

INTERNSHIP REPORT

The user perspective on an online intervention for insomnia symptoms

A mixed method study to define the perspective of adults with insomnia symptoms on online cognitive behavioural therapy for insomnia symptoms

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Content

1. Introduction	4
2. Contextual background	
2.1 Human sleep	6
2.2 Insomnia	6
2.3 Consequences of insomnia symptoms	6
2.4 Insomnia symptoms interventions	8
2.5 Online cognitive behavioural therapy	8
2.6 Lekker Slapen	9
3. Theoretical background	
3.1 Internet Intervention Model	10
3.2 Technology Acceptance Model	14
4. Conceptual framework	16
5. Method	
5.1-5.5 Part A	18
5.6-5.9 Respondents and population sampling	20
6. Results	
6.1-6.7 Part A	22
6.8-6.11 Part B	26
7. Discussion	30
Appendix	37
References	43

Preface

The conduction of this study was part of a five months internship within the master *Management, Policy Analysis and Entrepreneurship in Health and Life sciences*, with a specialization in *Community-based Health Technologies*. Commissioned by general practice Huisartsten Oude Turfmakt, the aim of this study is to obtain a better understanding of the perspective of adults with insomnia symptoms on online cognitive behavioural therapy interventions for insomnia.

In order to provide a better understanding on this topic, a mixed method approach was implemented. Notable, the initial aim of the study was to solely conduct a qualitative research. However, based on partly saturating data and the difficulty to find more respondents, a second part was developed. Therefore, through the paper you will notice that the initial and first part of the study is addressed as *part A* and the additional second part as *part B*. Corresponding, the participants of part A could be referred to as *group A*, and the participants of part B as *group B*.

Abstract

Without any doubt it can be stated that sleep is an important aspect of healthy human life. This important aspect is sensitive for disturbance. One of the most common disturbances of sleep are insomnia symptoms. These are symptoms that lead to insufficient sleep. Cognitive behavioural therapy (CBT) is often implemented to combat these symptoms. More specific, online CBT shows promising results in literature, however a gap can be observed regarding the user perspective on online CBT for insomnia (CBTI). Hence, the current study focussed on the perspective of users on online CBTI in terms of factors that contribute to the effectiveness and the behavioural intention to use such an intervention. In order to reveal this perspective, a mixed method approach was implemented, in which results of an interview and a questionnaire were combined. The interview revealed that the level of knowledge, duration of the intervention and the severity of the insomnia symptoms were important factors that contributed to the effectiveness of online CBTI. Additionally, more therapeutic support is needed to convert knowledge into action. Also, respondents expressed that online CBTI would be more suitable for individuals with onset or milder insomnia symptoms. In addition, results of the questionnaire indicated that the severity of insomnia symptoms was one of factors that contribute to the behavioural intention to use online CBTI. These findings combined indicate a healthcare challenge. This means that online CBTI intervention is perhaps more suitable for individuals with onset or milder symptoms, however they show less behavioural intention to use such an intervention. Therefore, awareness of potential CBTI treatments should increase amongst those with less severe symptoms. Furthermore, the level of knowledge and the level of the conversion of that knowledge into action should also be considered in order to determine the amount of support an individual needs.

1. Introduction

Sleep is undoubtedly an important aspect of healthy human life. Nevertheless, approximately 20% of the Dutch population experiences problems related to sleep, according to Statistics Netherlands (CBS, 2018). The reasons for the importance of sleep have been studied comprehensively in the past, which has resulted in strong indications that sleep contributes to physical restoration, learning and memory, and emotional regulation (Assefa *et al.*, 2015). Therefore, sleep problems can eventually lead to several physical and mental dysfunctions (Leone *et al.*, 2018). One of the most common causal factors of sleep problems are insomnia symptoms (Hershner & Chervin, 2014). These symptoms refer to a sleeping pattern that is associated with problems regarding initiating or maintaining sleep, which can lead to abnormal sleep (International Classification of Sleep Disorders, 2014).

The most common treatment for insomnia symptoms is cognitive behavioural therapy (CBT), amongst several other potential treatments. Traditional delivery of CBTI mainly include in-person delivery by a therapist or through printed materials, however a rise in CBTI that is delivered through the internet is observed (Cugelman, Thelwall & Dawes., 2011; Seyffert *et al.*, 2016). This rise accords with the current increasing use of information and communication technologies (ICT) for health, which is known as eHealth (WHO, 2018). Consequently, improvement of efficiency, reduction of healthcare costs, enhancement of quality and empowerment of patients are examples of beneficial impacts of eHealth (Botha, Botha & Herselman, 2014). Alongside these benefits, online CBT interventions for insomnia (CBTI) show to be effective in improving sleep and reducing insomnia symptoms, using both cognitive and behavioural methods aimed to change visible and hidden behaviours that could enhance or lead to these symptoms (Koffel, Koffel & Gehrman., 2015; Ho *et al.*, 2015). These effective treatment results of online CBTI are similar to those of traditional delivery methods (Seyffert *et al.*, 2016). Thus, CBT is an effective treatment for insomnia symptoms, and the digitalizing of its delivery could lead to overall healthcare optimisation.

Several studies have indicated efficacy of online CBTI, however too little is known about the user perspective. According to van Gemert-Pijnen *et al.* (2011), in order to optimally determine the effectiveness of an online intervention, in terms of uptake and impact, there is a need for both qualitative and quantitative data collection methods. More specific, they stated that studies regarding eHealth do not focus enough on in-depth evaluations, which include the perspective and experience of users. This lack of perspective or feedback could eventually lead to usability problems

and low acceptability (van Gemert-Pijnen et al., 2011). Increasing these qualitative in-depth evaluations and integrating this data with quantitative measured outcome variables could lead to triangulation, which is the process of combining data from various methods in order to validate the consistency of the findings (Van Der Meijden et al., 2003). Considering the current study, the qualitative methods can give meaning to the subjective and non-measurable perspective of users on online CBTI. Whereas quantitative methods can be included to objectively investigate measurable data regarding this user perspective. In order to reveal the relatively unfamiliar user perspective on online CBTI, both quantitative and qualitative methods should be included to create a more accurate interpretation of this perspective.

The overall aim of this study is to obtain a better understanding of the perspective of adults with insomnia symptoms on online CBTI. In order to explore this perspective, both qualitative and quantitative methods were used to answer the following research questions: *“What factors contribute to the effectiveness of an online CBTI intervention according to adults with insomnia symptoms?”* and *“What factors contribute to the behavioural intention of adults with insomnia symptoms to use an online CBTI intervention?”*. It is expected that this research will lead to a better understanding on the perspective of adults with insomnia symptoms on online CBTI, in which user perspective is defined in terms of the factors that contribute to the effectiveness and behavioural intention to use online CBTI. The outcomes of this research could contribute to the optimisation of the impact and uptake of online CBTI interventions.

2. Contextual background

2.1 Human sleep

Human sleep is an important physical and mental state that typically occurs at night for several hours and is regulated by circadian and homeostatic processes (Mongrain, Carrier & Dumont, 2006). Most studies revolve around the pathophysiological consequences of sleep deprivation or restriction in healthy subjects in order to better comprehend this phenomenon. A sleep duration that is considered optimal for adults lasts between seven to nine hours per night (Hirskowitz et al., 2015). Studies that have focussed on sleep duration that was less than this required range suggest that there are many biological functions that are associated with sleep (Assefa et al., 2015). The most common of which are, daytime neurocognitive and neurobehavioral performance, the process of learning and memory and emotional regulation (Assefa et al., 2015; Walker & Stickgold, 2006; Zohar et al., 2005). Given these outcomes, sleep duration can be considered as an essential factor in optimal daytime performance and health.

2.2 Insomnia symptoms

The number of individuals that experience insufficient sleep is still a commonly occurring problem, which in many cases can be attributed to the presence of insomnia symptoms. More specific, these symptoms include: *global sleep dissatisfaction* (GSD), which refers to a dissatisfaction with sleep quality or quantity, *difficulty initiating sleep* (DIS) once in bed with the intention to sleep, *difficulty maintaining sleep* (DMS), *early morning awakenings* (EMA) and *nonrestorative sleep* (NRS), which refers to the experience that sleep is not refreshing anymore even though someone had a normal sleep duration (Ohayon et al., 2012). Insomnia symptoms can vary among individuals, however these symptoms can all lead to an inadequate sleep duration.

2.3 Consequences of insomnia symptoms

Personal health

Development of insomnia symptoms could have psychological and physiological health consequences. First, a major consequence is an increased risk for developing mood disorders, such as depression. Studies have shown that insomnia symptoms can predict the development of a depression in the majority of the cases (Johnson, Roth and Breslau, 2006; Riemann & Voderholzer, 2003). Second, not only can insomnia symptoms contribute to the development of mental disorders, it can also enhance the symptoms of certain psychological disorders that have already manifested.

For instance, poor sleep increases the expression of anxiety disorder, leading to increased anxiety symptoms and panic attacks (Ramsawh et al., 2009). Third, increased cardiovascular risk can be linked to an inadequate sleep duration, which can eventually lead to cardiovascular morbidity and mortality (Covassin & Singh, 2016). The reason for this is that sleep insufficiency seems to induce cardiovascular dysfunction. Last, disrupted sleep is found to be associated with undesirable changes in the immune system (Bryant, Trinder & Curtis, 2004). More specific, chronic insomnia symptoms, which means suffering insomnia symptoms for three months or longer, is associated with a significant decline in the numbers of essential immune cells and a decrease in cellular response. This indicates a reduced immunological activity among individuals with chronic insomnia symptoms, which can lead to health problems (e.g. increased risk of infections). In short, these findings form a representation of physical and mental health decline that is associated with insomnia symptoms.

Safety

The presence of insomnia symptoms is associated with considerable impairments in safety (Roth & Roehrs, 2003). For instance, the rate of home, work and car accidents are significantly higher in people with insomnia symptoms (Leger et al., 2014). Notable, car accident rates are higher among employed individuals with these symptoms, whereas home accidents are more frequently reported by unemployed individuals with these symptoms. However, regardless of the type of accident, individuals report that insomnia symptoms were the main cause of their accident. Furthermore, fatigue, daytime sleepiness and/or tiredness as a result of insomnia symptoms can also significantly increase the risk of traffic crashes among both commercial and non-commercial drivers (Smolensky et al., 2011). The reduced safety of individuals with insomnia symptoms can be considered as an highly damaging (inter)personal effect.

Work productivity

The presence of insomnia symptoms can infect the workplace of the individual who suffers these symptoms. For instance, employees with insomnia symptoms show a significantly higher rate of absenteeism compared to those who sleep well, which can lead to high costs for the employers (Godet-Cayré et al., 2006). In addition, employees with insomnia symptoms that do appear at the workplace experience twice as much work productivity loss compared to good sleepers and notice an impaired activity level (Bolge et al., 2009; Léger et al., 2006). Thus, the presence of insomnia symptoms can lead to high absenteeism and low productivity.

Economy

Individual consequences of insomnia symptoms also form a significant problem for the public economy (Morin & Jarrin, 2013). For instance, the usage of healthcare resources is twice as high for individuals with insomnia symptoms compared to good sleepers (DiBonaventura et al., 2015). These healthcare resources partly include the number of healthcare provider visits, the amount of emergency room visits and the number of times hospitalized. Consequently, this depletion of healthcare resources leads to a considerably economic burden for the healthcare system (Moring & Jarrin, 2013). Aside from the economic healthcare burden, the productivity loss at work seems to take on the largest section when investigating the economic consequences of these symptoms (Daley et al., 2009). In conclusion, conquering insomnia symptoms could contribute to economical sustainability.

2.4 Insomnia symptoms interventions

Various interventions are being offered that aim to treat or alleviate insomnia symptoms, which are based on pharmacotherapy or psychotherapy. Pharmacotherapeutic interventions refer to treatment through use of medication, mainly including short-acting benzodiazepine agonists (Farmacotherapeutisch Kompas, n.d.). Despite its effectiveness, due to unwanted side effects individuals with insomnia symptoms are only allowed to use benzodiazepines short-term. These side effects include psychological and psychobiological dependence, reduced coordination and concentration, weakening of muscles, decrease in emotions and increased drowsiness (Bijwerkingen Centrum, n.d.; NHG, 2005.). Hence, a more favoured and commonly proposed intervention for insomnia is psychotherapy. In particular, CBT is one of the most clinical effective techniques to treat insomnia symptoms, compared to pharmacotherapy (Jacobs et al., 2004). CBT interventions are problem-focused and action-oriented. Both cognitive and behavioural factors are included to promote desired behaviour change (Butler et al., 2006). Additionally, these interventions tend to mainly focus on the perpetuating factors to improve disturbed sleep duration (Ebben & Spielman, 2009). Examples of such factors are increased night activity, an unbalanced sleep schedule, excessive time spend in bed in order to regain sleep loss and daytime naps (Stepanski, 2006). In conclusion, psychotherapy interventions are more preferred to pharmacotherapeutic interventions, because of the unwanted side effects of pharmacotherapeutic interventions.

2.5 Online Cognitive Behavioural Therapy

The delivery of CBT is achieved though in-person delivery by a therapist or through use of the internet. There does not seem to be a difference between personally delivered CBT and online CBT

in regard to the overall effects in patient treatment (Andersson et al., 2014). As for insomnia symptoms, several studies have conducted research where they compared in-person delivered CBTI and online CBTI. These studies have suggested that both delivery methods are more effective than a waitlist condition (Lancee et al., 2016), lead to sleep improvement and a decline in insomnia symptoms (Ritterband et al., 2009), and that online CBTI shows equivalent treatment results when compared to both in-person delivered CBTI and pharmacotherapy (Zachariae et al., 2016). This means that the implementation of CBTI would be beneficial to cancel out unwanted side-effects of pharmacotherapeutic interventions without shortcoming in treatment results. Also, the switchover from in-person delivery to online delivery will not lead to shortcoming in treatment results. However, considering the overall benefits of digitalisation, online delivery of CBTI could be more beneficial than in-person delivery. These benefits include lowering the threshold for patients to consider and initiate treatment, lowering the workload for healthcare providers and reducing healthcare costs that are related to insomnia symptoms (Botha, Botha & Herselman, 2014). Thus, both delivery methods are effective in treating insomnia symptoms, however online CBTI seems more profitable due to the beneficial effects of digitalization.

2.6 Lekker slapen

There are numerous online CBTI interventions offered. In regard to this study, a Dutch online CBT intervention for individuals with sleep problems is implemented as the online CBTI intervention. The intervention *Lekker slapen* (i.e. “sleep well” in Dutch; LS) integrates CBT into a five week online program for patients with sleep difficulties. The program offers patients teachings to overcome these difficulties. Through implementation of CBT, patients will learn to focus on factors that potentially cause their insomnia symptoms and eventually change the way they encounter these factors. Besides the integration of CBT, acceptance and commitment therapy (ACT) also has a fundamental role in LS. ACT can be considered as a valuable element of the currently most common CBT treatments (Forman et al., 2007). Instead of only changing the factors that cause the condition, ACT encourages patients to also accept their experiences while moving towards the goal of overcoming their insomnia symptoms. The platform incorporates several procedures that fall under CBT, these include stimulus control therapy, relaxation training, cognitive therapy and sleep hygiene education.

3. Theoretical background

3.1 Internet Intervention Model

As previously mentioned, online CBT interventions can beneficially contribute to the treatment of insomnia symptoms. These *internet interventions* are a complementary aspect in today's public health, offering several benefits. Additionally, a lot of research has been conducted to determine the effectiveness of these interventions. The present study aims to elucidate the factors that contribute the effectiveness of an online CBTI intervention according to the users. This will be defined by use of the Internet Intervention Model (IIM). The IIM model explicitly includes frameworks from behaviour change models and aim to explain behaviour change through use of internet interventions, because most internet interventions are behavioural treatments (Ritterband & Tate., 2009). This addition of behavioural theories is not implemented in most other models that aim to explain internet interventions, however it is a valuable component in order to optimally develop, test and implement internet interventions. Therefore, implementation of the IIM model is suitable for the current study, because the aim is to reveal the user perspective on online CBTI interventions, which are interventions that are based on (cognitive) behaviour change.

In order to determine treatment efficacy of internet interventions that aim to change behaviour, Ritterband et al. (2009) proposed a behaviour change model that predicts and explains this efficacy. This IIM model implies that an internet behavioural intervention is effective when it leads to behaviour change (and maintenance) and symptom improvement. As seen in figure 1, this is reached through nine components: beginning with the *user characteristics*, which will lead to *website use*. Then website use is influenced by *support* and *website*, and will induce *mechanisms of change*. Through these mechanisms, *behaviour change* and *symptom improvement* will be established. These improving changes are then continued through *treatment maintenance*. All these components, except for support and website, can be influenced by the *environment*. These nine components can each be perceived, evaluated and some can be modified. In order to understand the contribution of each element to the model, several aspects comprising each component will be discussed.

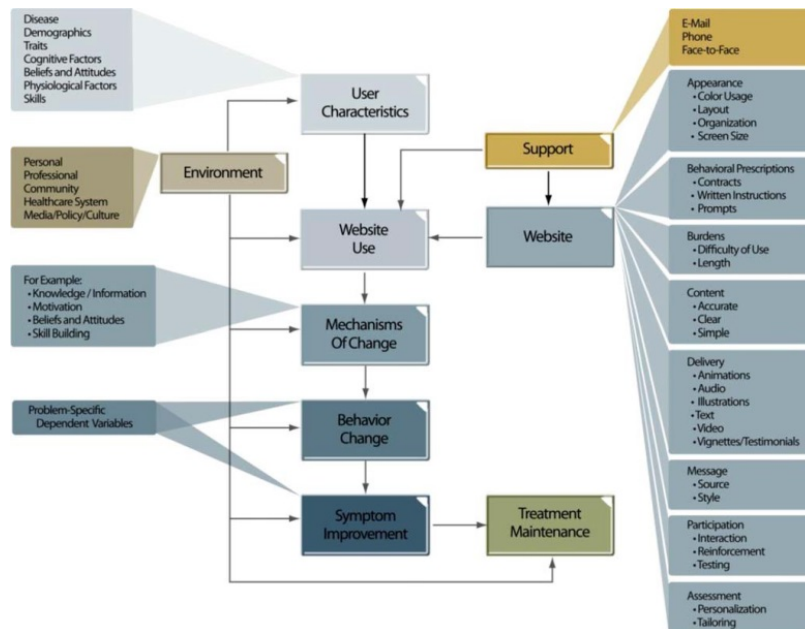


Fig. 1. Internet Intervention Model (Ritterband et al., 2009)

User characteristics

User characteristics refer to a number of complex and dynamic variables. With regard to the IIM model, Ritterband et al. (2009) suggested that these variables can be divided into seven main categories, which include: disease, demographics, traits, cognitive factors, beliefs and attitudes, physiological factors, and skills. Within the current research these variables will embed the following aspects: insomnia symptoms are perceived as the disease. A better representation of the user will be established through their demographics (i.e. age, gender etc.). The category trait will not be incorporated, because these include personality, temperament and intelligence, which are concepts that will not be obtained. The reason for this is that the components personality and temperament are broad terms, which makes it difficult to measure. Furthermore, measuring intelligence is not relevant, because it does not contribute to the subjective user perspective. The next category is cognitive factors, which are an important aspect when studying an intervention with a CBT fundament. These factors include self-efficacy, knowledge and self-regulatory strategies. An additional important aspect are beliefs and attitudes. They refer to treatment expectations, intentions, interest, motivation, readiness for change and perceived benefits and barriers to online CBTI. Moreover, physiological factors refer to motor functioning and skills to psychological mindedness and computer abilities to actually use the online CBTI intervention.

Website use

The user characteristics can then influence website use, which is principally intervention utilization, meaning the use of LS. Patients will be able to use the website through a reference from their GP. It is a self-help intervention, meaning that patients should be able to independently partake in the program.

Support

The component support is one of the components that can influence website use. According to Ritterband et al. (2009) it is still unclear whether support enhances website use or not, due to contradicting research outcomes. However, because support is part of the website, it also directly influences the website. LS offers support in two ways. First, users can approach Therapieland, which is the company that offers LS, for technical or operational support (i.e. non-treatment issues). Furthermore, they send e-mail reminders if the user has not been logged in for a while. Second, if the user wishes to discuss the content of the treatment more extensively, they can contact their GP.

Website

The website is the application through which a certain intervention is offered, which in the current study is that of an eHealth developing company named Therapieland. They offer several therapeutic online modules, such as LS. There are eight main categories that conclude the website and contribute to development and functioning according to Ritterband et al. (2009), these are: appearance, behavioural prescriptions, burdens, content, delivery, message, participation and assessment. Here, appearance refers to the look and the feel of Therapieland, or more specific LS. Behavioural prescriptions refer to the guidelines that are offered to the user. These guidelines can be used to explain what the user should do to target their insomnia symptoms. The burdens strictly refer to the perceived content related troubles in LS. For instance, poor application navigation and intervention length. These do not include technical or environmental burdens, such as troubles with internet access. Moreover, content is the actual information that is offered through LS and delivery refers to the way this information is transferred to the user. For instance, LS offers the content through use of videos in which a therapist is talking. Additionally, the content that the therapist is addressing is also completely written in text and they offer a library where you can find more in-depth text about certain matters that the therapist discussed. The source and the style of this content is referred to as the message. Furthermore, the ability to engage users to actually use LS is the participation aspect. This participation is tried to be achieved by requiring users to perform certain tasks. To finish, assessment refers to the ability of LS to measure the needs of the user,

personalize the program and provide tailored content and recommendations. LS does not specifically measure the needs of the user during the program, however after completing the program the user will receive a short evaluation questionnaire in which they are asked to indicate their satisfaction, symptom improvement and if they would recommend it to others. Furthermore, patients are able to personalize the program in terms of choosing their therapist (i.e. a male or female therapist).

Mechanisms of change

The next step are the mechanisms of change. These mechanisms include gears that will eventually lead to the desired behaviour change. Regarding LS, these include knowledge to improve sleep, cognitive restructuring on how to change certain cognitive and behavioural factors that can lead to insomnia symptoms and skill building on how to incorporate this restructured knowledge into their daily life.

Behaviour change

The mechanisms of change can eventually lead to behaviour change. Although the effectiveness of an intervention for an any condition is reflected by symptom improvement, a prior step to that is behaviour change. The selection of variables that are part of this change depend on the problem that is being studied or treated. In terms of the current study, behaviour change refers to change in (cognitive) behaviour, which can lead to the reduction of insomnia symptoms. These behaviours can be changed through cognitive or behavioural therapy (Morin et al., 2006). LS includes several treatment domains, meaning several cognitive and behavioural domains which can be personally altered by the user: *stimulus control therapy*, where the individual is instructed to re-associate the bed and/or bedroom with sleep and to re-establish a steady sleep-wake schedule; *relaxation training* is incorporated, which refers to actions that lead to a reduction in somatic tension or meddling thoughts that appear at bedtime; *cognitive therapy* revolves around the misconceptions about sleep, for instance the required amount of sleep. In order to improve sleep, these misconceptions need to be diminished; and *sleep hygiene education* is implemented, in order to teach the users important general guidelines about health practices (e.g. substance use, or technology use prior to bed) and environmental factors (e.g. light, room temperature). All these therapy domains combined, form the CBTI base of LS.

Symptom improvement and treatment maintenance

The modification of the CBT variables can then lead to the ultimate goal of an intervention, symptom improvement. These symptoms are also problem or condition specific. Here, symptom improvement

refers to a reduction in insomnia symptoms. A reduction in any of these symptoms will lead to symptom improvement. In the end, behaviour change and symptom improvement are warranted in treatment maintenance, which the user is required to self-manage.

Environment

All the before mentioned components, except for support and website, can be influenced by the environment. This includes personal relationships and space, workplace/school, healthcare system, community, and media, social, cultural and policy factors that can form an enhancement or barrier for individuals to use LS. For example, LS recommends an user to check their personal space in order to determine whether there are environmental factors that may inhibit decent sleep. Concepts that are embedded within the environmental factors can vary substantially. According to Ritterband et al. (2009) relationships between these factors and the model components should be identified, measured and evaluated more. For the current study, it is yet unclear which environmental factors may influence the LS program.

3.2 Technology Acceptance Model

The second part of the study aims to elucidate the factors that contribute the behavioural intention to use an online CBTI intervention according to the users. These factors can be defined by use of the *Technology Acceptance Model (TAM)*. This model can be implemented to predict the use or acceptance of technologies (e.g. eHealth) based on six determinants (Davis, 1985; Holden & Karsh, 2010). As seen in figure 2, the *external variables (EV)* are variables that could influence the *perceived usefulness (PU)*, and *perceived ease of use (PEOU)* of a technology. Then the *attitude toward using (ATT)* is directly influenced by PU and PEOU. The ATT, together with PU, in turn affects *behavioural intention to use (BI)*, which eventually leads to *actual system use*.

The EV considered in this study include eHealth experience, level of education and age (Burton-Jones & Hubona, 2006). Additionally, the outcomes of part A of this study indicated the relevance of certain factors that contributed to the effectiveness of online CBTI. These were the severity of insomnia symptoms, duration of sleep problems and sleep medication use. These variables will be implemented to gain more insight into their impact on the behavioural intention to use online CBTI. Furthermore, PU is an individual's perception of the degree to which using an online CBTI intervention will improve their sleep, PEOU is the perception of the degree to which using an online

CBTI intervention is free of effort, the ATT is the degree to which an individual thinks positively about an online CBTI intervention and the BI is the eventual intention towards usage or adoption of an online CBTI intervention.

Notable, the last concept *actual system use* will be eliminated from the model in regard to the current study. The reason for this elimination is the focus of the (part B) study, which will only consider factors that contribute to the behavioural intention to use an online CBTI intervention and not the actual use of it. The reason for this, is a lack of time to let all participants complete the five week intervention. Considering these determinants, this study will provide a better understanding on the behavioural intention to use online CBTI and define which underlying factors contribute to this intention.

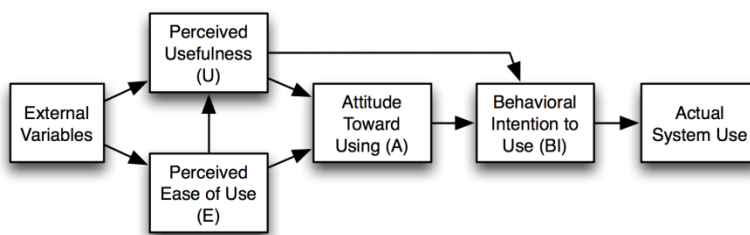


Fig. 2. Technology Acceptance Model (TAM; Davis., 1985)

4. Conceptual framework

Part A

Based on IIM, several sub-questions have been developed regarding the nine concepts and their relationships. These sub-questions serve as a tool to answer main research question one: *“What factors contribute to the effectiveness of an online CBTI intervention according to adults with insomnia symptoms?”*.

1. How do components of the IIM directly contribute to the effectiveness of LS?
 - a. How do mechanisms of change contribute to behaviour change?
 - b. How does behaviour change contribute to insomnia symptom improvement?

2. How do components of the IIM indirectly contribute to the effectiveness of LS?
 - a. How do user characteristics contribute to behaviour change and insomnia symptom improvement?
 - b. How does the website use contribute to behaviour change and insomnia symptom improvement?
 - c. How does the website contribute to behaviour change and insomnia symptom improvement?
 - d. How does support contribute to behaviour change and insomnia symptom improvement?

Part B

Based on TAM, several sub-questions have been developed regarding the five concepts and their relationships. These sub-questions serve as a tool to answer main research question two: *“What factors contribute to the behavioural intention of adults with insomnia symptoms to use an online CBTI intervention?”*.

1. How do the components of TAM contribute to the behavioural intention to use online CBTI?
 - a. How do external variables contribute to the behavioural intention to use online CBTI?
 - b. How do perceived ease of use and perceived usefulness contribute to the behavioural intention to use online CBTI?

c. How does attitude contribute to the behavioural intention to use online CBTI?

5. Method

Part A

5.1 Design

This part of the study was designed to explore which factors contribute to the effectiveness of LS according to adults with insomnia symptoms. The study consisted of two parts. First, the respondents were required to complete the online CBTI program LS. Next, after completion of the program respondents were asked to share their perspective on the factors that contributed to the effectiveness of the program during an interview. According to Seidman (2013), interviewing is a qualitative research method that can be used to capture someone's perspective and the meaning of that perspective. Therefore, to establish the perspective on these factors, in-depth semi-structured interviews were conducted with seven respondents, in which components of the IIM were taken into account. This means that users were asked about their user characteristics, website use, environment, behaviour change and symptom improvement, and perspective on support, website and mechanisms of change. The interview data contributed to defining the perceived factors that contribute to the effectiveness of LS according to adults with insomnia symptoms.

5.2 Respondents and population sampling

The respondent were recruited from the database of a Dutch general practice located in Amsterdam. Forty-four adult patients that were given a code for sleep difficulties combined with sleep medication use, were approached and informed about the study by the general practice. The patients were required to have been prescribed and have used sleep medication at least two times prior to the study, because due to the side effects of medication use, this seemed to be the target group who would benefit the most from a non-pharmacotherapeutic intervention. Consequently, this would eliminate patients that had suffered less severe insomnia symptoms or incidental IS (e.g. when traveling, or suffering the loss of a relative). Out of forty-four patients, eleven patients accepted the offer. In the end, seven respondents were able to complete the LS program and do the interview. Two of the remaining four participants did complete the LS program, however one of them did not respond to a repeated interview invitation. The other participant expressed that he was not impressed with the content of the program, meaning that the content was too basic and not relevant for him. Additionally, he as well did not respond to any further communication. The other two participants did not begin or finish the LS program due to personal reasons.

5.3 Procedure

After inclusion, respondents were asked to follow the LS program on the website of Therapieland from their home or another location where they felt comfortable. The program consisted of five sessions. It was recommended to finish one session per week, bringing the total amount of time to complete this program to five weeks. The first session took place at the general practise. The respondent was again informed about the study and was asked to sign an informed consent. Thereafter, they were introduced to the program and instructed to complete the first session by themselves. Session two revolved around stimulus control therapy and sleep hygiene education. In the following session, users learned how to introduce relaxation habits into their daily life. The fourth session focussed on the mental aspect that comes along with insomnia symptoms by offering cognitive therapy. And the last session consisted of a sleep test. This test measured the severity of their sleep problems and was also offered in session one.

After completion of the LS program, meaning that the user started and finished all sessions, a semi-structured interview was conducted. The interview took place at the general practice, which was familiar territory for all respondents. The interview guide can be found in appendix A. The guide contains questions that were operationalized from sub-questions based on the IIM. Furthermore, the interviews were recorded after the respondents were asked to consent to audio recording prior to the interview. One respondent preferred not to be recorded due to privacy concerns. In this case, the interviewer took extensive notes during the interview. The mean length of the interviews was approximately forty-four minutes. After completion, all respondents received a bol.com gift card of €20,- as compensation for their participation.

5.4 Data analysis

In total, seven interviews were transcribed and coded. The program Atlas.ti 8 was used in order to analyse the interview data. A deductive and inductive thematic analysis was incorporated, meaning that the semi-structured interview questions and analytical themes were based on the conceptual framework, and that new themes could emerge during the interviews that were not included in the conceptual framework. The coding of the data was then done based on a coding scheme, which was deductively made based on components within the IIM. Additionally, new emerged themes were coded and also added to the coding scheme. The data was coded in order through open, axial and selective coding (Boeije, 2014). Considering these codes, subthemes and then overarching themes were constructed to answer the corresponding research questions. A scheme of the codes can be found in appendix B. Validity of the data was ensured by the design of the interview, which was

based on the IIM model that is specifically developed for online CBT interventions such as LS. Furthermore, to ensure reliability a colleague researcher checked the coding scheme and coded one interview. The transcribed and coded data led to a better understanding of the perspective of seven adults with insomnia symptoms on the factors that contribute to the effectiveness of online CBTI intervention LS.

Part B

5.6 Design

This part of the study was designed to explore which factors contribute to the behavioural intention of adults with insomnia symptoms to use an online CBTI intervention. Patients of the same general practise were asked to fill out a questionnaire. Due to time restrictions, the choice for a questionnaire was made based on the advantages that a specific group can be approached whilst achieving time- and cost-effectiveness (Wright, 2005). The questionnaire data contributed to defining the factors that contribute to the behavioural intention of adults with insomnia symptoms to use an online CBTI intervention.

5.7 Respondents and procedure

The patients that were recruited in this part of the study were likewise retrieved from the database of the general practise. These patients were also given the code for sleep difficulties, however these patients either had been prescribed medication once or never. This meant that this group assumable consisted of patients with less severe insomnia symptoms compared to group A. In order to confirm this assumption, the Insomnia Severity Index (ISI) was included in the questionnaire to measure the severity of the insomnia symptoms, which is a validated tool to measure participants' insomnia severity (Bastien, Vallières & Morin, 2001). The patients were approached (n=583) and asked to fill out an online questionnaire regarding online CBTI interventions that the general practise offers. The online CBTI intervention is offered in Dutch, therefore only Dutch-speaking patients could participate. In total, 118 (male: 32%, female: 68%) patients with a mean age of 43 years old filled out the questionnaire.

5.8 Measurement

The questionnaire was developed in order to reveal what factors contribute to the behavioural intention to use an online CBTI intervention according to the (potential) users. First, the participants were asked about their demographics and sleep problems, these included some of the external variables. Then the participants received a brief explanation about online CBTI interventions offered

by the general practise. Thereafter, each component of the TAM model was measured by four items. The items that measured the components were specifically developed for the current study. An overview of the components and their according items can be found in appendix C. First, participants were asked about the outcome variable, which was the behavioural intention to use (BI) an online CBTI intervention ($\alpha = 0.76$). Second, the ATT, PU and PEOU were also measured by four items on a seven-point Likert scale ($\alpha = 0.89$; 0.83 ; 0.79). Last, the external variables included: age, education level, prior experiences, ISI, duration of sleep problems and medication use. Here, prior experiences refer to experience with eHealth and/or therapy.

5.9 Data analysis

The questionnaire data was analysed with SPSS Statistics 24. Two tests were performed to ensure the validity and reliability of the items. First, the internal consistency of the constructs were measured with Cronbach's alpha. Second, in order to confirm the factor structure of the questionnaire, a confirmatory factor analysis was performed of each of the constructs separately. Thereafter, the correlations between the dependent variable (BI) and independent variables (PEOU, PU, ATT and EV) were measured with a Pearson correlation. In addition, a regression analysis was performed to indicate which of the independent variables function as a determinant for BI.

6. Results

Part A

6.1 Participants

In total, seven interviews were conducted after respondents finished the online intervention LS. The length of the interviews ranged from 35 to 55 minutes. All respondents were physically able and were competent enough to follow the online intervention LS. Furthermore, the respondents were all female, but differed in age and daily occupation (see Table 1). Data from the interviews provided insight on the factors that contribute to an effective online CBTI intervention according to the respondents.

Table 1. Age and occupation of interviewees.

Respondent	Age	Daily occupation
1	48	Editor and teacher
2	54	Editor
3	41	Jurist
4	30	Programmer
5	46	Journalist
6	47	Teacher
7	51	Restorer

6.2 Principal findings

The following findings are considered to be the most essential, because these were the most saturated findings. The revelation of these findings have also led to the development of part B, which has added more value to the overall study.

Level of knowledge

Out of the seven respondents, six were already aware of (nearly) all the information that was offered in the online intervention. Presumably, the reason for this is that the information offered through LS is considered to be basic. Respondent 6 stated: *“It is just all the things you start with, what the general practitioner starts with [...] Just the basic things, which are of course very important.”* Most of them also indicated that they would preferably started with an intervention such as LS at the beginning of their insomnia symptoms. They considered the intervention to be more suitable for individuals who just started to experience these symptoms. Respondent 7 stated: *“[...] I think it is especially suitable for people who know very little, call them beginners.”*

Severity of insomnia symptoms

Considering the severity of insomnia symptoms, the majority felt that LS is probably more suitable for patients with less severe sleep problems or those who experience onset sleep problems. However, these seven respondents did not fall under these categories. They suffer more severe sleep problems for a significant long period of time. According to the majority, an online CBTI intervention will presumably not treat severe sleep problems, such as they themselves experience. Respondent 2 stated *“I do not think that this will solve people’s sleep problem. Perhaps for those whom only experience worrying, however for people like me, that experience everything, it cannot be solved with this.”*.

Duration of online intervention

Six respondents indicated that the length was not sufficient enough to actual lead to behaviour change. For instance, respondent 2 stated: *“If I would do this training with the goal to improve my sleep, it should be longer. Five weeks is quite short, if you really want to make a change. She also said at the end that she hopes that you have changed a lot. That is too short for someone with twenty years of sleeping problems. A lot of people are struggling with it for a long period of time. I do not think you can change that in four weeks.”*.

6.3 User characteristics

Disease

All respondents experience either problems with falling asleep or staying asleep, which affects their life. Most of them suffer considerable consequences as a result of these problems. Respondent 6 explained: *“It is just hazier, less concentration, more irritable, crankier, uhm sometimes so tired that everything hurts. Your face, everything. That is the physical part, however the other... But you also learn to live with it a little.”*.

Most of these respondents suffer sleep problems for years, and some even decades. The reason for the development of these problems differ among them. However, five respondents stated that it is related to stress or overthinking. Respondent 4 stated: *“[...] and at some point it also maintains itself. Then I start to think: “Where does the stress come from? Is it caused by too little sleep? Or is too little sleep the cause of the stress?”*. Besides stress, some respondents relate their sleep problems to their hormonal cycle. Many of the respondents find it hard to put a finger on the factors that will lead to a good or bad night sleep.

Beliefs and attitudes

Most respondents agreed to follow the online CBTI intervention, because they are very motivated and interested in their continuous search to improve their sleep. Their expectations prior to starting the online CBTI intervention differed among them. Two out of seven respondents expected more from the intervention. Respondent 6 explained: *“[...] it is too basic for me. I already know and do everything, however I always have hope and I am excited for new things.”*. In contrast, two other respondents expected that the intervention would be more demanding. The remaining respondents expected either that the intervention would have no great impact or would be annoying. However, as indicated before, the respondents are very motivated to try new treatment options that could improve their sleep. Additionally, as for the perceived benefits of online interventions, two respondents indicated that it is good to be able to retrieve information easily.

Cognitive factors

Although the participants were generally already well informed, most of them could appreciate the repetition of this information. For instance, respondent 5 stated: *“ Yet, it is very good to hear it again specifically for this kind of sleep. I find that good and it works.”*. Whilst most knowledge has already reached the respondents, not everyone is applying it to their daily lives. The reason for this differs among them. Respondent 1 explained: *“Well, because I find it hard to do what I have to do, and that is also the case in my daily life. This is also part of it. I understand that you have to do it, I understand that very well, but yes...”*. Besides respondent 1, three other respondents have also indicated that, although they are aware of the knowledge, they find it difficult to change a certain behaviour or cognitive pattern in order to improve their sleep.

6.4 Website

There were five out of eight categories that concluded the website in which the respondents' perspectives diverged the most. These categories included: appearance, assessment, delivery, content and massage. To start with, regarding the appearance of the website, respondent 3 stated: *“The website was neutral and well-arranged.”*. In contrast, respondent 5 stated: *“I found certain things very unclear and messy.”*. Following, some respondents appreciated that they could choose a therapist, others did not really consider it to be necessary. Respondent 4 stated: *“[...] yes, I think I would not have minded if the option was not available, however I do think that everyone has their own preference.”*. After assessing their therapist, they watched the videos in which the therapist would share information. Only one respondent preferred to read the information in text instead of watching the videos. Half of the remaining respondents found the method of information delivery

clear, the other half found it either slow or childish. Respondent 4 explained: *“Yes, I found it clear because she explained it brief and to the point.”*. Whereas respondent 7 experienced the following: *“Yes, sometimes it is a little bit slow or a little patronizing. It is a familiar tone of voice.”*. In regard to the content and message of the information, most respondents would have wanted it to be more profound. However, some respondents considered certain information to be eye-opening. They either learned about a new topic or re-evaluated their perspective on these topics. This divergent perspectives on website related categories did not result in an ambiguous outlook.

Perspectives on the remaining categories, which are behavioural prescriptions, participation and burdens, seemed to correspond more. First, the majority of the respondents did not experience any content related burdens. This could be due to the lack of obligation that three of the respondents had addressed. The online intervention offers a non-committal atmosphere. Regarding a certain exercise, respondent 2 expressed: *“[...] because there is no obligation, so I did not do anything.”*. Second, two respondents experienced burdens in the form of privacy concerns. They did not feel comfortable with participating in certain exercises where they had to share personal information.

6.5 Support

The majority of the respondents found that the instructions on the website were clear and easy to understand. They understood what action they had to undertake in order to change certain behaviour(s). However, a majority of the respondents felt that there was too little support and guidance to support those instructions. Related to this perceived lack of interaction, respondent 3 stated: *“I experience it as an one-way street. I miss the interaction.”*. In addition, respondent 5: *“[...] and then I feel a bit alone. And of course it is just a computer. Therefore, you have to figure things out yourself.”*. Some of the respondents expressed that this online intervention is a suitable addition to other therapy. Others stated that the intervention could be effective if it offered more guidance. None of the respondents could indicate what kind of guidance or from whom they would have wanted to receive this.

6.6 Environment

There were two main environmental subgroups that seemed most relevant, these included the personal and professional environment. First, the personal environment mostly included the partners of the respondents. Two respondents expressed that their partner also suffered sleep problems, which amplified their sleep problems. For instance, respondent 1 stated: *“ We have only been together for five years now and it always has been a factor. We have a hard time sleeping together [...] However, we have bought a very good bed with separate mattresses, so we do not*

bother each other when we toss.”. Furthermore, respondent 2 stated that her partner’s working hours have an influence on her willingness to improve her sleep. She stated: *“The rhythm of my boyfriend, that is why I am not really encouraged to go to bed earlier. Which is actually something I should do.”*. In addition, respondent 4 experienced some resistance from her environment regarding using the website. However, this did not influence her decision to actually use the website. In contrast, the remaining respondents received either encouraging or neutral feedback. In regard to the professional environment, two respondents experienced negative influences on their sleep. For instance, respondent 6 expressed: *“[...] so then you are full of adrenalin when you cycle home at 22:00 o’clock. And then it is difficult to sleep of course, because you are home but you cannot unwind. That is the tricky part of it. I also notice that many of my older aged colleagues experience sleep problems.”*.

6.7 Behaviour change and symptom improvement

Overall, most respondents were not able to change certain behaviour(s), which eventually would have led to symptom improvement. The main reason is that they were already well-informed on the topics that were discussed in the online intervention, and that they already applied or have tried to apply this information. In addition, another relevant factor seems to be the total length of the intervention (i.e. five weeks). However, four respondents noticed small changes. Three of them experienced an increased awareness for certain behaviour patterns. Respondent 4 experienced the following: *“Let’s say, if I would not take any action, I would at least be more aware. Simply becoming aware. I still think about it a lot.”*. Other small changes included skills related to changing their mindset or food related tips. This altered mindset has led to light symptom improvement among respondent 4, who stated: *“I think that I am a bit more relaxed. I will not be upset anymore or... That it will become this annoying thing. I find it more easy to just keep calm, even though I am having a bad night.”*. Besides respondent 4, none of the other respondents have indicated clear symptom improvement.

Part B

6.8 Severity of insomnia symptoms

Beforehand it was assumed that the participants of group B did not suffer severe insomnia symptoms like group A. This assumption was met based on the mean ISI score of group B, which was a score of 13. This number indicates subthreshold insomnia, meaning a clear existence of insomnia symptoms, however not as severe that it is diagnosed as clinical insomnia (Bastien, Vallières & Morin, 2001). However, it should be noted that the participants of group A did not receive an ISI

test. Their severity was assumed based on their prior medication use and confirmed during the interviews by themselves. This is always considered when comparing the two groups' insomnia symptom severity. Yet, the mean ISI score confirmed the mildness of the insomnia symptoms for group B.

6.9 Behavioural intention to use

Results showed that the overall behavioural intention to use the intervention on average was slightly positive (M=4.85, SD=1.10). Participants were most inclined to intend to use the intervention when their sleep problems would get out of hand (M=5.27, SD=1.43). Contrary, they were less inclined to intend to use the intervention when they only experience first signs of sleep problems (M=4.01, SD=1.65). In addition, the participants indicated they are more inclined to use the intervention if they would have access to it (M=5.22, SD=1.34). However, they would be less inclined to apply the useful information to their daily lives (M=4.88, SD=1.36). Remarkably, approximately 50 patients indicated that they wanted to try an online CBTI intervention offered by the GP at the end of the questionnaire.

6.10 Relationships dependent and independent variables

Pearson correlations of the determinants and behavioural intention to use can be observed in table 2. Behavioural intention to use strongly positively correlated with perceived ease of use ($r = 0.64$), perceived usefulness ($r = 0.53$) and attitude ($r = 0.67$). This indicates that the more an individual perceives the technology as easily to use, useful and/or has a positive attitude towards it, the more they will have the behavioural intention to use it .

In addition, the external variables showed weak correlated outcomes. For instance, the ISI score showed to be negatively correlated with the perceived ease of use ($r = -0.21$). This means that the higher the ISI score is, the less the individual will perceive the technology as easily to use. Another factor that seemed to correlated with the perceived ease of use is the experience factor "searched online for solutions for sleep and/or health problems" ($r = 0.22$). This positive correlation indicates that the more a person has searched online for health and/or sleep related information, the more they would perceive it to be easy to use the technology. Furthermore, the age of the individual showed a weak negative correlation with the attitude ($r = -0.20$). Meaning, that the higher the age of the user, the less positive their attitude is towards the technology.

Table 2. Pearson correlations between TAM components.

Constructs	Correlations													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1. ISI score	1													
2. PEOU	-0,21*	1												
3. PU	-0.06	0,63**	1											
4. ATT	-0.17	0,67**	0,69**	1										
5. BI	0.08	0,64**	0,53**	0,67**	1									
6. Experience with eHealth	-0.08	0.00	0.04	0.07	0.04	1								
7. Experience with therapy	0.00	0.06	-0.05	-0.07	-0.05	0.16	1							
8. Experience with online therapy	0.00	0.00	0.08	-0.01	-0.07	0,44**	0,30**	1						
9. Experience with online search for sleep and/or health related topics	-0.17	0,22*	0.13	0.11	-0.01	0.09	0.09	0.05	1					
10. Prior medication use	0.08	-0.12	-0.01	-0.13	0.02	-0.14	-0.09	-0.06	-0.11	1				
11. Duration insomnia symptoms	0.02	-0.01	-0.06	-0.03	0.02	-0.02	-0.04	0.06	-0.26**	0.07	1			
12. Age	0.03	-0.14	-0.10	-0,20*	-0.16	0.11	0.10	0.13	0.14	0.13	0.17	1		
13. Education level	-0.11	0.10	0.05	0.15	0.11	-0.01	-0.08	-0.11	0.08	0.01	-0.08	-0.09	1	

Note: *. Correlation is significant at the 0.05 level (2-tailed) and **. Correlation is significant at the 0.01 level (2-tailed).

6.11 Regression

As seen in table 3, a regression analysis was performed to indicate which determinants function as a predictor for the outcome variable behavioural intention. These determinants included PEOU, PU, ATT and EV. Three determinants seemed to significantly predict behavioural intention. These include: perceived ease of use ($\beta = 0.40$, $t(113) = 4.18$, $p < .001$), attitude ($\beta = 0.46$, $t(113) = 4.74$, $p < .001$) and ISI score ($\beta = 0.20$, $t(113) = 3.01$, $p = 0.003$). These outcomes indicate that the level of behavioural intention to use can be predicted by the level of PEOU, ATT and ISI score. This means that the higher the level of PEOU, ATT and ISI score, the higher the behavioural intention to use an online CBTI intervention will be. The remaining determinants were not found to be a significant predictor for behavioural intention to use. These included the perceived usefulness and all the remaining external variables, which are age, education level, eHealth experiences, duration of sleep problems and medication use. This means that the PU and mentioned EV do not predict the behavioural intention to use an online CBTI intervention.

Table 3. Regression table: dependent variable behavioural intention to use and its predictors

<i>Independent Variable</i>	<i>Behavioural intention to use</i>				
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>p</i>
PE	0.39	0.09	0.40	4.18	0.00
PU	0.04	0.10	0.03	0.36	0.72
ATT	0.50	0.11	0.46	4.74	0.00
ISI score	0.04	0.01	0.20	3.01	0.00
Experience with eHealth	0.19	0.19	0.07	1.00	0.32
Experience with therapy	0.00	0.15	0.00	-0.03	0.97
Experience with online therapy	-0.52	0.27	-0.14	-1.94	0.06
Duration insomnia symptoms	0.01	0.12	0.01	0.11	0.91
Prior medication use	0.18	0.16	0.08	1.13	0.26
Experience with online search for sleep and/or health related topics	-0.17	0.16	-0.08	-1.11	0.27
Age	0.00	0.00	0.02	0.36	0.72

7. Discussion

The implementation of online CBTI interventions shows promising results (Seyffert et al., 2016). However, little is known about the user perspective (van Gemert-Pijnen et al., 2011). Therefore, this study was designed to obtain a better understanding of the perspective of adults with insomnia symptoms on online CBTI. Part A of the study focussed on the factors that contribute to the perceived effectiveness of the online intervention LS. Based on the IIM model, effectiveness can be determined by behaviour change, which then leads to symptom improvement. These two concepts are related to seven other concepts, including: user characteristics, support, website, website use, mechanisms of change, environment and treatment maintenance. Thereafter, part B of the study focussed on the factors that contribute to the behavioural intention to use online CBTI. Based on the TAM model, external variables, perceived usefulness, perceived ease of use and attitude toward using are linked to the behavioural intention to use. The outcomes of the study can be considered during development and implementation of online CBTI interventions in order to optimise the impact and uptake of these interventions.

The respondents in group A have shared interesting perspectives on factors that contribute to the effectiveness of online CBTI. First of all, the willingness to reduce sleep problems was high among all these respondents. They are all motivated and interested to try new interventions in the hope that they will improve their sleep, although some of them did not have high expectations of an online CBTI intervention and have tried numerous interventions before. This could be explained by increased help-seeking behaviour that is observed among patients with more severe insomnia symptoms (Cheung et al., 2014). Help-seeking behaviour is defined as: *“A problem focused, planned behaviour, involving interpersonal interaction with a selected healthcare professional”* (Cornally & McCarthy, 2011). These patients tend to seek medical help more often compared to those with less severe insomnia symptoms. This may arise from the urge to decrease the daily consequences they experience as a result of insufficient sleep. Thus, the motivation and willingness, which is somehow linked to the symptom severity, of an individual seem to function as an important initiator to seek and undergo an intervention. In other words, in order for an online CBTI intervention to lead to behaviour change, the first step to this change is the preparedness to receive the intervention, which is supported by the beliefs and attitudes of the potential user.

Secondly, the overall results of the interviews indicated that completion of the online intervention LS did not lead to considerable behaviour change among the patients, despite their initiating beliefs and attitudes towards it. It may be even stated that due to their positive beliefs and attitudes towards finding a solution, they have a rich past of experiences regarding interventions for sleep problems. This has led to a high level of knowledge, which resulted in that most patients were well informed and already apply or have tried to apply the knowledge offered in LS. Thus, this could confirm the importance of knowledge as a mechanism of change. This means that if an individual has already acquired a certain amount of knowledge, which is specifically offered through the online intervention, it will be less likely that behaviour change will occur.

Thirdly, not all knowledge offered through LS was being applied, although most patients were well aware of the knowledge, thus this left some room for behaviour change. However, as mentioned before there was no overall substantial behaviour change observed. This could be explained by two factors that seem to contribute to this application of knowledge, or to put it differently, behaviour change. First, most patients clearly understand what action to undertake in order to change their behaviour, however most of them believe that a lack of support and guidance withholds them from actual behaviour change. Indeed, a higher level of personal guidance is related to better online intervention treatment outcomes and more adherence (Spek et al., 2007 & Lancee et al., 2013). This indicates that a lack of support and guidance could lower a user's level of participation. This lower level of participation may then decrease the chances of behaviour change to occur, because users seem to need a sufficient level of guidance in order to convert knowledge into action. Second, nearly all patients inclined that the duration of the online intervention LS, which is five weeks, was too short to essentially lead to behaviour change. This is consistent with previous research, which indicates that a six to eight weeks treatment duration is more optimal than five weeks (van der Eijken, 2019). Longer treatment durations tend to show better results in overall sleep improvement and decrease in insomnia symptoms (Koffel, Koffel & Gehrtman, 2015). Thus, in order for users to apply certain knowledge to their lives through online CBTI, it is important that they are sufficiently supported in this process and are offered plentiful time to accomplish this.

Lastly, most respondents indicated that the intervention LS seems unsuitable for them due to the severity of their insomnia symptoms. More specifically, the intervention does not offer sufficient therapeutic support to treat insomnia symptoms as severe as these patients experience. They expressed that this intervention would be more suitable for individuals with onset or milder insomnia symptoms. Additionally, they expressed that they would have rather received this online

CBTI intervention in an earlier stage of their own symptoms. This assumptive perspective is supported by prior findings that individuals with less severe insomnia severity show better treatment results compared to those with more severe symptoms in group CBTI (Koffel, Koffel & Gehrtman, 2015). This indicates that disease, especially the severity of a disease, seems to contribute to the occurrence of behaviour change. This could mean that the more severe the symptoms are, the more difficult it is for an individual to change certain behaviours through online CBTI. This may be due to the number of symptoms that have to be combated in order to improve sleep. An individual with less sleep disturbances may therefore benefit more from online CBTI interventions, because they have a shorter way to go in combating their symptoms.

As mentioned before, the initiating step towards behaviour change seems to lay in the beliefs and attitudes of the individual towards receiving an intervention. Together with this finding and the finding that the online CBTI would be more suitable for individuals with less severe insomnia symptoms, it is interesting to reveal whether the severity of the symptoms is somehow linked to the behavioural intention to use such an intervention. Therefore, the following discussion of results of part B, which on average included individuals with milder insomnia symptoms compared to group A, will illustrate this relationship.

The results indicate that higher insomnia severity is related to higher behavioural intention to use. This means that individuals are more inclined to use an online CBTI intervention when they experience more severe insomnia symptoms. Accordingly, as mentioned before, individuals that experience more insomnia symptoms, tend to show more help-seeking behaviour (Cheung et al., 2014). This could indicate a possible relationship between behavioural intention to use and help-seeking behaviour. Meaning, when an individual suffers severe insomnia symptoms, they would likely seek more medical help and would have a greater intention to use an medical intervention, such as online CBTI. However, this would mean that individuals with less severe symptoms, who may also benefit, or perhaps benefit even more, from such an online CBTI intervention, are less inclined to seek medical help. This could lead to an increase in untreated insomnia symptoms to the point where the symptoms are so severe that these individuals would start seeking help. However, then the chances of treatment efficacy will decrease parallel to an increasing in severity. Thus, it seems crucial to somehow increase the behavioural intention to use an online CBTI intervention of individuals with less severe insomnia symptoms in order to guarantee treatment efficacy of online CBTI.

An additional interesting result was that approximately fifty patients indicated that they wish to try an online CBTI intervention offered by the general practise. Besides this beneficial outcome, this also indicates that a relatively large group of people would want to treat their insomnia symptoms, however they are somehow unaware of their options. Due to the milder insomnia symptom nature of this group, this could be attributed to less help-seeking behaviour. Nevertheless, the unawareness can also be attributed to the overall low general public and healthcare practitioners knowledge on early intervention programs for insomnia symptoms (Morin et al., 2006). This implies that healthcare practitioners should be more active in staying up to date on interventions for individuals with onset or mild insomnia symptoms. This could lead to an increased treatment awareness among those individuals and additional increased treatment onset.

Other factors also seem to contribute to the behavioural intention to use online CBTI, besides severity of insomnia symptoms. First, attitude also seems to predict the behavioural intention to use. Individuals that have a positive attitude towards using online CBTI have a higher intention to actually use it. Notable, age seems to be negatively correlated with attitude. This indicates that the higher a person's age, the less positive their attitude is towards using online CBTI. This is in line with previous studies that focussed on the relationship between age and internet usage (Porter & Donthu, 2006). Secondly, results further showed that the perceived ease of use also predicts the behavioural intention to use. This indicates that the easier the use of an online CBTI intervention seems, the higher the intention will be to use that intervention. Additionally, if someone already has experience with online search for health and/or sleep related topics, the more inclined they will be to perceive the online CBTI intervention is easy to use.

Strengths

There are a number of strengths with regard to the execution of the current study. First, the findings of the study contribute to the previously relatively unknown user perspective on online CBTI. Second, another strength is the fast adjustment after results of part A indicated some saturation. This resulted in part B, which added more valuable data to this field of research. Besides the additional data, the development of part B resulted in an opportunity for a relatively large group of patients to start with an online CBTI intervention that until this study was not on their radar. Lastly, as mentioned in the introduction, research concerning eHealth interventions should be studied with qualitative as well as quantitative research methods. The current study made use of a mixed method approach, which resulted in a more comprehensive overview of the perspective of (potential) users on online CBTI.

Limitations

Although the study shows a number of strengths, there are some limitations that should be considered as well. To begin with, although part A showed some saturating data, the amount of respondents was too little. A larger number of respondents could have supported the current findings more. Also, there was a relatively large amount of concepts that were covered during the interview. The interviewer experienced as if the amount of interviews did not offer enough opportunity to get familiar with the concepts and to really get to grips every concept, especially during the first couple of interviews. Second, it should be considered that only patients with severe insomnia symptoms shared their in-depth experience. The missing experience of patients with milder insomnia symptoms forms a gap in the data. Additionally, the severity of insomnia symptoms of group A were measured with a different tool, namely a built-in tool in LS, compared to group B, whom received the ISI. However, the data of the tool in LS was not used to determine the severity of insomnia symptoms in group A, this was solely done based on the shared experiences and amount of prior medication use of this group. Furthermore, regarding the assumption that group B had only received medication once or never, cannot be confirmed based on the current data. According to the database of the general practise, these patients did not receive medication more than once, however it is not clear whether they have received and used medication outside of the practise's knowing. Lastly, throughout the study the term *insomnia symptoms* was used as an overarching term to describe several sleep related problems. However, this resulted in the elimination of measuring the effect of different insomnia problems on the user perspective on online CBTI.

Recommendations

In order to accommodate both patients who suffer severe insomnia symptoms and those who suffer milder symptoms, the level of knowledge should be considered during development of online CBTI interventions. More specific, it should also be considered how knowledgeable an individual is, how this knowledge is currently converted into action by them and what support is needed to achieve this. This could mean that someone with a high level of knowledge could have troubles with converting this knowledge into action. In this case, there should be more personal support for this particular individual. In contrast, someone who has a low level of knowledge could perhaps try to convert new knowledge into action by themselves first, however they should be able to receive more support if this is wished. Furthermore, it should also be considered that users receive enough time to achieve that conversion of knowledge into actions. eHealth developers and providers could benefit from these findings in order to optimise the effectiveness of their intervention.

As for healthcare practitioners, increasing their own awareness of online CBTI interventions that target those who especially suffer onset or milder insomnia symptoms, could increase the awareness of those individuals regarding their treatment options. This could lead to the reduction of the amount of individuals that develop severe symptoms. As a result of this reduction, a decrease in medication use could be positively affected by this. This will result in more long-term treatment efficiency, instead of short-time.

Future research

For future research, several factors could be considered in order to build on the current study findings. First, in order to achieve full saturation regarding the in-depth experiences of patients, more respondents should be included compared to the current study. Furthermore, this group of respondents should consist of patients with insomnia symptom severity ranging from onset to severe symptoms. These symptoms should then be measured with the same tool, for instance the ISI. Second, in order to distinguish the effects of different sleep related problems on the perspective on online CBTI, the overarching term insomnia symptoms should be disassembled. This was not done in the current study, however could have brought along some relevant findings.

Conclusion

In conclusion, the current study has partly contributed to a better understanding of the user perspective on online CBTI. Combining of part A and part B show some interesting findings regarding the perspective of adults with insomnia symptoms. Based on the perspective of patients from group A it seems that beliefs and attitudes, level of knowledge, support and insomnia symptoms severity contribute to the occurrence of behaviour change. Especially the severity of the symptoms showed to be a factor throughout the whole process. Knowing this, the next step was to determine what factors contribute to the behavioural intention to use an online CBTI intervention, including the severity of insomnia symptoms. This led to the result that the lower the severity of the symptoms, the lower the behavioural intention is to use the online CBTI intervention. This represents an obstacle in treating individuals with mild or onset insomnia symptoms. Preferably, the aim is to treat these patient as soon as possible, before the symptoms get more severe. This was also indicated by the patients with more severe symptoms, as they stated that they would have wanted to use an intervention such as LS earlier. Thus, the perspective of adults with insomnia symptoms differs based on the severity of those symptoms. Those with more severe symptoms seem to have a higher level of knowledge and are highly motivated and interested in trying out new interventions. As opposed to those with milder symptoms, who show a lower behavioural intention to use an online

CBTI intervention. This could be increased when healthcare practitioners would increase their own awareness on treatment options and transmit this to the patient. Also, when transmitting this information, the attitude and ease of use towards online CBTI should be considered, because these factors seem to contribute the behavioral intention to use such an intervention among patients. Overall, these findings have increased the understanding on the perspective of adults with insomnia symptoms on online CBTI. This user perspective on online CBTI was relatively unknown, and still can be considered as an area which offers much opportunity for research. Unravelling this perspective could contribute to improving overall public sleep and the optimisation of a digitizing healthcare culture.

Appendix

A. Interview Guide

[Opname starten]

[Deelnemer nogmaals toestemming vragen voor opname]

Topic I: Persoonlijk (het ijs breken en proberen een beeld te schetsen van zijn/haar leven)	
Vraag	Zou u mij iets over uzelf kunnen vertellen?
Vraag	Waar komen slaapproblemen vandaan? Hoe ziet uw huidige slaappatroon eruit?
Topic II: Online cognitieve gedragstherapie (achterhalen wat hij/zij vindt van online therapie en wat de verwachtingen waren)	
Vraag	Wat heeft u in het verleden geprobeerd om uw slaapproblemen te verminderen?
Vraag	Wat vindt u van online therapie? (voordelen + nadelen)
Topic III: Lekker Slapen	
Vraag	Wat waren uw verwachtingen LS?
Vraag	Wat vond u van de module LS?
Vraag	Heeft u denkt u goed gebruik kunnen maken van de website? Zo ja of zo nee , welke factoren hebben daaraan bijgedragen? <ol style="list-style-type: none">De website<ul style="list-style-type: none">- Uiterlijk- Manier van uitleggen- Tegen dingen aangelopen- Duidelijke inhoud- Manier van informatie overdracht- Overtuigend en geloofwaardig- Aanzetten tot deelname of interactie- PersonaliserenOndersteuning van Therapieland en/of huisarts (<i>telefoon, email en face-to-face</i>)Persoonlijke eigenschappen (Hierbij heel belangrijk om na te gaan of ze wel het advies hebben opgevolgd van 1 sessie per week en of ze ook alles hebben proberen toe te passen in het dagelijks leven)<ul style="list-style-type: none">- Zelfdoeltreffendheid- kennis- zelfregulatie- interesse- klaar om te veranderenUw omgeving (<i>Persoonlijke relaties, professionele, gezondheidszorg</i>)

Topic IV: Gedragsverandering → Symptoom vermindering (achterhalen of LS heeft geleid tot gedragsverandering en of die verandering heeft geleid tot symptoom vermindering)

<p><u>Vraag</u></p>	<p>Heeft u verandering in uw gedrag opgemerkt na gebruik van LS?</p> <ul style="list-style-type: none"> • Zo ja, welke veranderingen zijn dat? • Welke factoren hebben bijgedragen aan die verandering? <p>Eerst afwachten wat de deelnemer zelf zegt, als hij/zij bepaalde onderdelen hieronder niet heeft genoemd, daarop verder gaan:</p> <p style="text-align: center;">1. Informatie/kennis</p> <p>Sessie 1: <i>Welkom – test</i> Sessie 2: <i>Slaapgewoonten</i> (slaapomstandigheden, planning van de dag en eetgewoonten) Sessie 3: <i>Ontspannen</i> Sessie 4: <i>Gedachten</i> (gedachten over slaap, gedachten ombuigen en piekeren) Sessie 5: <i>Tot ziens – test</i> Slaapdagboek</p> <p style="text-align: center;">2. Uw omgeving <i>(Persoonlijke relaties, professionele(werk/school), gezondheidszorg)</i></p> <p style="text-align: center;">3. Persoonlijke eigenschappen (overtuiging en houding)</p> <p style="text-align: center;">4. Motivatie</p> <p style="text-align: center;">5. Vaardigheden aanleren (toepassen van kennis)</p> <p>Wat voor impact heeft <i>*gedragsverandering X*</i> gehad op uw symptomen? (Gedragsverandering X= bijvoorbeeld eerder naar bed gaan, eetpatroon etc. → Alle veranderingen langsgaan)</p>
<p><u>Vraag</u></p>	
<p><u>Vraag</u></p>	<p>❖ Zo nee, waardoor heeft er geen gedragsverandering plaatsgevonden denkt u?</p> <p>Eerst afwachten wat de deelnemer zelf zegt, als hij/zij bepaalde onderdelen hieronder niet heeft genoemd, daarop verder gaan:</p> <p style="text-align: center;">1. Informatie/kennis</p> <p>Sessie 1: <i>Welkom – test</i> Sessie 2: <i>Slaapgewoonten</i> (slaapomstandigheden, planning van de dag en eetgewoonten) Sessie 3: <i>Ontspannen</i> Sessie 4: <i>Gedachten</i> (gedachten over slaap, gedachten ombuigen en piekeren) Sessie 5: <i>Tot ziens – test</i> Slaapdagboek</p> <p style="text-align: center;">2. Uw omgeving <i>(Persoonlijke relaties, professionele(werk/school), gezondheidszorg)</i></p> <p style="text-align: center;">3. Persoonlijke eigenschappen (overtuiging en houding)</p> <p style="text-align: center;">4. Motivatie</p> <p style="text-align: center;">5. Vaardigheden aanleren</p> <p>Welke eigenschappen van LS zouden verbeterd kunnen worden waardoor het misschien wel zou leiden tot gedragsvernadering?</p> <p>Welke eigenschappen die nog niet terug te zien zijn in LS zouden kunnen worden toegevoegd zodat het misschien wel zou kunnen leiden tot gedragsverandering?</p>
<p><u>Vraag</u></p>	<p>Heeft u verder nog verandering opgemerkt in u slaapprobleem symptomen wat niet met een mogelijke</p>

	gedragsverandering te maken heeft gehad?
<u>Vraag</u>	Hoe denkt u dat u hetgeen wat u heeft geleerd uit LS zal blijven/zal gaan toepassen in uw verdere dagelijks leven? → Welke rol speelt uw omgeving daarin?
<u>Vraag</u>	Hoe waarschijnlijk acht u de kans dat u de module zult aanraden aan iemand anders? En aan wie?
<u>Vraag</u>	Als u nu naar uw slaapprobleem verleden kijkt, is er dan een moment waarop u denkt dat de module meer had geholpen?
<u>Vraag</u>	Hoe effectief vindt u deze vorm van therapie? 1. Gedragsverandering 2. Symptoomvermindering
Afbouw interview	
<u>Vraag</u>	Bedankt voor het beantwoorden van mijn vragen en het delen van uw ervaringen. Heeft u misschien zelf nog toevoegingen?

B. Coding scheme

Code name	Explanation	Example quote
User characteristics		
<u>Disease</u>		
IS cause	The potential cause of IS	<i>"If I drink (alcohol) a lot for a while, my sleep gets worse."</i>
IS treatment	Interventions that are used or were used to treat IS	<i>"I used to take melatonin and then your body already knows it's time for the melatonin."</i>
Cognitive factors	These include self-efficacy, knowledge and self-regulatory strategies	<i>"I find it very difficult to change things."</i>
Beliefs and attitudes	Treatment expectations, intentions, interest, motivation, readiness for change and perceived benefits and barriers to online	<i>"I was purely curious to try the intervention."</i>
Environment		
Personal	Influence of any personal relationships	<i>"My environment thought I should not start the intervention."</i>
Professional	Influence of any professional relationships	<i>"Regarding my work, I do not really know when the week starts what my week will look like. That makes me quite restless."</i>

Mechanisms of change

Knowledge/information	Knowledge and information regarding IS, IS treatment, optimal behavior	<i>"I already know most of it".</i>
Motivation	Motivation that leads to behavior change	<i>"The best thing that works for me is if I am in a group with fellow sufferers."</i>
Beliefs and attitudes	Beliefs and attitude that lead to behavior change	<i>"I changed my attitude towards a bad night. I now think it is just one night, maybe will the next one be better."</i>
Skill building	Skills that lead to behavior change	<i>"I always enjoy learning new things and I really think a lot about it."</i>

Support

Therapieland	Technical or operational support	<i>"I miss the interaction on the website."</i>
GP	Opportunity to discuss the content of the treatment more extensively	<i>"I find it very pleasant that the practice offered this."</i>

Website

Appearance	Refers to the look and the feel of Therapieland, or more specific LS	<i>"The website looked easy to use."</i>
Behavioral prescriptions	The guidelines that are offered to the user	<i>"Then you had those exercises, which t I found very unclear."</i>
Burdens	Refer to the perceived content related troubles in LS	<i>"Some exercises required you to share personal information, I did not like that."</i>
Content	Content is the actual information	<i>"The information was good and believable."</i>
Delivery	The way this information is transferred to the user	<i>"I would also rather not see people, but something more neutral such as animations."</i>
Message	Source and the style of this content	<i>"The website was a little unclear."</i>
Participation	The accessibility to perform certain tasks	<i>"Then I had to fill out a test, but that did not make any sense to me."</i>

Assessment	The ability of LS to measure the needs of the user, personalize the program and provide tailored content and recommendations	<i>“Regarding choosing your therapist, well the choice was offered so I started paying attention, but it was not necessary.”</i>
<u>Behavior change</u>	Change of a certain behavior or cognitive pattern	<i>“If I now have a better night, it is thanks to the things I do that I learned from the intervention.”</i>
<u>Symptom improvement</u>	Reduction of IS	<i>“Not really improvement symptoms, however I am more aware now of certain behaviour.”</i>
<u>Treatment maintenance</u>	Continuation of learned topics or keep trying to learn new topics	<i>“I would like to keep repeating what I learned.”</i>
<u>Experience</u>	Prior online therapy experience	<i>“I have some experience with online mindfulness.”</i>
<u>Proposed target group</u>	Target group that could benefit the most	<i>“Especially people who have trouble with going outside or live remotely could benefit from this kind of intervention.”</i>
<u>Website use</u>	Everything related to website use	<i>“Being able to retrieve information make it more easy.”</i>

C. TAM components and items

Characteristics

Measures	Scale	Reliability
<u>Perceived ease of use</u>	7-point Likert scale from 1 = <i>strongly disagree</i> to 7 = <i>strongly agree</i>	0.79
(1) I think using the online intervention is an easy way to get help with my sleep problem. (2) I expect that the online intervention will offer an easy solution for my sleep problem. (3) It would be easy for me to follow the online intervention for sleep problems. (4) It seems easy to integrate the intervention for sleep problems into my daily life.		
<u>Perceived usefulness</u>	7-point Likert scale from 1 = <i>strongly disagree</i> to 7 = <i>strongly agree</i>	0.83
(1) Following an online intervention for sleep problems has the potential to improve my sleep. (2) I think an online intervention for sleep problems will help me gain more control over the quality of my sleep. (3) Following an online intervention for sleep problems will help solve my sleep problem. (4) I think an online intervention for sleep problems is able to give me new information and knowledge about sleep.		
<u>Attitude</u>	7-point Likert scale from 1 = <i>strongly disagree</i> to 7 = <i>strongly agree</i>	0.89
(1) Following an online intervention for sleep problems is a good idea. (2) Following an online intervention for sleep problems is useful. (3) I think an online intervention is a good solution for people with sleep problems. (4) I have a positive view on using an online intervention for sleep problems.		
<u>Behavioural intention to use</u>	7-point Likert scale from 1 = <i>strongly disagree</i> to 7 = <i>strongly agree</i>	0.76
(1) If I had access to an online intervention for people with sleep problems, I would have the intention to use it. (2) If I have access to an online intervention for sleep problems, I see myself applying everything I find useful in everyday life. (3) I would use an online intervention for sleep problems if my sleep problems get out of hand. (4) I would use an online intervention for sleep problems with the first signs of sleep problems.		

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