliefs about sleep at baseline. Patients receiving treatment displayed increased total perfectionism scores posttreatment $d = .49$. In those receiving treatment, levels of organization $d = .49$ and parental expectations $d = .47$ were significantly increased posttreatment, relative to baseline. In line with the literature, our results confirm that perfectionism is related to insomnia. Here, insomnia was related to increased sleep effort, pre-sleep arousal and dysfunctional beliefs about sleep. The

This study was supported by a grant of the German Heart Foundation (DRKS00007128).
Conflict of interest: This was not an industry sponsored study. We received funding from the German Heart Research Foundation. Dr. Nissen reports personal fees from Lundbeck and Vifor, outside the submitted work. Dr. Akram, Dr. Baglioni, Ms. Benz, Dr. Feige, Dr. Hertenstein, Ms. Johann, Ms. Steinmetz, Dr. Riemann, and Dr. Spiegelhalder have nothing to disclose.
Address correspondence to Umair Akram, Ph.D., Sheffield Hallam University, Collegiate Crescent, Sheffield, South Yorkshire, S10 2BP, UK. e-mail: umair.akram@some.ox.ac.uk.
[1] These authors contributed equally.

propensity to maintain a high standard of order and organization may be elevated following CBT-I, considering the treatment protocol expects patients to strictly adhere to a set of clearly defined rules. Levels of parental expectations may be increased following CBT-I since the patient-therapist-relationship may trigger implicit expectations in patients which are reminiscent of their relationship to their parents.

Keywords: personality; perfectionism; objective sleep; insomnia; polysomnography

THE EXPERIENCE OF PERFECTIONISM, defined as a disposition for excessive critical self-evaluation and high standards for oneself (Frost et al., 1990), plays a crucial predisposing and perpetuating role in relation to many psychiatric disorders, including anxiety, depression, disordered eating, and insomnia (Bardone-Cone et al., 2007; Egan et al., 2011; Hewitt et al., 1991). According to cognitive models of perfectionism, intrusive thoughts (e.g., perfectionistic, self-critical and/or procrastinatory), worry (e.g., hopelessness, negative future outlooks), and rumination (e.g., past mistakes and failures, anger-related, work-related) related to perfectionistic strivings may increase the vulnerability of new-onset, or accentuation of preexisting, psychiatric difficulties among perfectionistic individuals (Arpin-Cribbie & Cribbie, 2007; Flaxman et al., 2012; Flett et al., 2012, 2016, 2018; O'Connor et al., 2004). Here, worry and rumination emerge due to an inherent yet unrealistic need to be perfect in all aspects of daily life as a means of compensating for underlying feelings of self-doubt, shame, perceived humiliation, and unworthiness (Flett et al., 2018). With that in mind, this line of thought may certainly elicit psychological and physiological stress, which feeds back to accentuate worry and rumination in a cyclical manner (Flett et al., 2016, 2018).

In the context of insomnia, perfectionistic individuals are theorized to display a propensity to be overly concerned with the daytime consequences of acute sleep-loss (e.g., fatigue, impaired concentration) (Lundh & Broman, 2000; Randles et al., 2010). In the evening—and, more specifically, the pre-sleep period—this may fuel a negative thought cycle comprised of worry, rumination, and dysfunctional beliefs concerning sleep, resulting in increased pre-sleep arousal. In turn, this may eventually lead to sleep initiation and maintenance difficulty, facilitating the transition from an acute to chronic sleep disturbance (Lundh & Broman, 2000). In support of this notion, specific aspects of perfectionism have been frequently associated with poor sleep and insomnia (Akram et al., 2015, 2017, 2020; Azevedo et al., 2010; Jansson-Fröjmark & Linton, 2007; Johann et al., 2017; Lundh et al., 1994; Vincent & Walker, 2000).

According to Frost and colleagues (1990), six dimensions characterize the construct of perfectionism: the propensity to be concerned over and react negatively to mistakes (concern over mistakes); the propensity to doubt one's own performance and actions (doubts about action); the perception that one's parents have high expectations of them (parental expectations); the perception that one's parents are overly critical towards them (parental criticism); the propensity to maintain a high standard of order and organization (organization); and the propensity to set and maintain high personal standards (personal standards).

Mixed outcomes have been reported concerning which aspects of perfectionism are specifically related to poor sleep and insomnia, which is possibly explained by varying methodologies, scale choices, and samples (e.g., general population vs. clinical patients). Elevated levels of doubts about action, concern over mistakes, parental criticism, personal standards, and socially prescribed perfectionism have related to the experience of poor sleep (Akram et al., 2015, 2017, 2020; Azevedo et al., 2010; Faber & Schlarb, 2018; Jansson-Fröjmark & Linton, 2007; Johann et al., 2017; Lundh et al., 1994; Maia et al., 2011; Raft, 2013; Vincent & Walker, 2000). However, to date, only three studies (each approximately a decade apart) have sampled individuals meeting the diagnostic criteria for insomnia, evidencing elevated levels of doubts about action, concern over mistakes, parental criticism and personal standards when compared with normal sleepers (Akram et al., 2017; Lundh et al., 1994; Vincent & Walker, 2000). Relatedly, several studies have observed perfectionistic-like behavior in patients with insomnia (Petrov et al., 2019; Regen et al., 2015; Schmidt et al., 2018). Longitudinal research further highlights the role of perfectionism in the etiology of insomnia. Here, Jansson-Fröjmark and Linton (2007) demonstrated that concern over mistakes appears to be significantly related to preexisting and future insomnia, characterized by sleep initiation or maintenance difficulties. Moreover, in a sample of French-Canadian cancer patients, Trudel-Fitzgerald et al. (2017) evidenced symptoms of insomnia to predict increased levels of perfectionistic doubts and concerns after 2 months. Using Hewitt and Flett's conceptualization of perfectionism, socially prescribed perfectionism appears (i.e., belief that others hold high standards for oneself) to be a reliable predictor of sleep disturbance over time (Azevedo et al., 2010). More

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

recently, the relationship between perfectionism and insomnia has been reported to be mediated by emotional distress (Jansson-Fröjmark & Linton, 2007; Lin et al., 2019), stress perception and emotion regulation (Brand et al., 2015; Molnar et al., 2020), counterfactual thinking (Richardson & Gradisar, 2020; Schmidt et al., 2018), symptoms of anxiety, and dysfunctional sleep-related cognition (Akram et al., 2020). Similarly, the relationship between sleep initiation difficulties and depressive symptoms has been mediated by overall perfectionism levels and repetitive negative thinking in young adults (Huang et al., 2020).

While these studies provide a seminal understanding of the insomnia-perfectionism relationship, they are limited to self-reported measures of sleep. To that end, Johann and colleagues (2017) used polysomnography to determine the extent to which perfectionism was related to specific parameters of sleep continuity across two nights in a laboratory setting. Here, increased perfectionism was related to an increased number of awakenings on the first night. More specifically, while concern over mistakes and personal standards was both related to a reduced total sleep time and greater number of awakenings, parental criticism and expectations were solely related to greater number of awakenings. These outcomes objectively support previous work highlighting aspects of perfectionism to be related to disturbed sleep. Still, it remains unclear if these outcomes are specifically characteristic of insomnia.

Studies examining the perfectionism-insomnia relationship theoretically highlight the potential of cognitive behavioral therapy for insomnia (CBT-I) in attenuating adverse perfectionistic tendencies (Akram, 2018; Johann et al., 2017, 2018). CBT-I is the most effective treatment, according to current guidelines, and comprises sleep hygiene education, relaxation training, cognitive therapy as well as sleep restriction and stimulus control therapy (Riemann et al., 2017). Here, correcting dysfunctional beliefs about sleep and reducing behavioral efforts to perfect sleep may alter the sleep-specific nature of perfectionistic thoughts (Akram, 2018, Johann et al., 2017). Against this background, CBT-I might not only improve sleep, but also serve to alter the patient experience of perfectionistic tendencies through the duration of treatment, while also influencing treatment outcomes. In particular, greater levels of organization and personal standards perfectionism may facilitate more effective and accurate engagement with treatment protocols. Alternatively, doubts and concerns about past and future behavior could possibly reduce treatment efficacy following increased worry and rumination about the nature of CBT-I (e.g., possible detriments of sleep restriction and concerns with daytime performance).

In the present study, we investigated the potential: (a) relationships between multidimensional perfectionism with dysfunctional beliefs about sleep, behavioral sleep-effort and pre-sleep arousal; (b) relationships between perfectionism and polysomnography determined markers of sleep among individuals with insomnia; (c) alterations in perfectionism levels following a randomized controlled trial testing cognitive behavioral therapy for insomnia. Given the previous longitudinal relationships between insomnia and multidimensional perfectionism (i.e., Akram et al., 2015), it was hypothesized that insomnia symptom severity, dysfunctional beliefs about sleep, sleep-effort and pre-sleep arousal would be related to increased doubts about action, concern over mistakes, parental criticism, and personal standards at baseline. Next, considering perfectionistic tendencies appear to be differentially related to objective parameters of sleep continuity (Johann et al., 2018), similar outcomes were expected. However, as the second study to examine the relationship between perfectionism and objective measures of sleep continuity, no a-priori hypotheses were made concerning these relationships. Similarly, as the first study to examine whether CBT-I alters levels of perfectionism following the successful completion of treatment, no a-priori hypotheses were made for this exploratory aim.

Method

This was a secondary analysis of a randomized controlled trial on CBT-I (see Johann et al., 2020). This randomized controlled trial was designed to investigate the effects of CBT-I on early markers of cardiovascular disease. The primary outcome was the average systolic blood pressure as measured by 24-hour ambulatory assessments. The trial was conducted in accordance with the Declaration of Helsinki and was registered in the German Clinical Trials Register (https://www.drks.de/drks_web/; DRKS00007128). The study protocol was approved by the Institutional Review Board of the University Medical Centre Freiburg. Written informed consent was obtained from all patients prior to any examination.

PARTICIPANTS

The study sample comprised of 43 patients ($M = 41.1$, $SD = 14.5$ years: 63% female; CBT-I group: 40.8 ± 14.0 years, 61% female; waiting list control group: $M = 41.2$, SD 15.1 years, 65% female) diagnosed with insomnia disorder according to the DSM-5 criteria (American Psychiatric

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

Association, 2013). All patients were referred to the outpatient sleep clinic at the Department of Psychiatry and Psychotherapy at the University of Freiburg Medical Centre by a medical specialist or primary care provider. In the sleep clinic, the diagnosis of insomnia disorder was made by a board-certified psychiatrist with a specialization in sleep medicine. Only patients with an age between 18 and 65 years were included. Exclusion criteria were any other comorbid psychiatric or sleep disorder; intake of medication, alcohol, nicotine or other substances, if affecting sleep, in the 2 weeks before or during study participation; a sleep apnea index > 5/hour; a periodic leg movement(s) during sleep with arousal index > 5/hour; night shift work; suicidality; previous treatment with CBT-I; heart failure NYHA II-IV; heart transplants; acute infectious diseases; end-stage renal disease; and cancer.

MEASURES

The original version of the Frost Multidimensional Perfectionism Scale (FMPS: Frost et al., 1990) assesses different aspects of perfectionism. The 35-item FMPS is comprised of six components, each rated on a 5-point Likert type scale. Subscale scores range as follows: concern over mistakes (CM) 9-45; doubts about action (DA) 4-20; parental expectations (PE) 5-25; parental criticism (PC) 4-20; organization (ORG) 6-30; and personal standards (PS) 7-35. Higher scores represent a greater tendency towards perfectionism. Previous examination of the psychometric properties suggests the FMS to present an acceptable degree of internal consistency, test-retest reliability, and concurrent validity across each subscale (Frost et al., 1990; Frost et al., 1993; Van den Berg et al., 2002). Internal consistency assessment in the current sample yielded a Cronbach's α of .92 for the subscale CM; .85 for DA; .92 for PE; .82 for PC; .90 for ORG; and .90 for PS.

Insomnia symptoms were assessed using the Insomnia Severity Index (ISI: Bastien et al., 2001). The ISI comprises 7 items examining the severity of insomnia symptoms over the past 2 weeks, including difficulty initiating and maintaining sleep and awakening too early. Items are rated on a 5-point Likert scale, with total scores ranging from 0–28. Higher scores represent greater insomnia severity. The ISI has previously demonstrated an acceptable degree of internal consistency, predictive validity, and concurrent validity (alpha = 0.76–0.78: Bastien et al., 2001). Assessment of internal consistency in the current sample yielded a Cronbach's alpha of .76.

The Glasgow Sleep Effort Scale (GSES; Broomfield & Espie, 2005) is a 7-item self-report questionnaire reflecting a patient's preoccupation with sleep (e.g., "I put too much effort into sleeping when it should come naturally"). Total scores range from 0 to 14, with higher scores indicating greater sleep effort over the past week. The scale has demonstrated an adequate level of internal consistency (alpha = .77: Broomfield & Espie, 2005; Hertenstein et al., 2015). Assessment of internal consistency in the current sample yielded a Cronbach's alpha of .83.

The 16-item version of the Dysfunctional Beliefs and Attitudes About Sleep Scale (DBAS: Morin et al., 2007) assesses sleep-related cognitions. More specifically, beliefs related to consequences of poor sleep, beliefs related to worry/helplessness about insomnia and its effects, beliefs related to expectations about sleep, and beliefs about medication use. Items are scored on a scale ranging from 0 (*strongly disagree*) to 10 (*strongly agree*). The total score for the measure is calculated as the average item score, such that DBAS total scores range from 0 to 10. Higher scores indicate greater dysfunctional beliefs. The DBAS previously demonstrated an adequate degree of internal consistency (alpha = .91), concurrent validity, and test-retest reliability (Espie et al., 2000; Hertenstein et al., 2015; Vand et al., 2014). Assessment of internal consistency in the current sample yielded a Cronbach's alpha of .87.

Finally, the Pre-Sleep Arousal Scale (PSAS: Nicassio et al., 1985) is a 16-item self-report scale that assesses somatic (PSAS-S: e.g., "heart racing, pounding or beating irregularly") and cognitive (PSAS-C: e.g., "worry about falling asleep") arousal prior to sleep. Participants must rate the extent to which they experienced each item while attempting to fall asleep in the past week from 1 (*not at all*) to 5 (*extremely*). All items are summated to create the composite score, ranging from 16–80. Likewise, the eight items of each subscale are also summated, where scores for each range from 8–40. Higher scores represent greater levels of arousal. The PSAS has previously yielded acceptable levels of internal consistency for both the somatic (alpha = .76) and cognitive scales (alpha = .81: Nicassio et al., 1985; Hertenstein et al., 2015). The assessment of internal consistency in the current sample yielded a Cronbach's alpha of .81 for the composite score, and .42 for the PSAS-S and .92 for the PSAS-C subscales.

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

POLYSOMNOGRAPHY

As part of the screening procedure, all patients underwent two consecutive nights of polysomnography (PSG) sleep monitoring. On the days prior to these nights, they had to refrain from caffeine and alcohol. Sleep was recorded for 8 hours from 22:09 h ± 20 min until 6:09 h ± 20 min adjusted to individual habitual bedtimes. The first night was used as an adaptation and screening night and the second night for the assessment of sleep parameters. All recordings included EEG (C3-A2; C4-A1), EOG (horizontal and vertical) and EMG (submental) and were scored visually by experienced raters according to the AASM criteria (Silber et al., 2007). All patients were screened for apneas and periodic leg movements by monitoring abdominal and thoracic effort, nasal airflow, oximetry, and bilateral tibialis anterior EMG. Sleep recordings were evaluated for the following parameters: total sleep time (TST); sleep onset latency defined as time from lights out until sleep onset (defined as first epoch of stage 2); wake after sleep onset (WASO) defined as difference between sleep period time (SPT; time from sleep onset until final awakening) and TST; number of awakenings; sleep efficiency (ratio of TST to time in bed); arousal index (per hour); sleep apnea index (per hour); periodic leg movements during sleep with arousal index (per hour); stages 1, 2, slow wave sleep (SWS) and rapid eye movement sleep (REM) as percentages of SPT.

COGNITIVE BEHAVIORAL THERAPY FOR INSOMNIA

The manualized CBT-I intervention consisted of 8 weekly individual sessions lasting 50 minutes each. The treatment comprised sleep hygiene education, relaxation training, sleep restriction therapy, stimulus control therapy, and cognitive therapy. Sleep hygiene education involved general information about sleep and insomnia, including the so-called "sleep hygiene rules" about health practices (e.g., exercise, substance use) and environmental factors (e.g., light, noise, temperature) that may promote or interfere with sleep. Relaxation therapy included progressive muscle relaxation and autogenic training. Sleep restriction therapy was based on continuous sleep diary data. The initial sleep window was generated using the average total sleep time of 7 days of sleep diary data. The window was positioned according to patient preference. The minimum time in bed was 4 hours. On a weekly basis, time in bed was either increased by 30 min when sleep efficiency was >90% or decreased by 30 min when sleep efficiency was <80% and remained the same when sleep efficiency was 80–90%. Stimulus control therapy was used as described in Bootzin (1972). Cognitive elements included cognitive restructuring, constructive worry, and paradoxical intention. CBT-I was delivered by a male psychologist, who is also a medical doctor, and a female psychologist; both were trained and supervised by an experienced clinical psychologist and accredited supervisor.

PROCEDURE

At baseline (T0), all patients completed the FMPS, ISI, GSES, DBAS and PSAS. Following this, patients were randomized using age-, gender- and ISI-stratified randomization with sealed opaque envelopes. The cut-off values for ISI stratification and age were set at 16.5 and 41 years, respectively. At this point, those allocated to CBT-I received treatment over an 8-week period as outlined above. Finally, all questionnaire measures were again completed by both groups at T1. For ethical reasons, patients in the waiting list control condition received CBT-I after T1.

STATISTICAL ANALYSES

All analyses were carried out using IBM SPSS v.24.0 (IBM Corp., Armonk, NT, USA). Descriptive presentation of the data includes mean values and standard deviations. Correlational analyses (Pearson's bivariate) examined possible relationships between perfectionism and subjective measures of sleep (ISI, GSES, DBAS, PSAS). This approach was also used to examine the relationship between perfectionism and PSG-determined sleep continuity and sleep architecture parameters. Afterwards, for each perfectionism variable (FMPS total and subscale scores; independent variable) and PSG parameter (see "Polysomnography" in Methods; dependent variable), a linear regression analysis was conducted. Finally, a series of 2 (group: treatment vs. waiting list) × 2 (time: T0 vs. T1) Bonferroni corrected repeated measures ANOVAs were employed with each perfectionism subscale as dependent variables. In addition, Klauers d (Klauer, 2001) was used to calculate the effect size of each interaction. This was to examine CBT-I effects on perfectionism. Simple effects analyses were performed to decompose each interaction. Cohen's d was used to calculate within-subjects' effect sizes relating to alterations in perfectionism between time points (Cohen, 1992). Significance was considered at the $p < 0.05$ level in all analyses. However, a Bonferroni correction to the alpha level was performed for the hypothesized baseline associations concerning perfectionism and sleep-related variables. More specifically, the initial 0.05 alpha level was divided by the number of tests performed ($N = 12$). Here, the corrected significance level was $p < .0042$.

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

Results

BASELINE ASSOCIATIONS BETWEEN PERFECTIONISM AND SUBJECTIVE SLEEP-RELATED VARIABLES

Total FMPS scores and the subscales of doubts about action, concern over mistakes, and personal standards were each significantly related to increased reports of behavioral sleep effort, both somatic and cognitive arousal, and dysfunctional beliefs and attitudes about sleep. No perfectionism subscales were significantly related to insomnia severity. No other correlations were statistically significant at the $p < .05$ level. After correcting for multiple comparisons, the relationships between total FMPS scores and the subscales of doubts about action, concern over mistakes and personal standards were no longer significantly related to dysfunctional beliefs and attitudes about sleep. In addition, somatic arousal was no longer related to total FMPS scores. That said, the remaining aforementioned relationships remained statistically significant at the $p < .0042$ level (see Table 1).

BASELINE ASSOCIATIONS BETWEEN PERFECTIONISM AND POLYSOMNOGRAPHY-DETERMINED SLEEP

Polysomnographic data of the sample are presented in Table 2. Specifically, the extent of WASO was negatively related to Total FMPS scores, personal standards, and an overconcern with mistakes, whereas TST and SE were positively related to personal standards. Finally, increased AHI scores were related to reduced levels of organization. No other correlations were statistically significant (see Table 3).

CBT-I EFFECTS ON PERFECTIONISM

Mean FMPS, ISI, GSES, PSAS, and DBAS scores at T0 and T1 for both treatment and waiting list control groups are presented in Table 4.

TOTAL FMPS SCORE

The results demonstrated a significant effect of group $F_{1,41} = 779.26$, $p = .021$ and Group × Time

Table 2
Polysomnography Data at Baseline

Variable	Mean ± SD
TST, minutes	401.4 ± 38.2
SOL, minutes	19.9 ± 12.2
WASO, minutes	45.8 ± 28.8
NWAK, minutes	25.4 ± 7.0
SE (%)	83.7 ± 8.0
AHI, events/h	0.3 ± 0.5
AI, events/h	14.5 ± 5.7
PLMS index, events/h	31. 7 ± 60.6
Stage N1 Sleep, % SPT	34.4 ± 14.9
Stage N2 Sleep, % SPT	54.2 ± 7.3
SWS, % SPT	9.8 ± 7.4
REM Sleep, % SPT	18.2 ± 5.2

Note. PSG data from second night.
TST = Total sleep time, SOL = Sleep onset latency, WASO = -Wake after sleep onset, NWAK = Number of awakenings, SE = Sleep efficiency, AHI = Apnoea hypopnea index, AI = Arousal index, PLMS = Periodic leg movements during sleep, SWS = Slow wave sleep, REM = Rapid eye-movement.

Table 1
Correlations Between Subjective Measures at Baseline

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. ISI	–										
2. GSES	.27	–									
3. PSAS-S	.02	.71**	–								
4. PSAS-C	.05	.68**	.63**	–							
5. DBAS	.36*	.65**	.39*	.58**	–						
6. Total FMPS	−.19	.51**,◆	.42**	.58**,◆	.36*	–					
7. DA	−.13	.62**,◆	.46**,◆	.54**,◆	.49**,◆	.72**	–				
8. CM	−.14	.54**,◆	.44**,◆	.53**,◆	.38*	.87**	.66**	–			
9. PS	−.17	.48**,◆	.45**,◆	.52**,◆	.31*	.80*	.48**	.62**	–		
10. ORG	−.15	.10	.09	.23	.14	.35*	.10	.17	.37*	–	
11. PE	−.05	.16	.13	.25	.06	.65**	.30*	.40**	.43**	−.04	–
12. PC	−.11	−.06	−.09	.13	.01	.50**	.33*	.37*	.10	−.11	.54**

Note. ISI = Insomnia Severity Index, GSES = Glasgow Sleep Effort Scale, PSAS-S = Pre-Sleep Arousal Scale (somatic arousal), PSAS-C = Pre-Sleep Arousal Scale (cognitive arousal), DBAS = Dysfunctional Beliefs and Attitudes about Sleep Scale, Total FMPS = Total Frost Multidimensional Perfectionism Scale Scores, DA = Doubts about action, CM = Concern over mistakes, PS = Personal standards, ORG = Organization, PE = Parental expectation, PC = Parental criticism.
* Sig at < .05.
** <.01.
◆ <.0042.

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

Table 3
Correlations Between Polysomnographic Measures and F-FMPS Scores and Subscales at Baseline

	Total FMPS	DA	CM	PS	ORG	PE	PC
TST	.21	−.07	.28	.32*	.10	.10	−.13
SOL	.05	.24	.01	.00	.17	−.19	.07
WASO	−.31*	−.07	−.37*	−.39*	−.01	−.16	.05
NWAK	−.03	−.03	−.05	−.05	.08	.01	.05
SE	.23	−.04	.30	.34*	.10	.10	−.15
AHI	−.16	−.17	−.02	−.13	−36*	−.04	−.07
AI	−.09	−.13	−.11	−.19	.14	.02	.04
PLMS	−.29	−.27	−.24	−.13	−.14	−.24	−.22
N1	−.11	−.14	−.13	−.14	.07	−.02	.01
N2	.18	.11	.16	.17	−.01	.16	.06
SWS	.14	.11	.18	.26	−.12	.11	−.15
REM	−.02	−.17	.04	−.04	.15	−.16	.05

Note. TST = Total sleep time (minutes), SOL = Sleep onset latency (minutes), WASO = Wake after sleep onset (minutes), NWAK = Number of awakenings, SE = Sleep efficiency %/100, AHI = Apnoea hypopnea index (events/h), AI = Arousal index (events/h), PLMS = Periodic leg movements during sleep (events/h), N1 = Stage N1 Sleep (% SPT), N2 = Stage N2 Sleep (% SPT), SWS = Slow wave sleep (% SPT), REM = Rapid eye-movement sleep (% SPT), Total FMPS = Total Frost Multidimensional Perfectionism Scale Scores, DA = Doubts about action, CM = Concern over mistakes, PS = Personal standards, ORG = Organization, PE= Parental expectation, PC = Parental criticism.PSG data from second night.
**<.01.
* Sig at <.05.

interaction $F_{1,41} = 4.80$, $p = .034$; Klauer's $d = .34$ concerning total FMPS scores. No effect of time $F_{1,41} = 0.25$, $p = .295$ was observed. Paired samples t-tests determined significantly increased levels of total FMPS amongst those in the treatment, $t_{23} = -2.35$, $p = .028$; Cohen's $d = .49$, but not control group $t_{20} = -0.94$, $p = .358$; $d = .23$ at T1, relative to T0 (Table 5).

DOUBTS ABOUT ACTION

The results revealed a significant Group × Time $F_{1,41} = 4.75$, $p = .035$; $d = .35$ concerning doubts about action. However, no significant main effects of group $F_{1,41} = 0.86$, $p = .355$ and time $F_{1,41} = 2.71$, $p = .107$ were found. Paired samples t-tests and effect size calculations determined reduced levels of doubts about action amongst

Table 4
Psychometric Data

	Treatment		Control		Treatment x Time		Effect Size□
Questionnaire	Pre	Post	Pre	Post	F	P	
ISI	15.4 ± 4.3	6.5 ± 3.8	14.5 ± 5.1	13.2 ± 4.6	31.33	.001**	1.79
GSES	6.8 ± 3.7	3.0 ± 1.9	6.3 ± 4.0	6.1 ± 3.3	65.12	.001**	1.30
PSAS-S	12.4 ± 3.3	10.2 ± 2.4	12.7 ± 3.4	11.7 ± 4.7	1.14	.291	.32
PSAS-C	20.8 ± 8.7	14.7 ± 4.5	22.3 ± 8.6	21.1 ± 9.5	7.26	.010*	.71
DBAS	4.5 ± 1.9	2.6 ± 1.3	4.8 ± 1.7	4.5 ± 1.7	15.92	.001**	1.10
FMPS (Total)	88.1 ± 25.8	92.7 ± 21.8	92.9 ± 20.8	89.9 ± 18.5	4.80	.034*	.34
DA	8.6 ± 4.1	8.8 ± 3.7	10.5 ± 4.4	9.2 ± 4.2	4.75	.036*	.35
CM	19.2 ± 9.2	19.7 ± 8.2	18.7 ± 17.9	24.6 ± 27.7	0.87	.355	.28
PS	18.8 ± 6.4	19.9 ± 5.5	20.5 ± 7.2	23.4 ± 15.6	0.36	.552	.06
ORG	22.9 ± 4.8	23.9 ± 3.7	23.7 ± 4.1	32.1 ± 38.0	1.00	.346	.14
PE	9.7 ± 5.5	11.0 ± 5.9	9.55 ± 5.2	10.1 ± 5.2	1.01	.320	.13
PC	7.1 ± 4.3	7.6 ± 4.4	8.3 ± 3.4	17.2 ± 41.8	1.00	.328	.03

Note. Results depict means ± standard deviations. ISI = Insomnia Severity Index, GSES = Glasgow Sleep Effort Scale, DBAS = Dysfunctional Beliefs and Attitudes about Sleep Scale, PSAS-S = Pre-Sleep Arousal Scale (somatic arousal), PSAS-C = Pre-Sleep Arousal Scale (cognitive arousal), FMPS = Frost Multidimensional Perfectionism Scale, DA = Doubts about action, CM = Concern over mistakes, PS = Personal standards, ORG = Organization, PE = Parental expectation, PC = Parental criticism.
□ = Klauer's *d*.
* Sig at <.05.
** <.01

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

Table 5
Paired *t*-Tests for Each Group Examining Levels of Perfectionism at Baseline and Posttreatment

Treatment Group:	Pre	Post	*t*	P	Cohen's *d*
FMPS (Total)	88.1 ± 25.8	92.7 ± 21.8	−2.35	.03*	.49
DA	8.6 ± 4.1	8.8 ± 3.7	−.46	.65	.10
CM	19.2 ± 9.2	19.7 ± 8.2	−.62	.54	.13
PS	18.8 ± 6.4	19.9 ± 5.5	−1.51	.14	.32
ORG	22.9 ± 4.8	23.9 ± 3.7	−2.37	.03*	.49
PE	9.7 ± 5.5	11.0 ± 5.9	−2.26	.03*	.47
PC	7.1 ± 4.3	7.6 ± 4.4	−1.33	.20	.28
Control Group:					
FMPS (Total)	92.9 ± 20.8	89.9 ± 18.5	1.01	.32	.23
DA	10.5 ± 4.4	9.2 ± 4.2*	2.28	.03*	.51
CM	18.7 ± 17.9	24.6 ± 27.7	−.97	.35	.22
PS	20.5 ± 7.2	23.4 ± 15.6	−.90	.38	.20
ORG	23.7 ± 4.1	32.1 ± 38.0	−1.01	.33	.23
PE	9.55 ± 5.2	10.1 ± 5.2	−.93	.37	.21
PC	8.3 ± 3.4	17.2 ± 41.8	−.97	.34	.21

Note. Significant within group pre-post change (paired samples t-test).
**<.01.
* At <.05.

those in the control $t_{20} = 2.28$, $p = .034$; Cohen's $d = .51$ but not treatment group $t_{23} = -0.46$, $p = .652$; $d = .10$ at T1, relative to T0.

CONCERN OVER MISTAKES

The results demonstrated no significant effects of group $F_{1,41} = 0.35$, $p = .557$, time $F_{1,41} = 1.25$, $p = .270$ or Group × Time interaction $F_{1,41} = 0.87$, $p = .355$; $d = .28$ concerning levels of concern over mistakes. Paired samples *t*-tests determined that, for each group, no significant differences in concern over mistakes were observed at T1, relative to T0, all *p*'s = >.05.

PERSONAL STANDARDS

The results demonstrated no significant effects of group $F_{1,41} = 1.16$ $p = .288$, time $F_{1,41} = 1.63$, $p = .223$ or Group × Time $F_{1,41} = 0.360$, $p = .552$; $d = .06$ concerning levels of parental standards. Paired samples *t*-tests determined that, for each group, no significant differences in personal standards were observed at T1, relative to T0, all *p*'s = >.05.

ORGANIZATION

The results demonstrated no significant effects of group $F_{1,41} = 1.15$, $p = .291$, time $F_{1,41} = 1.47$, $p = .232$ or Group × Time interaction $F_{1,41} = 1.00$, $p = .346$; $d = .14$ concerning levels of organization. Paired samples *t*-tests and effect size calculations determined significantly increased levels of organization amongst those in the treatment $t_{23} = -2.37$, $p = .027$; $d = .49$ but not control group $t_{20} = -0.93$, $p = .367$; $d = .23$ at T1, relative to T0.

PARENTAL EXPECTATIONS

The results revealed a significant main effect of time $F_{1,41} = 5.00$, $p = .031$ on levels of parental expectations. However, no main effects of group $F_{1,41} = 0.13$, $p = .717$; $d = .13$ or Group × Time interaction $F_{1,41} = 1.01$, $p = .320$; $d = .13$ were observed. Paired samples *t*-tests and effect size calculations determined significantly increased levels of parental expectation amongst those in the treatment $t_{23} = -2.26$, $p = .027$; $d = .47$ but not control group $t_{20} = -0.93$, $p = .367$; $d = .21$ at T1, relative to T0.

PARENTAL CRITICISM

The results demonstrated no significant effects of group $F_{1,41} = 1.37$, $p = .246$, time $F_{1,41} = 1.21$, $p = .277$ or Group × Time interaction $F_{1,41} = 0.98$, $p = .328$; $d = .03$ concerning levels of parental criticism. Paired samples *t*-tests determined that, for each group, no significant differences in parental criticism were observed at T1, relative to T0, all *p*'s = >.05.

Discussion

This study examined the relationship between perfectionism, dysfunctional beliefs about sleep, behavioral sleep-effort and pre-sleep arousal among individuals with insomnia; the relationship between multidimensional perfectionism and polysomnography determined markers of sleep;

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

and the alterations in perfectionism following CBT-I.

PERFECTIONISM IN RELATION TO SLEEP-RELATED COGNITION AND BEHAVIOR AT BASELINE

Several key subjective relationships were observed. Specifically, dysfunctional beliefs and attitudes about sleep were related to increased doubts (e.g., "I usually have doubts about the simple everyday things that I do") and concerns (e.g., "People will think less of me if I make a mistake") over past and future behavior, and personal standards (e.g., "I set higher goals than most people"). These observations are in line with previous work indicating dysfunctional sleep-related cognition to mediate the relationship between specific aspects of multidimensional perfectionism (i.e., doubts about action) and symptoms of insomnia in the general population (Akram et al., 2020). More crucially, validating previous theoretical postulation (Akram et al., 2020), we determined increased reports of behavioral sleep effort among those presenting perfectionistic tendencies relating to personal standards, doubts about action, and an overconcern with making mistakes. Finally, increased somatic and cognitive pre-sleep arousal was observed in those reporting increased perfectionistic personal standards, and doubts and concerns.

Increased pre-sleep arousal stemming from worry and rumination during the pre-sleep period has previously been theorized to occur alongside particular perfectionistic tendencies (i.e., worry and doubts about one's own actions), together contributing to delayed sleep onset (Lundh et al., 1994; Randles et al., 2010; Vincent & Walker, 2000). In acute periods of sleep loss/disturbance, perfectionistic doubts and concerns may become focused on the critical evaluation of sleep and daytime dysfunction (Akram et al., 2015). When paired with dysfunctional beliefs and attitudes about sleep, critical evaluation of sleep and daytime performance in perfectionistic individuals is potentially heightened. To compensate for these deficits, cognitive and behavioral approaches may be deployed to correct or, rather, perfect sleep. As evidenced by the current data, increased behavioral sleep effort (i.e., increased time in bed, daytime napping) appears a favourable approach for those displaying perfectionistic tendencies. The current relationships between perfectionism, dysfunctional sleep-related cognition and behavioral sleep effort nevertheless highlight key treatment targets for those at risk from CBT-I dropout due to sleep-restriction therapy. Sleep restriction therapy often causes severe mental and physical side effects such as daytime sleepiness and moodiness, due to the initial sleep loss following from limited bedtimes at an early stage of treatment (Kyle et al., 2011). Certainly, an initial emphasis on cognitive behavioral CBT-I components and perhaps the role of their perfectionistic tendencies may serve to ease the patient into accepting sleep restriction therapy following initial concerns. From another perspective, normalizing behavioral sleep effort and dysfunctional beliefs and attitudes about sleep in clinical samples of normal sleeping perfectionists (e.g., as part of the CBT for perfectionism curriculum) may prevent the acute bouts of sleep disturbance from transitioning to insomnia disorder. Nevertheless, it is relevant to note that neither total FMPS scores nor subscales were associated with insomnia severity. This raises the question whether perfectionism is epiphenomenal to insomnia disorder itself, irrespective of symptom severity.

PERFECTIONISM AND OBJECTIVE SLEEP CONTINUITY IN INSOMNIA

The current outcomes yielded positive relationships between objectively recorded sleep continuity and multidimensional perfectionism. More specifically, total perfectionism scores were significantly related to reduced wake after sleep onset. When exploring individual dimensions, levels of personal standards were significantly related to increased total sleep time and sleep efficiency, but reduced wake after sleep onset. Concerns over mistakes were also related to reduced wake after sleep onset. Interestingly, these observations directly contrast the subjective relationships evidenced between increased levels of perfectionism and reports of adverse sleep-related cognition and behavior.

In line with previous research, polysomnographic parameters of sleep continuity were significantly related to specific aspects of multidimensional perfectionism (Johann et al., 2017). However, the directional orientation of these outcomes differs between the current and previous work. In a sample of sleep-disorder patients, Johann and colleagues (2017) found total perfectionism, personal standards, and concern over mistakes to be associated with reduced NWAK and TST. The different relationships observed in the present study between dimensions of perfectionism and objective sleep may be attributed to the sampled population and the night of testing. In particular, the present study comprised of patients meeting the diagnostic criteria for insomnia disorder and utilized data recorded on

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

the second night of testing. In contrast, our prior work sampled patients experiencing various sleep and psychiatric disorder symptoms and only evidenced negative relationships between objective sleep and perfectionism on the first, but not the second night of testing (Johann et al., 2017). Against this background, perfectionism may be considered a specific feature of insomnia, rather than physiological sleep-disorders, and might require particular attention during CBT-I. Indeed, while evidence of nocturnal compulsive behaviors (i.e., eating and smoking behaviors) is seen in narcolepsy patients (Palaia et al., 2011), to the best of the authors' knowledge, no sleep disorders other than insomnia have been related to increased reports of perfectionism.

PERFECTIONISM FOLLOWING CBT-I

Against expectations, a significant interaction effect determined that patients who received treatment presented an increase in total perfectionism scores at posttreatment. It should be noted that some patients were still undergoing voluntary sleep restriction therapy, although they had already completed the set of eight sessions of CBT-I in line with the study protocol. This suggests that CBT-I may increase perfectionism in insomnia patients, at least temporarily.

Concerning the subscales of perfectionism, a significant Group Allocation × Time interaction was observed for levels of doubts about action. This effect appeared to be primarily driven by reduced doubts about action among controls awaiting CBT-I. There may be several possible explanations for this. First, the prospect of upcoming (but not immediate) treatment may attenuate negative perfectionistic tendencies, where to some extent, doubts and concerns are reduced in the hope of successful treatment. Second, levels of perfectionism appeared marginally higher in this group at baseline but not follow-up. Considering this, reports of perfectionism in insomnia may be subject to substantial variability over time. While no other interactions were demonstrated, additional group-level changes in specific aspects of perfectionism were observed. In those receiving treatment, levels of organization (e.g., "I try to be an organized person") and parental expectations (e.g., "My parents want me to be the best at everything") were significantly increased posttreatment, relative to baseline. Here, increased levels of organization may have emerged given the structural nature of their treatment, where an emphasis on punctuality may facilitate treatment compliance. This may particularly relate to sleep restriction therapy where patients are instructed to strictly comply with a set of rules to strengthen their conditioned association between the bed and sleep. In this context, organization may be considered an adaptive trait, resources deployed when required, here for CBT-I. In contrast, increased levels of organization may represent obsessive hyper-organization typically observed in patients with insomnia (Regen et al., 2015; Spiegelhalder et al., 2012). Parental expectations are consistently elevated in the insomnia population relative to normal sleeping controls (Akram et al., 2015, 2020; Regen et al., 2015; Schmidt et al., 2018). Furthermore, insomnia symptoms are known to alter future doubts about action and perception of parental criticism in relation to perfectionism (Akram et al., 2015). This is in line with our finding that parental expectations were significantly increased posttreatment, relative to baseline. The evolving relationship between patient and therapist within CBT-I may trigger in the patient an unconscious feeling of expectations. Within CBT-I, there are indeed explicit expectations: that is, the therapist expects the patient to comply with the instructions. On the part of the patient, these expectations may implicitly allude to parental expectations to comply. This may explain elevated levels of parental expectations in our sample at posttreatment. Interestingly, patients receiving treatment failed to elicit any change in the more commonly observed perfectionistic traits linked to poor sleep and insomnia (e.g., personal standards, concerns over mistakes). These outcomes may indicate greater resilience to certain perfectionistic traits, which are considered to play a predisposing and potentially perpetuating role in the development and maintenance of insomnia (Lundh & Broman, 2000; Spiegelhalder et al., 2012). As treatment of the present sample was successful, the role of perfectionism may be considered largely predisposing, serving to accentuate the initial experience of pre-sleep arousal and behavioral sleep effort while remaining following treatment.

LIMITATIONS

Several strengths and limitations of the current study should be noted. While the current sample comprised a well-defined group of insomnia patients, this limits the generalizability of our findings since many insomnia patients suffer from comorbid conditions (Baglioni et al., 2011; Hertenstein et al., 2019). Similarly, as we failed to collect demographic data concerning participant ethnicity, education, and socioeconomic data, the current outcomes cannot be extrapolated to the wider general population of individuals pre-

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

senting with insomnia disorder. Further, the total number of participants was small. As such, we were unable to examine the possible mediating role of perfectionism in relation to treatment efficacy. In addition, this may have limited the ability to detect interaction effects at the 5% alpha while increasing the possibility of a Type I error when considering the number of statistical tests performed. However, moderate effect sizes were observed when comparing total perfectionism ($d = .49$ for treatment group), doubts about action ($d = .51$ control group), organization ($d = .49$ treatment group), personal-standards ($d = .32$ treatment group) and parental expectation ($d = .47$ treatment group) at baseline and posttreatment. Furthermore, the alpha level was corrected for the hypothesized relationships between perfectionism and sleep-related variables at baseline. Here, dysfunctional beliefs about sleep were no longer related to perfectionism at baseline. Next, only aspects of the FMPS were examined as the HF-MPS is not available in a validated German version (Hewitt & Flett, 1991a,b). Moreover, the current observations were limited to two time points (baseline and posttreatment). As such, the long-term influence of CBT-I on perfectionism remains unclear. Indeed, as perfectionism is generally considered a stable personality trait, CBT-I (and the prospect of upcoming treatment) in the current context may reflect temporary alterations in perfectionistic tendencies. It is relevant to note that total perfectionism scores are not typically calculated and reported. Furthermore, it is important to highlight the notion that dimensions related to parental perception and organization are, by some, considered peripheral background markers of perfectionistic tendencies, rather than central elements of perfectionism (Stöber, 1998). To that end, Stöber reduced the scoring of the original FMPS to yield only four dimensions based on the factor analysis of $N = 243$ university students. Here, the subscales of concern over mistakes and doubts about action were combined into a single item, whereas parental expectations and criticism were also combined. However, personal standards and organization were retained as independent dimensions.

CONCLUSIONS

In sum, we expand upon previous relationships in perfectionism and objectively determined poor sleep to a population of well-screened patients meeting the diagnostic criteria for insomnia disorder (Johann et al., 2017). In addition, the current outcomes confirm previously theorized relationships between perfectionism with pre-sleep cognitive arousal, dysfunctional beliefs about sleep, and reports of behavioral sleep effort (Akram et al., 2020). Finally, for the first time, this study examined the possible influence of CBT-I concerning reports of perfectionistic tendencies in insomnia. However, as perfectionism was unrelated to insomnia severity, future studies may investigate whether perfectionism is epiphenomenal to the insomnia experience. As organizational behavior and personal standards were elevated following CBT-I, a certain level of perfectionism may improve patient adherence and engagement with the provided treatment guidelines, improving treatment outcomes. Nevertheless, multidimensional perfectionism may remain a risk factor for relapse. To that end, CBT-I may be modified to include techniques drawn from the CBT for perfectionism literature, which target perfectionistic tendencies. Likewise, CBT for perfectionism may draw from the CBT-I curriculum in a preventative manner, with an emphasis on correcting dysfunctional beliefs about sleep, reducing pre-sleep arousal and preventing the onset of behavioral sleep efforts. Moving forward, additional studies are required to determine directional causality in the context of the current research questions: more specifically, to determine if multidimensional perfectionism alters in response to CBT-I or whether facets of perfectionism serve to influence treatment outcomes.

References

Akram, U. (2018). Objective sleep and personality. *Journal of Clinical Sleep Medicine, 14*(3), 485–486. https://doi.org/10.5664/jcsm.7010.

Akram, U., Ellis, J. G., & Barclay, N. L. (2015). Anxiety mediates the relationship between perfectionism and insomnia symptoms: A longitudinal study. *Plos One, 10*(10), e0138865. https://doi.org/10.1371/journal.pone.0138865.

Akram, U., Ellis, J. G., Myachykov, A., Chapman, A. J., & Barclay, N. L. (2017). Anxiety mediates the relationship between multidimensional perfectionism and insomnia disorder. *Personality and Individual Differences, 104*, 82–86. https://doi.org/10.1016/j.paid.2016.07.042.

Akram, U., Gardani, M., Riemann, D., Akram, A., Allen, S. F., Lazuras, L., & Johann, A. F. (2020). Dysfunctional sleep-related cognition and anxiety mediate the relationship between multidimensional perfectionism and insomnia symptoms. *Cognitive Processing, 21*(1), 141–148. https://doi.org/10.1007/s10339-019-00937-8.

American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596.

Arpin-Cribbie, C. A., & Cribbie, R. A. (2007). Psychological correlates of fatigue: Examining depression, perfectionism, and automatic negative thoughts. *Personality and Individual Differences, 43*, 1310–1320. https://doi.org/10.1016/j.paid.2007.03.020.

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

Azevedo, M. H., Bos, S. C., Soares, M. J., Marques, M., Pereira, A. T., Maia, B., Gomes, A., & Macedo, A. (2010). Longitudinal study on perfectionism and sleep disturbance. *The World Journal of Biological Psychiatry, 11*(2), 476–485. https://doi.org/10.3109/15622970903304467.

Baglioni, C., Battagliese, G., Feige, B., Spiegelhalder, K., Nissen, C., Voderholzer, U., Lombardo, C., & Riemann, D. (2011). Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. *Journal of Affective Disorders, 135*(3), 10–19. https://doi.org/10.1016/j.jad.2011.01.011.

Bardone-Cone, A. M., Wonderlich, S. A., Frost, R. O., Bulik, C. M., Mitchell, J. E., Uppala, S., & Simonich, H. (2007). Perfectionism and eating disorders: Current status and future directions. *Clinical Psychology Review, 27*(3), 384–405. https://doi.org/10.1016/j.cpr.2006.12.005.

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Medicine, 2*(4), 297–307. https://doi.org/10.1016/S1389-9457(00)00065-4.

Bootzin, R. R. (1972). Stimulus control treatment for insomnia. *Proceedings of the American Psychological Association, 7*, 395–396. https://doi.org/10.1016/B978-0-12-535606-0.50007-9.

Brand, S., Kirov, R., Kalak, N., Gerber, M., Pühse, U., Lemola, S., Correll, C., Cortese, S., Meyer, T., & Holsboer-Trachsler, E. (2015). Perfectionism related to self-reported insomnia severity, but not when controlled for stress and emotion regulation. *Neuropsychiatric Disease and Treatment, 11*, 263–271. https://doi.org/10.2147/NDT.S74905.

Broomfield, N. M., & Espie, C. A. (2005). Towards a valid, reliable measure of sleep effort. *Journal of Sleep Research, 14*(4), 401–407. https://doi.org/10.1111/j.1365-2869.2005.00481.x.

Cohen, J. (1992). Quantitative methods in psychology: A power primer. *Psychological Bulletin*, 153–159. https://doi.org/10.1037/0033-2909.112.1.155.

Egan, S. J., Wade, T. D., & Shafran, R. (2011). Perfectionism as a transdiagnostic process: A clinical review. *Clinical Psychology Review, 31*(2), 203–212. https://doi.org/10.1016/j.cpr.2010.04.009.

Espie, C. A., Inglis, S. J., Harvey, L., & Tessier, S. (2000). Insomniacs' attributions: Psychometric properties of the dysfunctional beliefs and attitudes about sleep scale and the sleep disturbance questionnaire. *Journal of Psychosomatic Research, 48*(2), 141–148. https://doi.org/10.1016/S0022-3999(99)00090-2.

Faber, J., & Schlarb, A. A. (2018). Picture perfect—how seeking perfection influences sleep and romantic relationships. *Somnologie, 22*(3), 163–167. https://doi.org/10.1007/s11818-018-0172-6.

Flaxman, P. E., Menard, J., Bond, F. W., & Kinman, G. (2012). Academics' experiences of a respite from work: Effects of self-critical perfectionism and perseverative cognition on postrespite well-being. *Journal of Applied Psychology, 97*, 854–865. https://doi.org/10.1037/a0028055.

Flett, G. L., Hewitt, P. L., Demerjian, A., Sturman, E. D., Sherry, S. B., & Cheng, W. (2012). Perfectionistic automatic thoughts and psychological distress in adolescents: An analysis of the perfectionism cognitions inventory. *Journal of Rational-Emotive and Cognitive Behavior Therapy, 30*, 91–104. https://doi.org/10.1007/s10942-011-0131-7.

Flett, G. L., Hewitt, P. L., Nepon, T., & Besser, A. (2018). Perfectionism cognition theory: The cognitive side of perfectionism. In J. Stoeber (Ed.), *The psychology of perfectionism: Theory, research, applications* (pp. 89–110). Routledge/Taylor & Francis Group. https://doi.org/10.1007/978-3-319-18582-8_6.

Flett, G. L., Nepon, T., & Hewitt, P. L. (2016). Perfectionism, worry, and rumination in health and mental health: A review and a conceptual framework for a cognitive theory of perfectionism. In F. M. Sirois & D. S. Molnar (Eds.), *Perfectionism, health, and well-being* (pp. 121–155). Springer International Publishing/Springer Nature. https://doi.org/10.1007/978-3-319-18582-8_6.

Frost, R. O., Heimberg, R. G., Holt, C. S., Mattia, J. I., & Neubauer, A. L. (1993). A comparison of two measures of perfectionism. *Personality and Individual Differences, 14*(1), 119–126. https://doi.org/10.1016/0191-8869(93)90181-2.

Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive Therapy and Research, 14*(5), 449–468. https://doi.org/10.1007/BF01172967.

Hertenstein, E., Feige, B., Gmeiner, T., Kienzler, C., Spiegelhalder, K., Johann, A., Jansson-Fröjmark, M., Palagini, L., Rücker, G., Riemann, D., & Baglioni, C. (2019). Insomnia as a predictor of mental disorders: A systematic review and meta-analysis. *Sleep Medicine Reviews, 43*, 96–105. https://doi.org/10.1016/j.smrv.2018.10.006.

Hertenstein, E., Nissen, C., Riemann, D., Feige, B., Baglioni, C., & Spiegelhalder, K. (2015). The exploratory power of sleep effort, dysfunctional beliefs and arousal for insomnia severity and polysomnography-determined sleep. *Journal of Sleep Research, 24*(4), 399–406. https://doi.org/10.1111/jsr.12293.

Hewitt, P. L., & Flett, G. L. (1991a). Dimensions of perfectionism in unipolar depression. *Journal of Abnormal Psychology, 100*(1), 98–101. https://doi.org/10.1037/0021-843X.100.1.98.

Hewitt, P. L., & Flett, G. L. (1991b). Perfectionism in the self and social contexts: Conceptualization, assessment, and association with psychopathology. *Journal of Personality and Social Psychology, 60*(3), 456–470. https://doi.org/10.1037/0022-3514.60.3.456.

Hewitt, P. L., Flett, G. L., Turnbull-Donovan, W., & Mikail, S. F. (1991). The Multidimensional Perfectionism Scale: Reliability, validity, and psychometric properties in psychiatric samples. *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 3*(3), 464–468. https://doi.org/10.1037/1040-3590.3.3.464.

Huang, I., Short, M. A., Bartel, K., O'Shea, A., Hiller, R. M., Lovato, N., Micic, G., Oliver, M., & Gradisar, M. (2020). The roles of repetitive negative thinking and perfectionism in explaining the relationship between sleep onset difficulties and depressed mood in adolescents. *Sleep Health, 6*(2), 166–171.

Jansson-Fröjmark, M., & Linton, S. J. (2007). Is perfectionism related to pre-existing and future insomnia? A prospective study. *British Journal of Clinical Psychology, 46*(1), 119–124. https://doi.org/10.1348/014466506X158824.

Johann, A. F., Hertenstein, E., Feige, B., Akram, U., Holub, F., Baglioni, C., Domschke, K., Schramm, E., Nissen, C., Kyle, S., Riemann, D., Biermann, J., & Spiegelhalder, K. (2020). Cognitive behavioural therapy for insomnia does not appear to have a substantial impact on early markers of cardiovascular disease: A preliminary randomized con-

Please cite this article as: Johann, Feige, Hertenstein et al., The Effects of Cognitive Behavioral Therapy for Insomnia on Multidimensional Perfectionism? Behavior Therapy, https://doi.org/10.1016/j.beth.2022.10.001

trolled trial. *Journal of Sleep Research, 29*(5), e13102. https://doi.org/10.1111/jsr.13102.

Johann, A. F., Hertenstein, E., Kyle, S. D., Baglioni, C., Feige, B., Nissen, C., Riemann, D., & Spiegelhalder, K. (2017). Perfectionism and polysomnography-determined markers of poor sleep. *Journal of Clinical Sleep Medicine, 13*(11), 1319–1326. https://doi.org/10.5664/jcsm.6806.

Johann, A. F., Riemann, D., & Spiegelhalder, K. (2018). Does perfectionism increase the risk for dropout from cognitive behavioral therapy for insomnia? *Journal of Clinical Sleep Medicine, 14*(3), 487–488. https://doi.org/10.5664/jcsm.7012.

Klauer, K. J. (2001). *Handbook of Cognitive Training [Handbuch kognitives Training]*. Göttingen: Hogrefe.

Kyle, S. D., Morgan, K., Spiegelhalder, K., & Espie, C. (2011). No pain, no gain: An exploratory within-subjects mixed-methods evaluation of the patient experience of sleep restriction therapy (SRT) for insomnia. *Sleep Medicine, 12*(8), 735–747. https://doi.org/10.1016/j.sleep.2011.03.016.

Lin, R. M., Xie, S. S., Yan, Y. W., Chen, Y. H., & Yan, W. J. (2019). Perfectionism and adolescent sleep quality: The mediating role of repetitive negative thinking. *Journal of Health Psychology, 24*(12), 1626–1636. https://doi.org/10.1177/1359105317693914.

Lundh, L. G., & Broman, J. E. (2000). Insomnia as an interaction between sleep-interfering and sleep-interpreting processes. *Journal of Psychosomatic Research, 49*(5), 299–310. https://doi.org/10.1016/S0022-3999(00)00150-1.

Lundh, L. G., Broman, J. E., Hetta, J., & Saboonchi, F. (1994). Perfectionism and insomnia. *Cognitive Behaviour Therapy, 23*(1), 3–18. https://doi.org/10.1080/16506079409455949.

Maia, B. R., Soares, M. J., Pereira, A. T., Marques, M., Bos, S. C., Gomes, A., Valente, J., Azevedo, M., & Macedo, A. (2011). Affective state dependence and relative trait stability of perfectionism in sleep disturbances. *Brazilian Journal of Psychiatry, 33*, 252–260. https://doi.org/10.1590/s1516-44462011000300008.

Molnar, D. S., Janssen, W. F., & Sirois, F. M. (2020). Sleeping perfectly? Trait perfectionism, perceived stress, and sleep quality. *Personality and Individual Differences, 167*, e110–244. https://doi.org/10.1016/j.paid.2020.110244.

Morin, C. M., Vallières, A., & Ivers, H. (2007). Dysfunctional beliefs and attitudes about sleep (DBAS): Validation of a brief version (DBAS-16). *Sleep, 30*(11), 1547–1554. https://doi.org/10.1093/sleep/30.11.1547.

Nicassio, P. M., Mendlowitz, D. R., Fussell, J. J., & Petras, L. (1985). The phenomenology of the pre-sleep state: The development of the pre-sleep arousal scale. *Behaviour Research and Therapy, 23*(3), 263–271. https://doi.org/10.1016/0005-7967(85)90004-X.

O'Connor, R. C., O'Connor, D. B., O'Connor, S. M., Smallwood, J., & Miles, J. (2004). Hopelessness, stress, and perfectionism: The moderating effects of future thinking. *Cognition and Emotion, 18*, 1099–1120. https://doi.org/10.1080/02699930441000067.

Palaia, V., Poli, F., Pizza, F., Antelmi, E., Franceschini, C., Moghadam, K. K., Provini, F., Pagotto, U., Montagna, P., Schenck, C. H., Mignot, E., & Plazzi, G. (2011). Narcolepsy with cataplexy associated with nocturnal compulsive behaviors: A case-control study. *Sleep, 34*(10), 1365–1371. https://doi.org/10.5665/Sleep.1280.

Petrov, M. E., Emert, S. E., & Lichstein, K. L. (2019). Obsessive-compulsive personality disorder features and response to behavioral therapy for insomnia among patients with hypnotic-dependent insomnia. *Behavioral Sleep Medicine, 17*(6), 740–752. https://doi.org/10.1080/15402002.2018.1483369.

Raft, M. M. (2013). *Relationship between essential trait dimensions of perfectionist behavior and insomnia*. ProQuest Dissertations Publishing: California Institute of Integral Studies. https://doi.org/10.1111/jsr.13548.

Randles, D., Flett, G. L., Nash, K. A., McGregor, I. D., & Hewitt, P. L. (2010). Dimensions of perfectionism, behavioral inhibition, and rumination. *Personality and Individual Differences, 49*(2), 83–87. https://doi.org/10.1016/j.paid.2010.03.002.

Regen, W., Hertenstein, E., Weil, P., Kyle, S. D., Holz, J., Baglioni, C., Nissen, C., Feige, B., Riemann & Spiegelhalder, K. (2015). Perfectionistic tendencies in insomnia patients' behavior during psychometric testing. *Behavioral Sleep Medicine, 13*(5), 387–394. https://doi.org/10.1080/15402002.2014.919918.

Richardson, C., & Gradisar, M. (2020). Perfectionism and insomnia in adolescents: The role of vulnerability to stress and gender. *Journal of Adolescence, 85*, 70–79. https://doi.org/10.1016/j.adolescence.2020.10.003.

Riemann, D., Baglioni, C., Bassetti, C., Bjorvatn, B., Dolenc Groselj, L., Ellis, J. G., Espie, C., Garcia-Borreguero, D., Gjerstad, M., Gonçalves, M., Hertenstein, E., Jansson-Fröjmark, M., Jennum, P., Leger, D., Nissen, C., Parrino, L., Paunio, T., Pevernagie, D., Verbraecken, J., Weeß, H.-G., Wichniak, A., Zavalko, I., Arnardottir, E. S., Deleanu, O.-C., Strazisar, B., Zoetmulder, M., & Spiegelhalder, K. (2017). European guideline for the diagnosis and treatment of insomnia. *Journal of Sleep Research, 26*(6), 675–700. https://doi.org/10.1111/jsr.12594.

Schmidt, R. E., Courvoisier, D. S., Cullati, S., Kraehenmann, R., & Linden, M. V. D. (2018). Too imperfect to fall asleep: Perfectionism, pre-sleep counterfactual processing, and insomnia. *Frontiers in Psychology, 9*, e1288. https://doi.org/10.3389/fpsyg.2018.01288.

Silber, M. H., Ancoli-Israel, S., Bonnet, M. H., Chokroverty, S., Grigg-Damberger, M. M., Hirshkowitz, M., ... Iber, C. (2007). The visual scoring of sleep in adults. *Journal of Clinical Sleep Medicine, 3*(02), 121–131. https://doi.org/10.5664/jcsm.26814.

Spiegelhalder, K., Regen, W., Kyle, S. D., Endres, D., Nissen, C., Feige, B., & Riemann, D. (2012). Time will tell: A retrospective study investigating the relationship between insomnia and objectively defined punctuality. *Journal of Sleep Research, 21*(3), 264–269. https://doi.org/10.1111/j.1365-2869.2011.00970.x.

Stöber, J. (1998). The Frost Multidimensional Perfectionism Scale revisited: More perfect with four (instead of six) dimensions. *Personality and Individual Differences, 24*(4), 481–491. https://doi.org/10.1016/S0191-8869(97)00207-9.

Trudel-Fitzgerald, C., Savard, J., Slim, L. M., Roy, R. C., Flett, G. L., Hewitt, P. L., & Ivers, H. (2017). The relationship of perfectionism with psychological symptoms in cancer patients and the contributing role of hyperarousability and coping. *Psychology & Health, 32*(4), 381–401.

Van den Berg, P., Thompson, J. K., Obremski-Brandon, K., & Coovert, M. (2002). The tripartite influence model of body

image and eating disturbance: A covariance structure modeling investigation testing the mediational role of appearance comparison. *Journal of Psychosomatic Research, 53*(5), 1007–1020. https://doi.org/10.1016/S0022-3999(02)00499-3.

Vand, H. D. A., Gharraee, B., Farid, A. A. A., & Bandi, M. G. (2014). Prediction of insomnia severity based on cognitive, metacognitive, and emotional variables in college students. *Explore, 10*(4), 233–240. https://doi.org/10.1016/j.explore.2014.04.005.

Vincent, N. K., & Walker, J. R. (2000). Perfectionism and chronic insomnia. *Journal of Psychosomatic Research, 49*(5), 349–354. https://doi.org/10.1016/S0022-3999(00)00175-6.

Received: January 29, 2022
Revised: October 4, 2022
Accepted: October 8, 2022
Available online: xxxx