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Original Article

ORIGINAL ARTICLE

The "Dream Changer": a randomized controlled trial evaluating the efficacy of a parent-based intervention for childhood nightmares

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Abstract

Study Objectives: Recurrent nightmares in childhood may have a range of detrimental effects for both the child and parents. This randomized controlled trial evaluated the efficacy of a novel parent-based intervention for childhood nightmares, using a new device called the "Dream Changer."

Methods: A total of 56 children aged 3–10 years (M = 7.1 ± 2.1 years; 51.8% boys), and one of their parents were randomized to either the intervention or waitlist control group. The intervention group received a "Dream Changer"—a light-emitting remote-control-like device that the child was encouraged to take to bed and use upon experiencing a nightmare. Parents completed online surveys at baseline, 1-week, and 2-weeks following the intervention. Parents in the intervention group additionally completed a 3-month follow-up survey. Outcome variables included children's nightmare frequency, sleep-wake patterns, and sleep anxiety, as well as parents' daytime sleepiness.

Results: Significant group-by-time interaction effects were found for nightmare frequency ($p = 0.001$) and sleep anxiety ($p = 0.006$). Parents of children who received the "Dream Changer" reported fewer nightmares ($M_{difference} = 1.7$, $p < 0.001$, $d = 1.06$) and decreased anxiety ($M_{difference} = 0.9$, $p = 0.001$, $d = 0.41$) at post-intervention, whereas such benefits were not found in the waitlist control group. Three-month follow-up assessments demonstrated that gains were maintained over-time. Interaction effects were not significant for children's sleep metrics or for parents' daytime sleepiness.

Conclusions: The present study provides preliminary evidence for the efficacy of a brief, highly accessible intervention for reducing children's nightmares and nighttime anxiety. Future research may wish to test these effects using larger samples and longer follow-up assessments.

Clinical Trial Registration: The trial has been registered at the Australian New Zealand Clinical Trials Registry (https://www.anzctr.org.au/; Identifier:ACTRN12620000633987).

Statement of Significance

Recurrent nightmares in children may be highly detrimental, and identifying accessible cost-effective interventions remains a high priority in the field. This randomized controlled trial tested the efficacy of the "Dream Changer"—a novel intervention, delivered solely by parents, encouraging cognitive change using a remote-control-like device. Results attested to the efficacy of the intervention in reducing nightmare frequency and anxiety in children aged 3–10 with recurrent nightmares compared to a waitlist control group. These findings suggest that the intervention may be used as a first step in a stepped-care approach, given its low cost, high accessibility, and preliminary evidence for efficacy. Future research is warranted to establish the effectiveness of this intervention, evaluate its long-term effects, and identify its underlying mechanisms.

Key words: sleep; children; nightmares; sleep anxiety; nighttime fears; insomnia

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Introduction

Nightmares are a common phenomenon affecting ~60% of young children [1]. However, recurrent nightmares (i.e. 1+ per week) are less common, and affect 3%–6% of youth [2, 3]. These are associated with a range of nighttime consequences, including reduced sleep quality and quantity, severe nighttime fears, and problems initiating and maintaining sleep [2, 4]. Frequent nightmares are also associated with adverse daytime consequences, including emotional, social, and academic difficulties [5–7]. Children experiencing recurrent nightmares often learn to associate bedtime with nightmare occurrences [8], which may lead to avoidance behaviors in the sleep context. For example, these children may engage in prolonged bedtime rituals, resist bedtime, and intentionally try to stay awake so as to not experience a nightmare [2, 9].

Parents' sleep can also be impacted by their child's nightmares [10]. Up to 50% of children between 3–5 years of age have nightmares severe enough to disrupt their parents' sleep [1]. Parents who are regularly woken as a result of the need to tend to their child at night are likely to experience higher levels of sleep restriction and fragmentation, which have been associated with impaired cognitive functioning, health, and wellbeing [10, 11]. Thus, it is clear that recurrent nightmares in children require adequate intervention to improve the health of both children and their parents.

Current treatments for childhood nightmares usually focus on a cognitive–behavioral framework that aims to help the child change their thinking about nightmares, while practicing exposure-based techniques and reinforcement management [9, 12]. Prior studies on childhood nightmares and nighttime fears have evaluated interventions, many of which showed promising findings [9, 13–17]. The most established intervention to date is Imagery Rehearsal Therapy (IRT), which aims to modify the avoidant cognitions and behaviors that form due to nightmare-related worries [18]. During IRT a client recalls their nightmare and rehearses it frequently to change its narrative, and consequently modifies it to yield more positive cognitive and physical symptoms. A few controlled trials have evaluated IRT in children and found significant reductions in nightmares following treatment [9, 15]. However, these studies relied on small samples ($N \leq 20$), and therefore, the generalizability of their findings is limited. Furthermore, despite evidence for the efficacy of brief IRT delivered online or over the phone in adults [19, 20], studies of IRT for pediatric populations have thus far required a health professional to administer over multiple sessions, which can be relatively costly and time-consuming [21].

Recent work has demonstrated the efficacy of very brief interventions in reducing children's nighttime anxiety and sleep-related problems. For example, a 2-session CBT-based intervention involving imaginary-play led to greater declines in sleep-related problems compared to an active control [13]. Similarly, an RCT by Kushnir and Sadeh [14] assessed a sample of children aged 4–6 years old ($N = 109$), and examined the effects of a brief intervention using an inanimate object during the night; specifically, a puppy doll named the "Huggy Puppy." Children were either instructed to protect the doll during the night or use it as a protector. These authors found a reduction in nighttime fears, and improved sleep quality following both versions of the intervention. They suggested that the doll appeared to have an anxiety-reducing role that was learned from its association with positive outcomes (i.e. protection, better sleep). These findings were promising as they showcased that when children are given a story and are encouraged to use their imagination to increase their sense of mastery and control, nighttime anxiety is diminished and sleep improves.

Findings from trials evaluating the aforementioned interventions are encouraging, however, albeit brief, these interventions still require healthcare professionals for delivery. A recent study provides evidence for the efficacy of a parent-delivered intervention to reduce nighttime fears in young children [22]. Children aged 3–8 years who received a 5-week CBT-based intervention, administered by their parents in the home setting, showed greater reductions in nighttime-related fears and phobic symptoms, and more pronounced increases in adaptive nighttime behavior compared to a waitlist control group. However, nightmare frequency was not assessed in this study, and the assignment to groups was not randomized.

Based on evidence for the efficacy of brief interventions, which have used an inanimate object to provide the child with a sense of control and protection at night [14], a novel intervention has recently been developed. This intervention is delivered in the home setting by parents, who provide the child with a device called the "Dream Changer." Parents present this small remote-control-like light-emitting device as an aid that may help their child change the content of their dreams. Children are then encouraged to take the "Dream Changer" to bed and use it throughout the night.

The primary aim of this randomized controlled trial was to evaluate the efficacy of this novel and brief parent-based intervention in reducing children's nightmares. This study further aimed to assess whether using the "Dream Changer" reduces the child's sleep onset latency (SOL), wake after sleep onset (WASO), nighttime awakenings, and sleep anxiety, and increases sleep duration. Finally, as children's nightmares have an impact on parents, we also assessed whether a reduction in parents' daytime sleepiness would be observed following the intervention.

Method

Participants

A total of 56 children (mean age = 7.1 ± 2.1 years, 51.8% male), and one parent from each family (mean age = 38.8 ± 5.9 years), most of whom were mothers ($n = 49$, 87.5%), were randomly assigned to either the intervention or waitlist control group. Participants were recruited through advertisements on social media platforms, newspapers and newsletter articles, childcare centers, and by word-of-mouth. Inclusion criteria for the study were: (1) parents 18 years of age and older; (2) child aged 3–10 years; and (3) child experiencing recurrent nightmares (at least one nightmare per week on average during the past month). Participants were excluded if parents indicated that their child was receiving socio-psychological treatment for nightmares or sleep-related problems.

Demographic details of participating children and parents are provided in Table 1. Five participants (8.9%) were using melatonin, and parents were advised to keep this consistent during their participation in the study. Moreover, 30.4% of the sample reported that their child had a medical/psychological condition, including autism spectrum disorder ($n = 4$), attention deficit hyperactivity disorder ($n = 4$), anxiety ($n = 1$), and other (e.g. Oppositional Defiant Disorder; $n = 8$). None of the children were

Table 1. Demographic characteristics of participating families by treatment group

Baseline characteristic	Intervention	Waitlist	P#
Child			
Age (years), mean ± SD	7.2 ± 2.3	7.0 ± 2.0	0.722
Girl, n (%)	11 (39.3)	16 (57.1)	0.181
Medical condition, n (%)	8 (28.6)	9 (32.1)	0.925
Melatonin use, n (%)	2 (7.1)	4 (14.3)	0.160
Parent			
Age (years), mean ± SD			
*Parent 1**	38.8 ± 7.2	38.8 ± 4.7	0.780
Parent 2	41.4 ± 6.8	38.0 ± 6.0	0.128
Mother, n (%)	26 (92.9)	23 (82.1)	0.304
Main nighttime support, n (%)			0.670
Mother	18 (64.3)	15 (53.6)	
Both shared equally	7 (25)	10 (35.7)	
Number of children, *n* (%)			0.672
1	6 (21.4)	4 (14.3)	
2	16 (57.1)	16 (57.1)	
3	3 (10.7)	4 (14.3)	
4 or more	0 (0)	1 (3.6)	
Marital status, *n* (%)			0.471
Married/Domestic partnership	22 (78.6)	25 (89.3)	
Single, never married	2 (7.1)	2 (7.1)	
Divorced	2 (7.1)	–	
Separated	2 (7.1)	1(3.6)	
Ethnicity, *n* (%)			0.838
Caucasian	25 (89.3)	26 (92.9)	
Asian/ Pacific Islander	2 (7.1)	1 (3.6)	
Other	1 (3.6)	1 (3.6)	
Household income *in Australian dollars*, *n* (%)			0.830
<50,000	5 (17.9)	4 (14.3)	
50,000 - 100,000	3 (10.7)	5 (17.9)	
100,000 – 200,000	15 (53.6)	12 (42.9)	
>200,000	4 (14.3)	6 (21.4)	
Education,*n*(%)			
Parent 1*			
Did not complete high school	1 (3.6)	–	.193
Completed high school	6 (21.4)	2 (7.1)	
Completed vocational training	5 (17.9)	4 (14.3)	
Completed higher education	15(53.6)	22 (78.6)	
Parent 2			
Did not complete high school	2 (7.1)	2 (7.1)	.105
Completed high school	4 (14.3)	1 (3.6)	
Completed vocational training	7 (25)	13 (46.4)	
Completed higher education	13 (46.4)	11 (39.3)	

*Parent who completed the weekly surveys.
#χ^2 test for categorical or *t*-test for continuous variables.

diagnosed with PTSD. Fifteen screened participants were excluded from the study, because their children were either outside the age range of interest, and/or were experiencing night terrors rather than nightmares (see Figure 1).

The dream changer

As illustrated in Figure 2, the "Dream Changer" is a simple remote-control-like device with a single button that emits blue light (~0.5 lm) when pressed. Along with the device, parents were provided with written instructions that presented general information about nightmares, including the following suggestion of how they could introduce the device to their child:

Sometimes you wake up from a bad dream at night, right? I want to give you something that will help you (present the "Dream Changer" to the child). This is the "Dream Changer." It is a remote control, like the remote we have for the TV. When you don't like something on the screen you use the remote to change the channel, right? Now you can do the same thing with your dreams. Dreams are like videos we watch in our sleep- our brain creates them, and we watch them with our eyes shut. From now on you decide which "video" to watch in your sleep. When you get into bed, think about a good dream you'd like to watch in your sleep tonight. And if a bad dream starts screening, use this to change it.

Parents were also provided with a link to a 2-min YouTube video of author MG who offered further guidance about using the device (https://youtu.be/O8_Skd1ArMA). For instance, parents could advise their child to use the device to help change their dreams, by waving the device around and pressing the button.

Materials

Nightmare frequency. Nightmare frequency was measured weekly using a stand-alone question, where parents reported the number of nights per week their child had at least one nightmare.

Sleep patterns. A modified version of the Sleep Habits Survey (SHS) [23] was used weekly to measure sleep-wake patterns in children. Sleep variables assessed were sleep onset latency (SOL), wake after sleep onset (WASO), and the number of awakenings per night. Other items of the SHS were not administered in an aim to reduce participant burden. Additionally, sleep duration (hours per night) was measured using a single item from the Child's Sleep Habits Questionnaire (CSHQ) [24]. These items provide hour/minute estimates for SOL, WASO, and sleep duration.

Sleep anxiety. The Sleep Anxiety Subscale of the CSHQ was used to measure sleep anxiety [24]. The subscale consisted of the following four items: (1) *"Does the child need a parent in the room to sleep?"*; (2) *"Is the child afraid of sleeping alone?"*; (3) *"Is the child afraid of sleeping in the dark?"*; and (4) *"Does the child have trouble sleeping away from home?"*. Items were rated on a 3-point scale: "*Usually*" if the sleep behavior occurred 5–7 times a week, "*Sometimes*" for 2–4 times a week, and "*Rarely*" for 0–1 time a week, with a maximum score of 12. The subscale showed modest internal reliability ($\alpha = 0.64$) in the present study.

Parental sleepiness. The Epworth Sleepiness Scale (ESS) [25] was used to measure parents' daytime sleepiness. The questionnaire comprised a set of scenarios whereby the parent was asked to rate the likelihood of dozing off or falling asleep in certain situations, in contrast to feeling just tired. The items were rated on a 4-point scale, whereby 0 = *Would never doze*, 1 = *Slight chance of dozing*, 2 = *Moderate chance of dozing*, and 3 = *High chance of dozing*. The ESS score can range from 0 to 24 and is the sum of all item scores; a higher score indicates higher daytime sleepiness. The normal range lies between 0 and 10, whereby scores above 10 represent mild–severe excessive daytime sleepiness [25]. A reliability check was undertaken for the present study which indicated the ESS had good internal reliability ($\alpha = 0.70$).

Demographics. Information was collected about participants' characteristics, namely parents' age, gender, ethnicity, marital

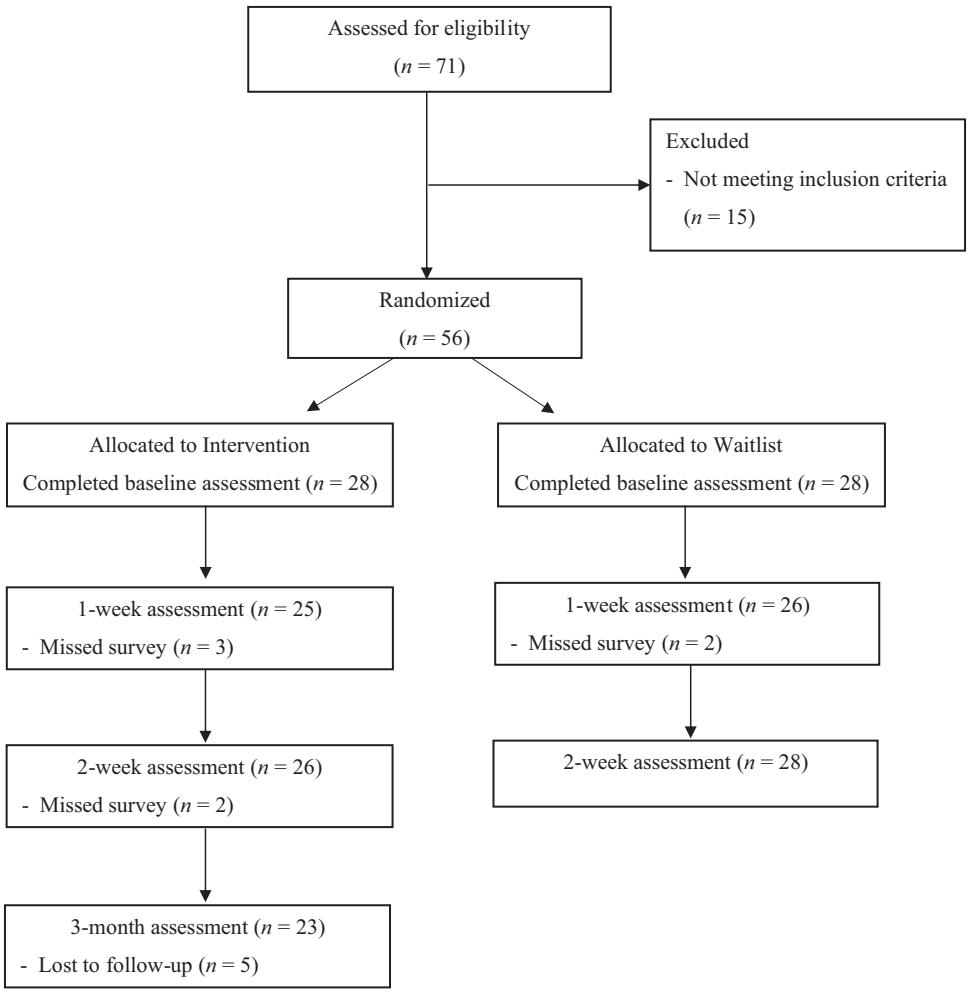

Figure 1. CONSORT diagram showing the flow of participants through the trial.

status, and level of education, as well as family income, number of children in the family, child age, and child gender.

Treatment adherence. Adherence with the intervention was assessed using a single item administered to parents who were allocated to the intervention group. At each of the 1-week, 2-week, and 3-month follow-up assessments, parents were asked the following question: "*In the past week, how many nights did your child take the Dream Changer into bed?*". Parents chose the frequency of use from a dropdown menu ranging between 0 and 7 nights per week.

COVID-19 questionnaire. Since this study was conducted throughout 2020, a short questionnaire was used to assess the effects of the COVID-19 pandemic on the family upon entering the study. This was performed in case COVID-related stress had an impact on any outcome variables. Parents completed two questions (one for their child, one for themselves), that is, "*Please indicate below the level of stress you/your child experienced in the past week, due to your circumstances during COVID-19 (1 = not at all stressed, 10 – extremely stressed)?*".

Procedures

The trial was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12620000633987) and approved by the Flinders University Social and Behavioral Research Ethics Committee. Interested parents were initially phone screened for eligibility. The study was conducted online and eligible families received internet instructions to access the online Qualtrics baseline survey. During pre-treatment one parent from each family completed the survey, and was then randomly assigned via a predetermined computerized block randomization to either the intervention or waitlist control group. Participants in the intervention group were sent the device and related instructions via post, shortly after completion of the baseline survey.

The child was then asked to use the device overnight for 14 consecutive nights. Following 1-week of treatment, participants in the intervention group completed a mid-treatment survey, and a post-treatment survey after 2-weeks. Participants in the waitlist control group completed the three online surveys at these same time points. Upon completing the 2-week assessment, all participants in the waitlist control group received the "Dream Changer" along with the cover letter, video link, and instructions for parents. Participants in the intervention group were asked to complete an additional follow-up survey 3 months after treatment ceased.

Statistical analysis

Data missingness ranged from 4.7% to 7.6%, and Little's MCAR test confirmed that missingness was completely at random,

Figure 2. The "Dream Changer.".

$\chi^2(64,56) = 75.76$, $p = 0.15$. Analyses were conducted using an intent-to-treat (ITT) approach, whereby all randomized participants were included in analysis. This method yields unbiased estimates of the efficacy of the intervention, while considering the level of adherence observed during the trial [26]. Correlation testing revealed no significant associations between outcome variables and demographic characteristics or COVID-19 related stress, thus this measure was not included in subsequent analyses. Independent samples *t*-tests and chi-square tests found no significant differences between groups on baseline demographic characteristics. Independent samples t-tests revealed that there was a significant effect of group on baseline sleep duration, $t(53) = 6.06$, $p = 0.017$, whereby the waitlist control group reported slightly longer sleep duration ($M = 10.0$ h, $SD = 1.6$) than the intervention group ($M = 9.7$ h, $SD = 0.9$). However, there were no significant differences on the remaining variables. A series of linear mixed models were used to test the effects of group (intervention vs waitlist control), time (baseline, 1-, 2-week, and 3-month post-intervention), and their interaction term. For significant interaction effects, pairwise comparisons were computed. Cohen's *d* was used to gauge the size of significant effects.

Results

Descriptive statistics revealed high adherence rates during the intervention. In the 2 weeks of treatment, parents reported that children took the Dream Changer to bed with them on 6.1 (±1.8) and 6.0 (±2.2) nights on average, respectively. Device use was lower on the 3-month follow-up, with an average of 4.2 nights (±3.3) of device use per week.

As expected, a significant "group ≤ time" interaction was found for nightmare frequency, $F(2,51.43) = 7.62$, $p = 0.001$ (see Table 2). The waitlist group's mean nightmare frequency remained relatively stable across time. In contrast, a significant decline was indexed in the intervention group from baseline to 1-week post-intervention (mean difference = 0.8, $p = 0.009$, $d = 0.50$), with a further decline from 1-week to 2-week post-intervention (mean difference = 0.9, $p < 0.001$, $d = 0.64$). Overall, from baseline to 2-week post-intervention there was a significant reduction in nightmare frequency for the intervention group, with a large effect size (mean difference = 1.7, $p < 0.001$, $d = 1.06$; see Figure 3A). Finally, pairwise comparisons of the intervention group's outcomes from 2 weeks post-intervention to 3 months follow-up demonstrated that nightmare frequency remained stable across time (mean difference = –0.1, $p = 0.85$).

To test the clinical significance of the reduction in nightmare frequency, a binary variable was created, comparing nightmare frequency of 0 to nightmare frequency of ≥1 per week at post-treatment. In the intervention group, parents of 8 out of the 26 (30.8%) children reported that their children were below this cut-off (i.e. had no nightmares in the past week) at post-treatment. In contrast, only 2 of the 28 (7.1%) children in the control group were reported to have had no nightmares at post-treatment. This translated into a significant difference ($\chi^2 = 4.72$, $p = 0.03$), which dovetails with the observed significant time-by-group interaction effect, indexing a reduction in nightmare frequency in the intervention group, but not in the control group.
A significant "group × time" interaction was also found for sleep anxiety, $F(2, 49.64)=5.63$, $p = 0.006$. Figure 3B presents this interaction for each group over time. As shown, the waitlist group's sleep anxiety scores remained stable over time. In contrast, a decline in sleep anxiety scores was observable for the intervention group. Pairwise comparisons showed a significant decrease from baseline to 1-week post-intervention, $p < 0.001$, $d = 0.30$, and a significant decline from baseline to 2 weeks post-intervention, $p = 0.001$, $d = 0.41$. The 3-month follow-up outcomes demonstrated that gains were maintained for children's sleep anxiety scores, with no significant change from post-intervention to the 3-month follow-up assessment ($M = 7.8$, $SD = 2.1$ $p = 0.52$).

Contrary to predictions, non-significant "group × time" interactions were found for all sleep-wake pattern variables, as well as for parents' daytime sleepiness (all $p > 0.05$; see Table 2).

Discussion

This randomized controlled trial evaluated the efficacy of the "Dream Changer"—a novel parent-based intervention for children with recurrent nightmares. Our findings provide preliminary evidence for the acceptability and efficacy of this brief and easily accessible intervention in reducing nightmare frequency and sleep anxiety. Whilst nightmare occurrence remained stable in the waitlist control group, a large decline ($d = 1.06$) was indexed following the intervention, with the average number of nightmares per week decreasing from 3.4 at baseline to 1.6 at post-treatment. Moreover, results revealed a moderate reduction in sleep anxiety in the intervention group following treatment ($d = 0.41$), whereas no changes between assessments were observed in the control group. Importantly, adherence to the intervention was high, and its gains were maintained at the 3-month follow-up assessment, suggesting that this intervention's benefits are not short-lived.

Table 2. Descriptive statistics and group-by-time interactions effects for treatment outcomes at baseline, 1-week, 2-week, and 3-month assessments

		Baseline	1-week	2-weeks	3 months	Group-by-time interaction
		M(*SE*)	*M*(*SE*)	*M*(*SE*)	M(SE)	*F*(*p*)
Nightmare frequency (per week)	Intervention	3.4 (0.3)	2.6 (0.3)	1.7 (0.3)	1.6 (0.4)	**7.62 (0.001)**
	Waitlist	3.1 (0.4)	3.2 (0.4)	2.7 (0.4)	–	
Sleep anxiety	Intervention	9.0 (0.4)	8.2 (0.5)	8.1(0.4)	7.8 (0.4)	**5.63 (0.006)**
	Waitlist	8.9 (0.4)	9.1 (0.5)	8.8 (0.4)	–	
Sleep onset latency (min)	Intervention	21.3 (1.5)	18.2 (1.6)	16.9 (1.6)	19.2 (1.6)	2.24 (0.12)
	Waitlist	22.8 (1.5)	22.3 (1.6)	22.7 (1.6)	–	
Nighttime awakening frequency (per night)	Intervention	1.9 (0.2)	1.3 (0.1)	1.4 (0.2)	1.3 (0.2)	0.56 (0.57)
	Waitlist	1.9 (0.2)	1.6 (0.2)	1.6 (0.2)	–	
Wake after sleep onset (min)	Intervention	18.8 (1.9)	11.9 (1.6)	9.5 (1.6)	10.6 (1.9)	2.67 (0.08)
	Waitlist	15.1 (1.9)	11.5 (1.5)	11.6(1.6)	–	
Sleep duration (h)	Intervention	9.7 (0.2)	10.1 (0.2)	10.2 (0.2)	9.9 (0.2)	2.17 (0.13)
	Waitlist	10.0 (0.2)	10.2 (0.2)	10.2 (0.2)	-	
Parent daytime sleepiness	Intervention	5.8 (0.8)	4.8 (0.7)	4.7 (0.8)	4.1 (0.7)	0.04 (0.96)
	Waitlist	6.1 (0.7)	4.9(0.7)	4.7 (0.7)	–	

Note. Significant interaction effects are marked in bold.

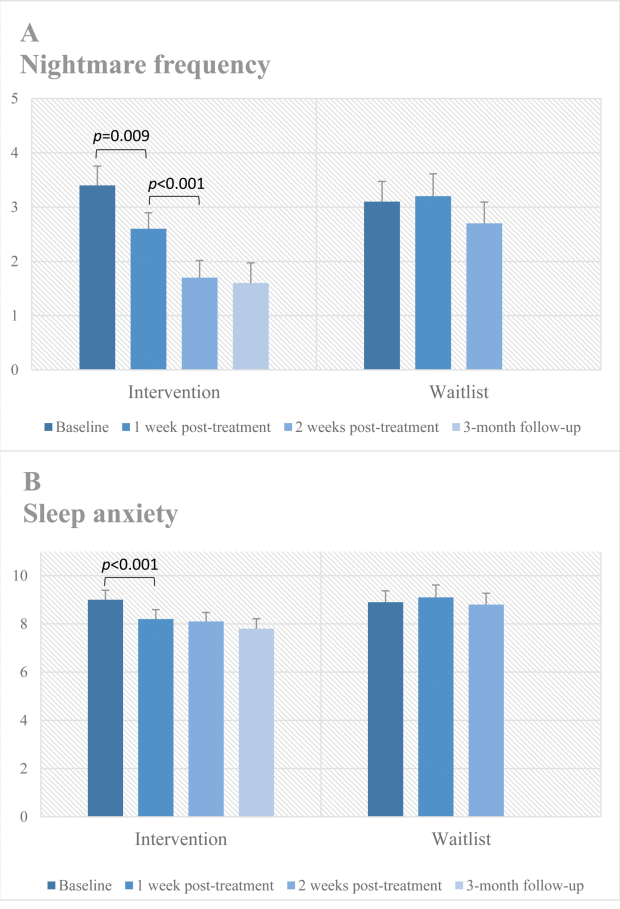

Figure 3. Nightmare frequency (A) and sleep anxiety (B) of intervention and waitlist control groups at the baseline, 1-week, 2-week, and 3-month follow-up assessments.

Our findings dovetail with previous evidence for the efficacy of CBT-based interventions and IRT in reducing childhood nightmares and nighttime fears [9, 13–15, 22]. While interventions for youth assessed thus far have required multiple sessions, and most required a clinician for implementation, the present study suggests that a very brief intervention administered solely by the child's parent may lead to meaningful and sustained improvements.

A few possible mechanisms may have instigated the lower occurrence of nightmare frequency and reduction in sleep anxiety following use of the "Dream Changer." First, the intervention may have inspired a change in the way children perceived their nightmares, sleep, and nighttime. Having a tangible device to use in case they experience a nightmare may have allowed children to feel less helpless, assume an active position, and acquire a sense of agency. Previous interventions for young children have also successfully used tangible objects, such as the "Huggy-puppy", to increase children's sense of mastery and control [14]. Furthermore, the instructions delivered by parents target the child's imagination, encouraging them to "change their channel on their dream." This approach corresponds with cognitive models in which children struggling with anxiety are urged to modify their inner dialogue, practicing alternative scenarios, thoughts, and interpretations [27]. It is also in harmony with IRT approaches, in which alternative dream scenarios are practiced [9].

Improvements indexed in this trial may also be explained by a cognitive change in these children's parents. Previous work has demonstrated the links between child anxiety and parental cognitions, with some evidence showing that treatments for child anxiety and sleep problems also lead to reductions in parent accommodation behaviors, and increased tolerance for child distress [28–30]. Similarly, parents in the present trial may have altered their perceptions of– and expectations from– their children, encouraging them to relinquish a dependent-avoidant position, and adapt a more potent-autonomous one.

Finally, it is possible that the dim light emitted by pushing a button on the "Dream Changer" device helped to alleviate child anxiety and reduce the occurrence of nightmares. King et al. [31] reported using a flashlight as part of the treatment for a child with fear of darkness, although the therapeutic effects of this

particular component of treatment were not evaluated. Similarly, the present study does not allow for inferences regarding the specific pathways through which the "Dream Changer" intervention exercised its benefits. Future investigations may wish to assess whether changes in child cognitions, parent cognitions, or the use of the light button, mediate an improvement in child nighttime anxiety and nightmares.

Contrary to hypotheses, group-by-time interaction effects were not significant for child sleep-wake patterns or for parental daytime sleepiness. Given that the intervention targets nightmares rather than nighttime sleep patterns, changes observed in children's sleep metrics and consequential parent sleepiness may have been smaller. In addition, inclusion criteria for the study included recurrence of nightmares, but did not address other sleep-related factors. Consequently, sleep patterns of children recruited for this study were not severely disrupted at baseline, potentially resulting in floor effects (e.g. average SOL at baseline was 22.0 min, which is merely >5min than the average SOL in the general population of 3–12 year-olds) [32]. Future investigations using larger samples, and including children with more severely disrupted sleep, will be beneficial in determining whether the "Dream Changer" may be beneficial not only in reducing nightmares, but also in generating improved sleep more generally.

The results of the current study should be considered in light of several limitations. First, nightmare frequency, sleep anxiety, and sleep-wake patterns were assessed solely using parent reports. Such reports have generally been demonstrated as reliable in assessing children's sleep, yet they may be subject to social desirability and imprecision [33]. For example, parents may not accurately remember or be fully aware of their children's nightmares or nighttime awakenings. The extent to which parents are aware of these nighttime events, and are involved in comforting and caregiving during the night, may impact on parent sleep and daytime functioning. This would best be measured using both parent reports and actigraphy. Moreover, while assessment of children's nightmares and sleep patterns once per week reduced participant burden, more frequent reports– via daily sleep logs for instance– may have reduced recall bias, and resulted in more accurate measurement. Thus, future studies would do well in applying multi-method assessment of these constructs, including daily parent and child reports, as well as objective measures of child sleep (e.g. actigraphy) [34].

Second, the use of a waitlist– rather than active control group– precludes conclusions about the precise cause of observed effects, as demand and nonspecific treatment effects could not be controlled. However, such effects are more likely to impact therapist-guided interventions, whereas the current study was a parent-based intervention with minimal contact with the researchers. Intervention adherence could have been more elaborately assessed, including monitoring of parents' viewing of the video, and detailed evaluation of children's nightly use of the device. Moreover, while a 3-month assessment indicated that benefits were maintained for the intervention group, the control group received treatment after 1-month of waiting, and thus follow-up effects were not adequately controlled. Moreover, it would be important to evaluate the efficacy of this intervention in the longer term (e.g. at 12-month follow-up). Finally, the current study was limited by the relatively low power to assess outcome effects, particularly for the potentially small effects of the intervention on child sleep-wake patterns and parental daytime sleepiness. Robust evidence for the efficacy of the "Dream Changer" intervention requires a RCT with a larger sample. Larger RCTs would also allow for evaluation of moderation and mediation effects, assessing not only whether this intervention is efficacious, but also who is it most efficacious for (e.g. younger vs older children), and what are the pathways through which it exercises its benefits.

In their recent 25-year review of studies into the treatment of children's nighttime fears, Lewis and colleagues [35] conclude that "*A goal of clinical scientists should be to expand the accessibility of evidence-based treatment in order to reach as many children and families as possible*" (p. 409). The results of the present study provide preliminary support for the use of the "Dream Changer" intervention in the treatment of children with recurrent nightmares. This highly accessible low-cost intervention, delivered entirely by parents, may be used as a first step in a stepped-care approach, thus reserving lengthier face-to-face interventions delivered by healthcare professionals for more severe cases. We are hopeful that the results of the current study provide a compelling basis for further work investigating the efficacy, effectiveness, and underlying mechanisms of this novel intervention.

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Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

References

1. American Academy of Sleep Medicine. *The International Classification of Sleep Disorders (ICSD-3)*. Darien, IL: American Academy of Sleep Medicine; 2014.
2. Reynolds KC, *et al*. Things that go bump in the night: frequency and predictors of nightmares in anxious and nonanxious children. *Behav Sleep Med*. 2016;**14**(4):442–456. doi:10.1080/15402002.2015.1017099.
3. Gauchat A, *et al*. Prevalence and correlates of disturbed dreaming in children. *Pathol Biol (Paris)*. 2014;**62**(5):311–318. doi:10.1016/j.patbio.2014.05.016.
4. Kushnir J, *et al*. Sleep of preschool children with nighttime fears. *Sleep Med*. 2011;**12**(9):870–874. doi:10.1016/j.sleep.2011.03.022.
5. Mindell J, *et al*. Nightmares and anxiety in elementary-aged children: is there a relationship? *Child Care Health Dev*. 2002;**28**(4):317–322. doi:10.1046/j.1365-2214.2002.00274.x.

6. Schredl M, *et al*. Longitudinal study of nightmares in children: stability and effect of emotional symptoms. *Child Psychiatry Hum Dev.* 2009;**40**(3):439–449. doi:10.1007/s10578-009-0136-y.
7. Schredl M, *et al*. Nightmares in children: influencing factors. *Somnol-Schlafforsch Schlafmedizin*. 2000;**4**(3):145–149. doi:10.1007/s11818-000-0007-z.
8. Moturi S, *et al*. Assessment and treatment of common pediatric sleep disorders. *Psychiatry (Edgmont)*. 2010;**7**(6):24–37.
9. St-Onge M, *et al*. Imagery rehearsal therapy for frequent nightmares in children. *Behav Sleep Med*. 2009;**7**(2):81–98. doi:10.1080/15402000902762360.
10. Hagen EW, *et al*. The sleep-time cost of parenting: Sleep duration and sleepiness among employed parents in the Wisconsin Sleep Cohort Study. *Am J Epidemiol*. 2013;**177**(5):394–401. doi:10.1093/aje/kws246.
11. Kahn M, *et al*. Effects of one night of induced night-wakings versus sleep restriction on sustained attention and mood: a pilot study. *Sleep Med*. 2014;**15**(7):825–832. doi:10.1016/j.sleep.2014.03.016.
12. Sadeh A. Cognitive–behavioral treatment for childhood sleep disorders. *Clin Psychol Rev.* 2005;**25**(5):612–628. doi:10.1016/j.cpr.2005.04.006.
13. Kahn M, *et al*. Cognitive–behavioral versus non-directive therapy for preschoolers with severe nighttime fears and sleep-related problems. *Sleep Med*. 2017; **32**: 40–47. doi: 10.1016/j.sleep.2016.12.011.
14. Kushnir J, *et al*. Assessment of brief interventions for nighttime fears in preschool children. *Eur J Pediatr.* 2012;**171**(1):67–75. doi:10.1007/s00431-011-1488-4.
15. Simard V, *et al*. Adaptation of imagery rehearsal therapy for nightmares in children: a brief report. *Psychotherapy: Theory Res Pract Training*. 2009; **46**(4):492. doi: 10.1037/a0017945.
16. Muris P, *et al*. The "anti-monster letter" as a simple therapeutic tool for reducing night-time fears in young children. *Behav Change*. 2003;**20**(4):200–207. doi:10.1375/bech.20.4.200.29384.
17. El Rafihi-Ferreira R, *et al*. Brief treatment for nighttime fears and co-sleeping problems: a randomized clinical trial. *J Anxiety Disord*. 2018;**58**:51–60. doi:10.1016/j.janxdis.2018.06.008.
18. Krakow B, *et al*. Imagery rehearsal therapy: principles and practice. *Sleep Med Clin*. 2010;**5**(2):289–298. doi:10.1016/J.JSMC.2010.01.004.
19. Lüth K, *et al*. Conquering nightmares on the phone: one-session counseling using imagery rehearsal therapy. *Somnologie*. 2021;**25**(3):197–204. doi:10.1007/s11818-021-00320-w.
20. Germain A, *et al*. Impact of imagery rehearsal treatment on distressing dreams, psychological distress, and sleep parameters in nightmare patients. *Behav Sleep Med*. 2003;**1**(3):140–154. doi: 10.1207/S15402010BSM0103_2.
21. Krakow B, *et al*. Clinical management of chronic nightmares: imagery rehearsal therapy. *Behav Sleep Med*. 2006;**4**(1):45–70. doi:10.1207/s15402010bsm0401_4.
22. Kopcsó K, *et al*. Reducing the nighttime fears of young children through a brief parent-delivered treatment—effectiveness of the Hungarian version of uncle lightfoot. *Child Psychiatry Hum Dev.* 2021:1–12. doi:10.1007/s10578-020-01103-4.
23. Wolfson AR, *et al*. Evidence for the validity of a sleep habits survey for adolescents. *Sleep*. 2003;**26**(2):213–216. doi:10.1093/sleep/26.2.213.
24. Owens JA, *et al*. The Children's sleep habits Questionnaire (CSHQ): psychometric properties of a survey instrument for school-aged children. *Sleep*. 2000;**23**(8):1043–1052.
25. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991;**14**(6):540–545. doi:10.1093/sleep/14.6.540.
26. McCoy CE. Understanding the intention-to-treat principle in randomized controlled trials. *West J Emerg Med*. 2017; **18**(6): 1075. doi: 10.5811%2Fwestjem.2017.8.35985.
27. Frechette-Simard C, *et al*. Strategies included in cognitive behavioral therapy programs to treat internalized disorders: a systematic review. *Cogn Behav Ther.* 2018;**47**(4):263–285. doi:10.1080/16506073.2017.1388275.
28. Storch EA, *et al*. Phenomenology and clinical correlates of family accommodation in pediatric anxiety disorders. *J Anxiety Disord*. 2015;**35**:75–81. doi:10.1016/j.janxdis.2015.09.001.
29. Kahn M, *et al*. Behavioral interventions for infant sleep problems: the role of parental cry tolerance and sleep-related cognitions. *J Clin Sleep Med*. 2020;**16**(8):1275–1283. doi:10.5664/jcsm.8488.
30. Lebowitz ER, *et al*. Parent training for childhood anxiety disorders: the SPACE program. *Cogn Behav Pract*. 2014;**21**(4):456–469. doi:10.1016/j.cbpra.2013.10.004.
31. King NJ, *et al*. Emotive imagery treatment for childhood phobias: a credible and empirically validated intervention? *Behav Cogn Psychother.* 1998;**26**(2):103–113. doi:10.1017/s1352465898000125.
32. Galland BC, *et al*. Normal sleep patterns in infants and children: a systematic review of observational studies. *Sleep Med Rev.* 2012;**16**(3):213–222. doi:10.1016/j.smrv.2011.06.001.
33. Sadeh A. Sleep assessment methods. *Monogr Soc Res Child Dev.* 2015;**80**(1):33–48. doi:10.1111/mono.12143.
34. Meltzer LJ, *et al*. Use of actigraphy for assessment in pediatric sleep research. *Sleep Med Rev.* 2012;**16**(5):463–475. doi:10.1016/j.smrv.2011.10.002.
35. Lewis KM, *et al*. A 25-year review of nighttime fears in children: past, present, and future. *Clin Child Fam Psychol Rev.* 2021:1–23. doi:10.1007/s10567-021-00354-4.