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SLEEPexpert+: Blending Internet-Based Cognitive Behavioral Therapy for Insomnia with In-Person Psychotherapy—A Feasibility Study in Routine Care

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Abstract: Insomnia is characterized by frequent and persistent difficulties initiating and maintaining sleep, along with impaired daytime functioning. Blended treatments are increasingly popular for treating psychological disorders such as depression. Blended treatments combine elements of face-to-face therapy and online interventions. A single-arm pre-post study investigated the feasibility of a blended treatment combining face-to-face cognitive behavioral therapy for insomnia and internet-based cognitive behavioral therapy for insomnia (SLEEPexpert+). The findings show that the therapists have a positive attitude toward blended CBT-I (b-CBT-I) and that they feel supported by the online components of the treatment. Possible barriers to implementing blended treatments are integrating the online materials into the face-to-face sessions and adapting one's therapeutic style to the blended treatment approach. No definitive statements about the effectiveness of the b-CBT-I treatment can be made. However, of the six presented cases, five patients showed notably higher sleep efficiency and fewer insomnia symptoms at the end of the therapy. Program usage data indicate that participants mainly used the online components at the beginning of their treatment. Future studies should investigate the effectiveness of b-CBT-I with a sufficiently powered randomized controlled trial comparing b-CBT-I with an adequate control group in routine care.

Keywords: insomnia; blended therapy; online intervention; routine care; implementation research; CBT-I

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1. Introduction

Insomnia disorder is characterized by frequent and persistent difficulties initiating and maintaining sleep, with impaired daytime functioning [1]. According to epidemiological studies, about 30% of the population suffers from at least one symptom of insomnia, and 10% meet the clinical diagnostic criteria of insomnia disorder [1–3]. Furthermore, insomnia takes a chronic course in about 70% of afflicted individuals [4,5]. Besides the negative effects of insomnia on daytime well-being, chronic insomnia disorder has a negative impact on physical and mental health [6–8]. Cognitive behavioral therapy for insomnia (CBT-I) is the first-line treatment for insomnia. However, only a fraction of patients will receive CBT-I because only a small number of trained professionals are available to meet population needs [9]. In the last few years, online therapy has led to new options for disseminating CBT-I [10,11].

Because of technological advances, the internet has become more integrated into our daily lives. This has resulted in the development of new methods for treating psychological disorders like insomnia via the internet [12–14]. Internet-delivered treatments are often informed by cognitive-behavioral therapy and include texts, pictures, quizzes, and videos [12]. There are different ways to deliver internet-based interventions [15]. In unguided internet treatments, patients work on the online material alone without therapeutic support. In guided internet treatments, patients work on online materials and are supported with short and regular (e.g., weekly) contacts with a professional (e.g., a psychologist). Increasingly popular are blended treatments, in which elements of face-to-face (f2f) therapy and online interventions are combined. For example, in a blended treatment approach, the internet intervention can act as an adjunct to f2f therapy and may be used parallel to the f2f therapy sessions [15–17]. It is assumed that blended treatments can improve the effectiveness or cost-effectiveness of f2f psychotherapy [15].

Internet-based treatments for psychological disorders have several advantages. Internet interventions can be cost-effective because they take less clinician time, can be used independently of time and location, and are available 24/7. Additionally, they can be personalized depending on the patient's needs and preferences and enable patients to work with the materials at a speed that suits them best [17–20]. However, stand-alone internet treatments have disadvantages as they require a certain level of reading, writing, and computer literacy; they lack non-verbal and para-verbal exchange; it is easier to conceal or avoid difficult topics; and it is difficult to react to crisis situations (e.g., suicidality) [19,21]. The blended treatment approach aims to maintain the best of f2f and online therapy while minimizing the disadvantages. In integrated blended interventions, the f2f and online therapy components benefit from each other. Therapists can effectively allocate their activities with patients during f2f therapy to the most impactful interventions while simultaneously offering online access to standard therapy elements. Furthermore, online treatment provides additional content that allows patients to prepare, repeat, or deepen certain therapy topics [17]. On the other hand, regular contact with therapists is ensured, which is more suitable in crisis situations and was shown to lead to better adherence to the online component of the therapy [16,17,22,23].

Numerous randomized controlled trials provide evidence for the effectiveness of internet-based CBT-I in treating insomnia (i-CBT-I) [24–28]. Besides small effects on health and psychological well-being (Cohen's d = 0.31 and 0.38) [29], medium to large effect sizes were found for the improvement of sleep efficiency (SE) and the reduction of insomnia severity (Hedges' g = 0.58 and 1.09) [28]. Further meta-analytical evidence shows statistically improved sleep parameters like increased SE by 10%, increased total sleep time (TST) by 22 min, decreased sleep onset latency (SOL) by 18 min, decreased wake after sleep onset (WASO) by 22 min [27], and a number needed to treat (NNT) ranging from 2.2 to 3.6 [28,30]. Furthermore, changes in insomnia symptoms persisted throughout short-term (8-week) and long-term (6-month) follow-up periods [27]. i-CBT-I was also shown to be an effective treatment for comorbid insomnia in patients with a wide range of psychiatric and somatic disorders [31,32] and reduced comorbid symptoms like depression, anxiety, and fatigue [33,34].

The reported studies show the effectiveness of i-CBT-I. However, these studies often used self-selected computer-literate samples. As a result, it can be challenging to generalize the findings to everyday clinical practice [19,21]. Furthermore, although some studies suggest the superiority of blended treatments in comparison with conventional psychotherapy in depression, e.g., [35,36], no studies are using a blended treatment approach combining f2f CBT-I and i-CBT-I in routine care. Thus, the primary aim of this study was to explore the feasibility and acceptability of a blended CBT-I (b-CBT-I) treatment in routine care. This was conducted by collecting therapists' perspectives regarding the content, functions, possibilities, and potential improvement opportunities of a CBT-I internet intervention and its integration into routine care. A secondary objective is to explore the uncontrolled

short-term effects of b-CBT-I on insomnia symptoms and possible dose–response effects between program usage and therapy outcomes in the form of case studies.

2. Materials and Methods

2.1. Ethics Approval

The clinical development project was conducted in accordance with a clarification of responsibility by the Bernese Ethics Committee (BASEC; Req-2023-00409, date 29 March 2023). Informed consent was obtained from all subjects involved in the study.

2.2. Blended Treatment of Insomnia at the Swiss Sleep House Bern

The feasibility study was conducted at the Swiss Sleep House Bern, which opened in November 2022. The Swiss Sleep House Bern is part of the Insel Group and is associated with the University Sleep-Wake-Epilepsy Center (SWEZ) of the Inselspital Bern. The Swiss Sleep House Bern is a specialized sleep unit for diagnosing and treating all types of sleep disorders. An interdisciplinary team of somnologists, psychologists, neurologists, and chronobiologists offers access to the best possible therapies for sleep disorders. Different options are available, like the examination at home or in the sleep laboratory of the Inselspital, telemedicine support, and on-site consultations. To further improve the treatment options for insomnia in the Swiss Sleep House Bern, a blended treatment approach combining f2f cognitive behavioral therapy with the online intervention SLEEPexpert+ was investigated in a single-arm pre-post design feasibility study with semi-structured therapist interviews.

2.3. SLEEPexpert+

SLEEPexpert+ is based on previous behavioral treatment programs for insomnia, like SLEEPexpert, which is a pragmatic behavioral treatment program for insomnia in inpatient psychiatric care and focuses on evidence-based treatment components [37,38]. SLEEPexpert+ is a CBT-I online web application with six modules containing videos, texts, and exercises optimized for their use in routine care. The modules can be worked through by the patients in any order, can be repeated indefinitely, and take 45 to 60 min each. The six modules are introduction (explanations of the functions and content of SLEEPexpert+ and motivational factors), psychoeducation (module with information on sleep, sleep myths, insomnia, and stimulus control), bedtime restriction (theory and application of bedtime restriction), relaxation (theory and application of guided and unguided relaxation techniques), cognitive restructuring (identifying sleep-disturbing thoughts and replacing them with an appropriate and realistic assessment), and relapse prevention (summary of key content and information on relapse prevention and aftercare). The content of the program SLEEPexpert+ is depicted in Table 1. Additionally, three diaries or protocols are available: the sleep protocol (documentation and illustration of sleep behavior), the relaxation protocol (documentation of relaxation exercises performed), and the thought protocol (a tool for the realistic assessment of sleep-disturbing thoughts). The content of the program SLEEPexpert+ is depicted in Table 1.

Table 1. Content of the program SLEEPexpert+.

Module Name	Module Description
Introduction	Explanations of the functions and content of SLEEPexpert+ and motivational factors (e.g., how to watch the videos and integrate SLEEPexpert+ in the daily routine)
Psychoeducation	Information on sleep, sleep myths, insomnia (e.g., sleep stages, sleep pressure, and circadian rhythms), and stimulus control (e.g., getting out of bed after a certain time of wakefulness)

Table 1. *Cont.*

Module Name	Module Description
Bedtime restriction	Theory and application of bedtime restriction (e.g., adjustment of a sleep window)
Relaxation	Theory and application of guided and unguided relaxation techniques (e.g., a 10 min relaxation video)
Cognitive restructuring	Identifying sleep-disturbing thoughts and replacing them with an appropriate and realistic assessment (e.g., exercises for cognitive restructuring)
Relapse prevention	Summary of key content and information on relapse prevention and aftercare (e.g., to use a sleep diary every last week of a month to monitor possible worsening of sleep)

2.4. Procedure

Patients of the Swiss Sleep House Bern who met the inclusion criteria were informed about the possibility of complementing their regular f2f therapy with an internet-based therapy and participating in the study. If interested, patients signed the informed consent form and received access to the online intervention via email. Depending on the preferences of the therapists and patients, the online materials were integrated into the f2f therapy during each therapy session (e.g., via desktop computers in the therapy rooms) or in preparation for or follow-up to a f2f therapy session at home. Therapy sessions at the Swiss Sleep House Bern were conducted weekly, fortnightly, or monthly, depending on the needs of the patients. Standard clinical questionnaires were completed at the start and end of the therapy. The investigation period spanned five months (December 2022 to April 2023) and was finished with semi-structured interviews with all therapists involved in the study.

2.5. Participants

Three therapists from the Swiss Sleep House Bern agreed to participate in the study and implement the b-CBT-I. The therapists (M_{age} = 35.3, SD = 4.0, 1 female) were in psychotherapy training and had a mean work experience as therapists of 4.7 years (SD = 3.5). Patients were recruited at the Swiss Sleep House Bern.

Patients were eligible for study participation if they (1) suffered from insomnia according to the International Classification of Sleep Disorders-3, (2) were at least 18 years old, (3) had internet access, (4) had a sufficient language level in German to understand the online treatment components, and (5) had stable medication over the last 3 months. Patients were excluded from the study if they (1) suffered from organic-induced insomnia, (2) showed active suicidal plans, (3) had a psychiatric comorbidity that required immediate other treatment such as severe major depression or anxiety disorder, substance dependence, bipolar affective disorder (current or past), psychotic disorder (current or past), obsessive–compulsive disorder, (4) had epilepsy (all types and causes of the disease), and (5) were shift workers.

2.6. Measures

2.6.1. Semi-Structured Therapist Interviews

Interviews were based on previous interview guides from blended treatment studies [39,40] and adapted to insomnia and SLEEPexpert+. The interviews were conducted by the first author of the manuscript.

2.6.2. Sleep Diaries

During the whole treatment period, participants kept a daily paper-and-pencil or online sleep diary. The sleep diaries allowed for the calculation of the SE, which was the primary outcome of the quantitative data.

2.6.3. Patients' Self-Report Questionnaires

Insomnia: To measure self-rated insomnia symptoms, the Insomnia Severity Index (ISI) [41] was used. Each of the seven items is rated on a five-point Likert scale (0 to 4), with a total score ranging from 0 to 28. The interpretation of the ISI is as follows: 0–7 (no clinically significant insomnia), 8–14 (subthreshold insomnia), 15–21 (clinical insomnia, moderate severity), and 22–28 (clinical insomnia, severe). The ISI has excellent internal consistency, is a reliable measure to detect insomnia, and is suitable for evaluating treatment response in a clinical sample [42].

Anxiety: To measure self-rated anxiety, the Generalized Anxiety Disorder 7 (GAD-7) [43] was used. The GAD-7 consists of seven items rated on a four-point Likert scale (0 to 3), with total scores ranging from 0 to 21. The GAD-7 is interpreted as follows: 0–4 (minimal anxiety), 5–9 (mild anxiety), 10–14 (moderate anxiety), and 15–21 (severe anxiety). The GAD-7 is a valid and reliable tool to assess symptoms of anxiety in research and clinical practice [43].

Depression: The Patient Health Questionnaire-9 (PHQ-9) [44,45] was used to assess self-rated depression. The PHQ-9 consists of nine questions rated on a four-point Likert scale (0 to 3), with a total score ranging from 0 to 27. PHQ-9 scores are interpreted as follows: 0–4 (no depression), 5–9 (mild depression), 10–14 (moderate depression), 15–19 (moderately severe depression), and 20–27 (severe depression). The PHQ-9 is a feasible and valid screening instrument with excellent internal consistency and is well-accepted for use in research and clinical practice [44].

Well-being: The World Health Organization Well-Being Index (WHO-5) [46,47] was used to measure the self-rated subjective well-being of participants. The WHO-5 consists of five questions rated on a six-point Likert scale (0 to 5), with a total score ranging from 0 to 25. A cutoff below 13 indicates low well-being. The WHO-5 has satisfactory reliability and is a psychometrically sound measure [46].

All self-reported questionnaires were administered on paper.

2.6.4. Usage Data

The web application automatically saves the usage time of SLEEPexpert+ and the participants' sleep diary entries.

2.7. Data Analysis

The interviews were analyzed using inductive analysis [48], with the following steps: (1) transcription of the audio files of the interviews; (2) creation of open codes for each paragraph; (3) grouping the open codes into broader inductive and deductive categories; and (4) grouping the categories into general themes. The transcripts were coded by the first author, and the codes and themes were discussed with the last author. As the interviews were held in German, the first author of the manuscript translated the quotes in the Results Section into English.

Statistical analyses were performed in Microsoft Excel or in R [49]. For usage data, means and standard errors are presented. The quantitative data are presented in the form of six case studies.

3. Results

3.1. Summary of the Qualitative Analysis

The three therapists implementing the blended treatment approach were interviewed at the end of the investigation period. The interviews resulted in 139 text passages relevant to b-CBT-I and the implementation of SLEEPexpert+ in routine care. The text passages were categorized into six general themes: (1) General attitude toward b-CBT-I; (2) expectations regarding SLEEPexpert+; (3) experiences with SLEEPexpert+ in routine care; (4) integration of SLEEPexpert+; (5) suggested changes to SLEEPexpert+; (6) therapeutic relationship and SLEEPexpert+. The following reports the condensed therapists' view for each main

theme with supporting quotations. The quotes were translated from German to English by the author.

3.1.1. General Attitude toward b-CBT-I

The therapists expressed a positive opinion regarding b-CBT-I and agreed that such approaches will play a more prominent role in the future in the treatment of psychological disorders and CBT-I. It was pointed out that through personal contact with a therapist, patients may be more motivated to follow through with the online components of the intervention and that the online resources help to repeat therapy content.

> *I am really convinced that this [blended treatment] will be standard in a few years.*
>
> *The main thing is that people stick with it [the online component of the intervention], and a bit of motivational work is necessary, and this motivational work is conducted by addressing people personally.*
>
> *I believe that it is a good medium for deepening information and doing exercises independently.*

However, some negative attitudes and fears were linked with b-CBT-I. For one therapist, personal contact with patients plays a major role in the treatment of psychological disorders, especially as the problems of the patients are often interpersonal and complex and thus cannot be adequately dealt with in standardized online therapy. Furthermore, due to high cost-saving pressure in the healthcare system, therapists fear that online treatments will completely replace f2f therapies.

> *(. . .) I am a passionate psychotherapist, and I believe that contact and relationships heal. I do not want to replace them [contact and relationships].*
>
> *It is important that a human being sits there and not a computer program. This aspect of therapy should not disappear.*
>
> *I think online therapies are generic, (. . .) they are not individually tailored.*
>
> *(. . .) but I am also afraid that something will be lost or that health insurance companies will continue to cut back on therapies and say, "Yes, there is an app".*

3.1.2. Expectations Regarding SLEEPexpert+

The therapists expected the online materials of the b-CBT-I intervention to be in accordance with the current guidelines for insomnia treatment and contain all the elements of CBT-I, where each module is theoretically embedded and includes practical exercises and protocols.

> *[An online sleep diary] might be easier for some [patients] than a paper-and-pencil sleep diary.*
>
> *In terms of content, (. . .) psychoeducation, sleep restriction, stimulus control, sleep hygiene (. . .) progressive muscle relaxation, cognitive restructuring, (. . .) a prophylactic module for relapse prevention (. . .) typically protocols like relaxation, thought, and sleep protocols.*

The therapists assumed that various patient groups would benefit differently from the online program. Specifically, perfectionism seems to be a relevant personality trait, even though the impact of perfectionism could be positive or negative.

> *I have the feeling that people who are perfectionists and who are very focused on tracking with smartwatches. . . I have the feeling that if I give them SLEEPexpert+, this would somehow increase the negative attention.*
>
> *There are also perfectionist self-optimizers. They think, "Maybe there is something else that I have not come across yet, to find the philosopher's stone after all. . . maybe there is something else that I have not tried yet".*

The online program was expected to be helpful in situations with time constraints during f2f sessions, toward the end of a f2f therapy cycle (e.g., when the intervals between f2f therapy sessions increase), and when patients should repeat or deepen the learned content of the f2f therapy.

> *I imagine that (. . .), especially if the intervals become a bit longer [between therapy sessions] (. . .) that we could increasingly use SLEEPexpert+.*
>
> *(. . .) you can refer patients. . . like, "Yes, there is a good video on muscle relaxation; take a look at it", or "If you want to deepen that, take another look at the psychoeducation module; there is a good video on the two-process model".*

3.1.3. Experiences Regarding SLEEPexpert+

The therapists perceived the online program as a helpful tool that supported them in their therapeutic work. They were able to refer patients to it, and it let them outsource some therapy tasks from f2f therapy. This allowed them to focus on the more individual and complex problems of the patients during the f2f sessions, which cannot be adequately addressed by an online program.

> *It makes sense to outsource certain things (. . .) I do not have to do progressive muscle relaxation with the patient, and (. . .) he can do it on his own with a cool video and a pleasant voice.*
>
> *We can concentrate on the essential problems not treated in the online components.*
>
> *I felt supported by SLEEPexpert+. It [SLEEPexpert+] takes something off my shoulders.*

Regarding the design of SLEEPexpert+, the well-balanced ratio between videos, texts, and graphics was mentioned. The videos, which are the main source of information for SLEEPexpert+, were perceived as trustworthy, credible, and easy to understand.

> *I thought it was great that it was very strongly video-based (. . .). I think that makes the whole thing less tiring. (. . .) I was very happy that it was not overloaded with text.*
>
> *I liked the language [of the videos]. I did not find it complicated or overly scientific.*
>
> *It was reassuring to have information from a reliable source.*

Although the experience with SLEEPexpert+ was positive, the therapists mentioned that the online program is not suited for all patient groups. Patient characteristics like higher age, insufficient German language skills, and high anxiety regarding sleep might prevent a successful integration of SLEEPexpert+ into the therapy. Additionally, some severely burdened patients seem to be at risk of being overloaded if they use SLEEPexpert+ in addition to the f2f sessions.

> *(. . .) she [the patient] was so fearful about sleep (. . .), SLEEPexpert+ would probably make it even worse because there is more information, and she would think, "Oh, I still have to pay attention to this and this and this".*

Furthermore, one therapist preferred a conventional paper-and-pencil sleep diary over an online sleep diary.

> *I am surprised that I prefer the sleep diary in paper-and-pencil form. . . I do not know, but it is just nice to see the visualization (. . .) you can see quickly, based on the visual impression [of the paper-and-pencil sleep diary], how the sleep has improved or worsened. You can say, "Hey, you have been lying in bed too long".*

3.1.4. Integration of SLEEPexpert+

Different barriers prevented the therapists from using the blended treatment to its full potential. The therapists mentioned that they forgot to refer to the online components or did not plan enough time to integrate the online materials into the f2f session. Furthermore, as the specialized sleep unit had just opened, the therapists first had to find their therapeutic style in the new environment. Additionally, many patients were still in the motivational

phase of their treatment; thus, the CBT-I-specific components of insomnia treatment moved to the background. One therapist pointed out that some patients did not like the homework-like character of the online treatment.

> *I must adapt my therapeutic style (. . .) I must plan time for the explanation of the online materials and the integration of the online resources.*
>
> *I had to learn how to treat insomnia myself. I gathered more routine over the last two months (. . .). In the beginning, I simply had to structure myself (. . .).*
>
> *(. . .) there is always something homework-like about it, and many patients hate that. (. . .) when they realize, "I have to listen to something; I have to absorb information", they drop out.*

Although the therapists experienced some barriers, they also mentioned successful ways to integrate the online materials into f2f therapy.

> *I have many older patients who were initially skeptical about the web application, and I ended up opening the platform [SLEEPexpert+] to provide a brief introduction. I said, "It looks like this; on the left is this navigation bar, (. . .) here are the different sections". This created a sense of security. I have the impression that this also increased trust in the system. When I, as a therapist, showed it to them and did not just hand them a piece of paper [with the login information of SLEEPexpert+]. . . this promoted the interaction.*

3.1.5. Suggested Changes to SLEEPexpert+

The therapists suggested several adjustments to SLEEPexpert+ for its use in routine care. Firstly, as in some cases, conventional CBT cannot successfully treat all symptoms of insomnia, an acceptance-based treatment approach could positively influence the effectiveness of SLEEPexpert+. Secondly, important concepts in insomnia treatment, like daytime sleepiness, fatigue, and discrepancies between objective and subjective sleep duration, should be explained in more detail. Thirdly, according to the therapists, the available relaxation resources should be diversified and expanded, e.g., with white noise, autonomous sensory meridian response (ASMR), nature sounds, variants of progressive muscle relaxation (different voices, different lengths), and standardized hypnosis. Fourthly, the design of the web application should be made more interactive and interesting.

> *What I think is missing in SLEEPexpert+ is acceptance. (. . .) Especially with chronic patients, sleep presents itself as a monster, and the more you fight with the monster, the worse it becomes (. . .) you must live with the fact that you are just not a good sleeper and that you wake up three to four times a night.*
>
> *(. . .) a small collection of background sounds for sleeping, such as nature sounds or white noise, (. . .) because many [patients] are noise sensitive.*
>
> *I would have liked it [the design] to be more interactive. I found it static. I thought to myself, "It is the content that is important, and I buy into that", but the design lacked a certain appeal.*

3.1.6. Therapeutic Relationship and SLEEPexpert+

Based on the therapists' experience, the online program can improve or worsen the therapeutic relationship. The therapeutic relationship benefits from the online program if it increases the credibility of the whole treatment or acts as a positive signal for the patient's self-efficacy. However, the implementation of the online program may also lead to a deteriorated therapeutic relationship if patients feel fobbed off or when the information of the therapist and the online program do not match.

> *You can give the patients something, and that (. . .) improves the therapeutic relationship as well. Because then credibility (. . .) and trust in the therapy can improve.*
>
> *You send a message to the patients, "Hey, I am convinced that you can do this on your own; you do not need me as much as you thought at the beginning", (. . .) and that can be a positive signal for the patient's self-efficacy.*

I am not sure whether this leads to a deterioration or improvement [of the therapeutic relationship] if I act differently than what is said in the tool, which has a university logo on it.

3.2. Results from the Quantitative Analysis

3.2.1. Usage of the SLEEPexpert+

Of the 56 patients who received an invitation to the online program, 44 logged in at least once. Participants used SLEEPexpert+ on average for 1.8 h (SE = 0.4), with a minimum of 0 h and a maximum of 14.5 h. In Figure 1, the usage time for each module is depicted.

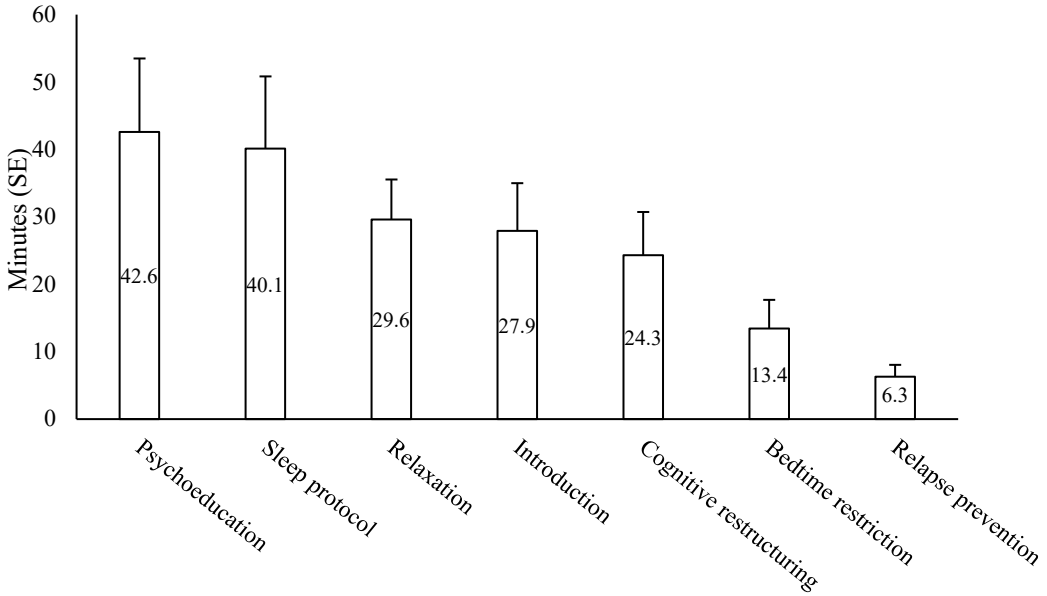

Figure 1. Mean usage time for each module of SLEEPexpert+ during the investigation period for participants who opened a module at least once.

3.2.2. b-CBT-I Outcomes in the Form of Case Studies

The treatment intervals in the Swiss Sleep House Bern are, depending on the patients' needs, weekly, fortnightly, or monthly. Thus, during the whole investigation period of five months, only six people started and finished their therapy at the Swiss Sleep House Bern and filled out the post-treatment questionnaires. Table 2 presents the demographic characteristics, treatment duration, number of face-to-face sessions, and comorbidities of the six case study participants.

Table 2. Characteristics and treatment duration of the case study participants.

Participant	Gender	Age	Treatment Duration (Weeks)	Number of f2f Sessions	Comorbidities
Case 1	male	45	17	7	Recurrent depressive disorder, experiencing a moderate episode
Case 2	male	37	8	4	Adjustment disorder
Case 3	male	70	16	4	No comorbidities
Case 4	male	57	15	4	Agoraphobia with panic disorder
Case 5	male	39	17	4	Recurrent depressive disorder (currently in remission)
Case 6	female	60	13	3	Specific phobias

The following section presents case studies of these treatment completers to illustrate the different usage patterns and symptom changes during the b-CBT-I therapy (e.g., the usage duration of the three most used modules). Table 3 summarizes the pre- and post-assessment scores of the relevant outcome variables.

Table 3. Pre- and post-assessment scores for each participant.

Participant	Measurement	SE (%)	ISI	GAD	PHQ-9	WHO-5
Case 1	Pre	65	26	16	16	4
	Post	90	7	5	5	17
Case 2	Pre	77	n/a	10	12	12
	Post	77	15	10	8	16
Case 3	Pre	63	24	n/a	7	7
	Post	82	16	n/a	6	7
Case 4	Pre	70	20	10	8	7
	Post	85	11	5	5	17
Case 5	Pre	83	21	6	5	16
	Post	94	7	4	4	16
Case 6	Pre	73	17	10	8	9
	Post	89	7	5	7	14

In Figure 2, the SE during the treatment period and the usage time per two weeks (UT) are shown for each of the six participants.

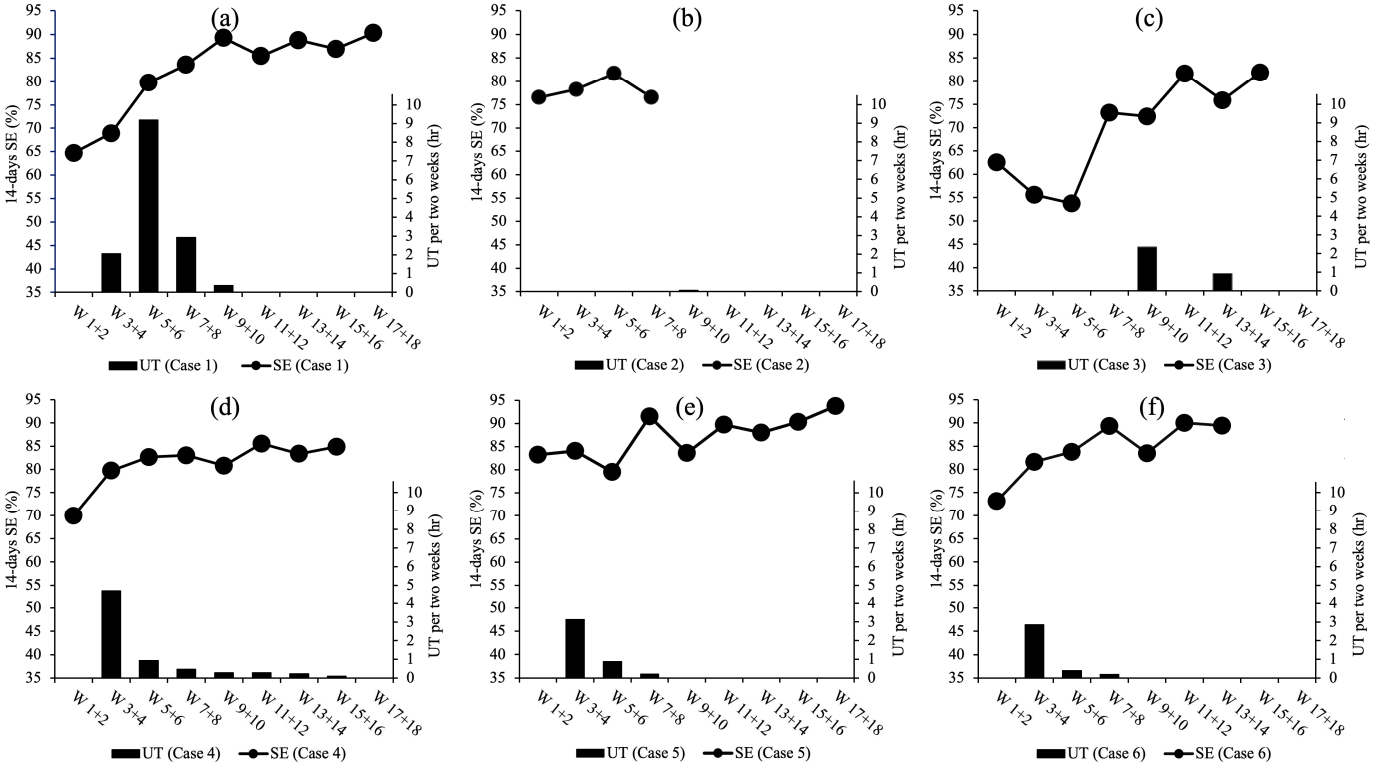

Figure 2. Sleep efficiency (SE) and usage time (UT) at two-week intervals during the treatment period. (**a**) Case 1; (**b**) Case 2; (**c**) Case 3; (**d**) Case 4; (**e**) Case 5; (**f**) Case 6.

Case 1 (male, 45 years): Case 1 suffered from chronic insomnia and recurrent depressive disorder, experiencing a moderate episode. At the start of his treatment, he had an SE of 64.7%. Furthermore, he suffered from severe clinical insomnia (ISI_{pre}: 26), severe anxiety

(GAD_{pre}: 16), and severe depression ($PHQ\text{-}9_{pre}$: 16) with low well-being ($WHO\text{-}5_{pre}$: 4). He attended seven therapy sessions, of which the first three were at a weekly interval and the last four at a monthly interval. The entire treatment took place over a period of 17 weeks. Besides the f2f therapy sessions, he intensively used SLEEPexpert+ and spent 14.5 h working with the online materials. He used all the modules but spent the most time on the psychoeducation (3.7 h), the cognitive restructuring (2.9 h), and the introductory (2.3 h) modules. Along with the modules, he also used the online sleep diary. Case 1 used the online materials mostly at the beginning of his treatment, in treatment weeks 5 and 6. At the end of the therapy, Case 1 had an SE of 90.3%. Furthermore, he reported no longer suffering from clinically significant insomnia (ISI_{post}: 7), less anxiety (GAD_{post}: 5), and less depression ($PHQ\text{-}9_{post}$: 5), with a high sense of well-being ($WHO\text{-}5_{post}$: 17).

Case 2 (male, 37 years): Case 2 suffered from chronic insomnia and adjustment disorders. At the start of his treatment, he had an SE of 76.6%, and he reported moderate anxiety (GAD_{pre}: 10), moderate depression ($PHQ\text{-}9_{pre}$: 12), and low well-being ($WHO\text{-}5_{pre}$: 12). Case 2 had four f2f therapy sessions. The entire treatment took place over a period of 8 weeks. He logged into SLEEPexpert+ twice, resulting in a usage time of 4.4 min. During the therapy, the SE slightly improved to 81.7% but decreased at the end of the therapy to the initial level of 76.6%. At the end of the therapy, he still reported clinical insomnia of moderate severity (ISI_{post}: 15), moderate anxiety (GAD_{post}: 10), and mild depression ($PHQ\text{-}9_{post}$: 8). However, his general well-being improved ($WHO\text{-}5_{post}$: 16).

Case 3 (male, 70 years): Case 3 suffered from chronic insomnia with no comorbidities. The SE of Case 3 was 62.6% at the start of the therapy, and he suffered from severe insomnia (ISI_{pre}: 24) and mild depression ($PHQ\text{-}9_{pre}$: 7) with overall low well-being ($WHO\text{-}5_{pre}$: 7). He had four f2f therapy sessions. The entire treatment took place over a period of 16 weeks. The SE decreased over the first month of therapy to 53.8%. Case 3 used SLEEPexpert+ from weeks 8 to 13 of his treatment for 3.3 h. He mainly used the relaxation module (1.0 h), the cognitive restructuring module (0.8 h), and the bedtime restriction module (0.7 h). Although sleep-specific measures like an SE of 81.9% and moderate reported insomnia (ISI_{post}: 16) indicate an improvement at the end of the therapy, the patient reported nearly no changes in depression ($PHQ\text{-}9_{post}$: 6) or well-being ($WHO\text{-}5_{post}$: 7) at the end of the therapy.

Case 4 (male, 57 years): Case 4 suffered from chronic insomnia and agoraphobia with panic disorder. At the start of the therapy, Case 4 had an SE of 70.0%, insomnia of moderate severity (ISI_{pre}: 20), moderate anxiety (GAD_{pre}: 10), mild depression ($PHQ\text{-}9_{pre}$: 8), and low well-being ($WHO\text{-}5_{pre}$: 7). He had four f2f therapy sessions. The entire treatment took place over a period of 15 weeks. He used SLEEPexpert+ overall for 7.0 h and mainly used the relaxation (1.5 h), the psychoeducation (1.0 h), and the cognitive restructuring (0.9 h) modules. Furthermore, Case 4 was the only patient who used the online sleep diary throughout the entire treatment period. Overall, he spent 2.4 h on his 69 sleep diary entries. At the end of the treatment, he had an SE of 84.9%, reported subthreshold insomnia (ISI_{post}: 11), mild anxiety (GAD_{post}: 5), mild depression ($PHQ\text{-}9_{post}$: 5), and improved well-being ($WHO\text{-}5_{post}$: 17).

Case 5 (male, 39 years): Case 5 suffered from chronic insomnia and recurrent depressive disorder (currently in remission). Case 5 started with a relatively high SE of 83.3%. However, he suffered from clinical insomnia of moderate severity (ISI_{pre}: 21), mild anxiety (GAD_{pre}: 6), mild depression ($PHQ\text{-}9_{pre}$: 5), and overall good well-being ($WHO\text{-}5_{pre}$: 16). Case 5 had four f2f therapy sessions. The entire treatment took place over a period of 17 weeks. He used SLEEPexpert+ for 4.2 h. He mainly worked with the cognitive restructuring (1.2 h) and the psychoeducation (0.8 h) modules. At the end of the therapy, Case 5 had an SE of 93.8%, no longer suffered from clinically significant insomnia (ISI_{post}: 7), and reported minimal anxiety (GAD_{post}: 4), no depression ($PHQ\text{-}9_{post}$: 4), and high well-being ($WHO\text{-}5_{post}$: 16).

Case 6 (female, 60 years): Case 6 suffered from chronic insomnia and specific phobias. Case 6 started with an SE of 73.2%, clinical insomnia of moderate severity (ISI_{pre}: 17),

moderate anxiety (GAD_{pre}: 10), mild depression ($PHQ\text{-}9_{pre}$: 8), and low well-being ($WHO\text{-}5_{pre}$: 9). She had three f2f sessions. The entire treatment took place over a period of 13 weeks. She used SLEEPexpert+ for 3.5 h. Case 6 mainly used the relaxation (0.9 h), the psychoeducation (0.5 h), and the introductory (0.5 h) modules. At the end of the therapy, Case 6 had an SE of 89.4%, did not suffer from clinically significant insomnia anymore (ISI_{post}: 7), and reported mild anxiety (GAD_{post}: 5), mild depression ($PHQ\text{-}9_{post}$: 7), and high well-being ($WHO\text{-}5_{post}$: 14).

4. Discussion

This study sought to investigate the feasibility of a blended treatment approach for insomnia in routine care. Through therapist interviews, experiences with the blended treatment and suggestions on how to optimally integrate and adapt the online components were collected. Additionally, changes in the therapeutic relationship due to the blended treatment approach were identified. The findings suggest that the therapists have a positive attitude toward b-CBT-I and are convinced that blended therapy will have a bigger role in the future. They also reported feeling supported by the online components of the treatment, like the relaxation and psychoeducation modules of SLEEPexpert+. The therapists also mentioned barriers to implementing blended treatments, like integrating the online materials into the f2f sessions and adapting one's own therapeutic style to the blended treatment approach. Due to the design of the study, no definitive statements about the effectiveness of b-CBT-I treatment can be made. However, of the six presented cases, five patients showed a notably higher SE and fewer insomnia symptoms at the end of the therapy. Program usage data indicate that participants mainly used the online components at the beginning of their treatment.

Considering the high prevalence of insomnia and the limited number of trained professionals [9], b-CBT-I is a promising way to increase the availability of CBT-I treatments in routine care. The current study revealed several points to consider when implementing a blended treatment approach. First, blended treatment approaches can result in more active treatment time, which could potentially improve the therapy outcome [35,50]. Of the six presented cases, one patient tripled, and three patients doubled their active treatment time with the online materials. The possibility to work actively between f2f sessions with the online materials is especially appropriate in cases with long intervals between f2f sessions. Furthermore, the therapist's statement that some patients did not like the homework-like character of the online treatment highlights the need to explain the importance of the work between sessions to achieve good therapeutic outcomes. Second, a diligently kept sleep diary may contain important information for the patient and the therapist, clarify certain, often unknown, sleep-disturbing behaviors (e.g., late caffeine intake, long daytime sleep periods), and allow the calculation of relevant metrics of the nightly sleep. There is a consensus in research that self-monitoring of sleep behavior is a helpful tool in the treatment of insomnia [51,52]. In preparation for the study, a considerable amount of time was spent developing a useful yet simple online sleep diary. However, the online sleep diary was used by a few patients, and most of the sleep data for this study were extracted from paper-and-pencil sleep diaries. One therapist even mentioned that he prefers the paper-and-pencil sleep diary, as it is simpler and faster to identify the relevant information than the online sleep diary. Therefore, in future studies on b-CBT-I, it should be clarified at the beginning of the study if an online sleep diary is needed and what functionalities should be available. Third, in line with results from studies on blended treatment for depression [53,54], the therapist mentioned that they like to outsource practical therapy components like psychoeducation or relaxation and focus in the f2f setting on problems that cannot be adequately treated with the online components. This may explain why the bedtime restriction module, which is the most effective part of CBT-I [55,56], was not used extensively in SLEEPexpert+. Bedtime restrictions were at the center of many of the f2f sessions. Thus, it could have been less relevant for patients to review the bedtime restriction module in SLEEPexpert+. Future studies on b-CBT-I should address which

components of CBT-I can best be worked on f2f or online. Fourth, different psychological disorders like depression and anxiety often co-occur with insomnia [33,57]. Indeed, of the six presented case studies, only one patient did not report suffering from any comorbidities. Future blended treatment programs could address this issue by adding specific modules for depression and anxiety to the online components of the b-CBT-I. Fifth, previous studies reported that patients often discontinued using online materials once they made certain progress [35]. The usage pattern of the six presented cases may reflect such a "good enough" effect [58]. Most patients stopped using SLEEPexpert+ in the last six weeks of their treatment as they already had a relatively high SE and may have perceived the progress as sufficient. Finally, the therapists mentioned that heavily burdened patients might not profit from the online components of b-CBT-I. Indeed, it could be speculated that Case 3 did not use the online materials at the beginning of his treatments as he suffered from severe insomnia. However, with the improvement of his SE due to the f2f therapy, he was able to profit from SLEEPexpert+. This underlines the advantage of the blended approach in comparison with pure online interventions. Depending on the patient's needs and state, different aspects of b-CBT-I can be prioritized.

The present study has some limitations, which should be acknowledged. First, the study has a small sample size. Due to relatively long treatment intervals, only six participants finished therapy during the investigation period. This small number of participants did not allow for statistical testing. Moreover, only the psychological psychotherapists used SLEEPexpert+ as an adjunct to their f2f therapies and were interviewed at the end of the investigation period. However, it would be interesting if a blended treatment approach could also benefit psychiatric care. Second, the investigation coincided with the opening period of the Swiss Sleep House Bern. As a result, therapists mentioned that they were not yet familiar with all the processes and could not solely focus on the study (e.g., not all therapists worked through the online materials by themselves). Furthermore, the therapists mentioned that an adaptation of the therapeutic style is necessary to successfully integrate a blended treatment approach. It is possible that such an adaptation of the therapeutic style takes more time than an investigation period of five months. Third, the effectiveness of the study cannot be explored as it is a small feasibility study. Nonetheless, of the six presented cases, five clearly improved in their SE and their reported insomnia symptoms. However, whether the improvements were due to the f2f therapy session, the online materials of SLEEPexpert+, or a combination of both, is unknown.

Despite these limitations, the presented study contributes to the understanding of blended treatments for insomnia and their use in routine care. Future studies should investigate the effectiveness of b-CBT-I with a sufficiently powered randomized controlled trial comparing b-CBT-I with an adequate control group like face-to-face therapy. Furthermore, it should be investigated if similar blended treatment programs would be suitable for other health contexts, like primary care, where patients with insomnia might receive treatment. Still, the personnel do not have an extensive background in CBT-I. The further investigation of SLEEPexpert+ could lead to an evidence-based, well-refined online treatment for insomnia that focuses on the most effective treatment components of CBT-I and can easily be prescribed as a program package in various health contexts. In prospect, such a broadly implemented and disseminated behavioral treatment program for insomnia could significantly improve insomnia care in the healthcare system.

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