

RESEARCH ARTICLE

Pilot feasibility and acceptability study evaluating use of group CBT-I in improving sleep and fatigue in older adults

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Abstract

Objective: This paper describes a pilot study, in a small sample of older adults, designed to ascertain the feasibility, acceptability and potential effectiveness of group Cognitive Behavioural Therapy For Insomnia (CBT-I).

Methods: Eleven older adults participated in a 3-week group CBT-I intervention with pre- and post-intervention outcome measures of sleep and fatigue. Acceptability was measured via post-intervention focus groups. Feasibility was measured via recruitment, retention and completion data. Subjective sleep outcomes were measured pre- and post-intervention using the Pittsburgh Sleep Quality Index. Fatigue was measured using the Fatigue Severity Index. Objective sleep outcome measures were obtained via pre- and post-intervention wrist actigraphy.

Results: Feasibility and acceptability were confirmed in the pilot study. Retention and completion levels were high, with participants largely positive in the focus group feedback. Preliminary sleep outcome data supported the potential effectiveness of the intervention in significantly improving several measures of sleep and fatigue including a three-point reduction in the Global PSQI scores, an increase in total sleep time of almost an hour per night and these results were mirrored by a significant reduction of nine points in the overall measure of fatigue severity.

Conclusions: A group CBT-I intervention is a low-cost, low-risk intervention which improves subjective and objective measures of sleep in older adults. These positive sleep outcomes are translated into significantly decreased levels of fatigue. Future research should focus on a larger sample size with a randomised controlled trial design.

KEYWORDS

cognitive behavioural therapy, fatigue, insomnia, intervention, middle-aged

1 | INTRODUCTION

Sleep is not a passive process, but rather, is an active process of detoxification, rejuvenation and repair. Sleep initiates a series of complex, highly organised processes which are necessary for optimal physical and psychological well-being. As we age, sleep architecture, length and quality changes. Normative age-related sleep changes occur due to developmental maturation and are independent of other medical co-morbidities.^{1,2} These changes include shortened overnight sleep periods, increased daytime napping, frequent night-time awakenings, decreased slow wave sleep periods and rapid eye movement periods.¹ Whilst these changes are expected, maintaining and promoting sleep is important given the key role sleep plays in mental and physical health.

However, despite the known importance of sleep, over 50% of older adults report symptoms of insomnia.³ Worryingly, there is evidence that poor sleep is associated with a myriad of negative impacts in older adults including cognitive decline,⁴ falls,⁵ increased frailty and all-cause mortality,⁶ malnutrition⁷ and geriatric depression.⁸

Whilst insomnia may be treated pharmacologically or non-pharmacologically, the use of sedatives and hypnotics can be detrimental in older adult populations with potential side effects ranging from residual daytime sleepiness to falls, fractures and dementia.⁹ Therefore, non-pharmacological treatments are preferred in this population.

Cognitive Behavioural Therapy for Insomnia (CBT-I) is a multi-component approach aimed at improving sleep through cognitive, behavioural and environmental changes. A recent systematic review has identified CBT-I as being both safe and effective for the treatment of insomnia in older adults.¹⁰ CBT-I has been shown to be as effective as pharmacological treatments for insomnia for short-term improvements, with more sustained effect on long-term sleep quality and outcomes^{3,11,12} and none of the adverse side effects associated with pharmacological treatment.

The purpose of this study was to evaluate a group CBT-I workshop series for older adults on its acceptability, feasibility and preliminary efficacy for sleep-related outcomes including subjective sleep quality, objective sleep quantity and fatigue levels. We hypothesised that participants would have improved sleep quality, increased sleep quantity and lessened fatigue at post-intervention testing.

2 | METHODS

2.1 | Study design

A single-arm feasibility and acceptability pre- and post-intervention study. Study duration was approximately

Practice impact statement

Suboptimal sleep is associated with a myriad of health problems including overall mortality, morbidity, cognitive decline and falls. This study supports the efficacious role of group cognitive behavioural therapy for insomnia (CBTI) in improving subjective and objective measures of sleep and fatigue in older adults. Acceptability of a group delivery format by older adults allows for greater accessibility of treatment and lower cost of delivery thus the potential to positively improve the sleep of a greater number of older adults.

5 weeks with pre-test measures completed 1 week prior to the intervention, 3-week intervention delivery and post-intervention measures completed 1 week after the completion of the intervention. The study has ethical approval from Edith Cowan University Human Research Ethics Committees (Project ID 2019-00206-SMYTH).

2.2 | Recruitment and participants

2.2.1 | Sample size

As the study did not intend to infer statistical significance, a sample size of 10 was deemed sufficient in order to investigate the feasibility and acceptability of CBT-I intervention in older adults.¹³ This will provide preliminary evidence around the efficacy of the intervention and is in keeping with other CBT-I pilot studies.¹⁴ Post-recruitment, a total of 13 participants were recruited, with 11 completing the entire protocol.

Recruitment of participants was achieved via social media campaigns and flyer distribution in retirement villages. Older adults were defined as those aged older than 60 years. Exclusion criteria included those with known pre-existing sleep apnoea, diagnosis of a sleep disorder or those regularly taking sleeping medication.

2.3 | Intervention

Cognitive behavioural therapy for insomnia (CBT-I) has been recommended as a first-line treatment for insomnia. The components of CBT-I include providing psychoeducation on sleep cycles, introducing cognitive therapy to replace unhelpful thoughts/beliefs of sleep, prescribing time-in-bed recommendations to limit time in bed to match perceived sleep duration, encouraging sleep

hygiene to alter habits and physiologic factors to improve sleep, as well as introducing relaxation techniques such as guided imagery to further support good sleeping habits. For these pilot groups, CBT-I was delivered as three 2-h group sessions.

2.4 | Feasibility and acceptability measures

Feasibility was measured by session recruitment and retention, attendance rates, tool completion and actigraph completion rates.

Acceptability was measured by focus group for each cohort of participants following intervention delivery. Focus groups consisted of semi-structured interview schedules aimed at eliciting feedback from the participants in relation to their satisfaction with the workshop series. Focus groups were conducted by AS and SA. Topics covered included the workshop content, adherence to the suggested behavioural changes, ease of use of outcome measures including tool completion and actigraph wearing. The interviews of the two focus groups were audio recorded and transcribed verbatim into textual format. Transcription of the descriptive responses was undertaken by one researcher (SP) and verified by another researcher for accuracy (AS). Inductive coding was undertaken by SP and confirmed by AS. Inductive coding categorised data, grouping related comments into themes using Excel spreadsheets. In this paper, quotes are attributed to participants identified by their first name. Where needed for clarity and brevity, words have been inserted into quotes (denoted by [square brackets]) or omitted (denoted by ...).

2.5 | Intervention efficacy measures

2.5.1 | Sleep outcomes

Sleep outcomes were measured subjectively and objectively. Subjective sleep quality was determined using the Pittsburgh Sleep Quality Index (PSQI).¹⁵

PSQI is a self-report questionnaire retrospectively assessing subjective measures of quality and patterns of sleep over the previous month across seven components including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, sleep medication usage and daytime dysfunction. Each component has a potential score of three, with a higher score indicating poorer sleep-related performance. The total score for the seven components creates a global score whereby a score greater or equal to five (≥ 5) indicates that the person is a 'poor' sleeper. PSQI is considered to be the gold standard

subjective measure of sleep quality and has been utilised in prior studies of older adult sleep.¹⁶

Actigraphy was employed to determine objective measures of sleep quantity and quality. Actiwatch refers to wearable, non-invasive accelerometers which determine sleep and wake periods, wake after sleep onset, sleep latency, awakenings and sleep efficiency. Actigraphs (Actiwatch Model wGT3X-BT) were worn on the non-dominant wrist for a period of 3–5 nights pre- and post-intervention. Actigraph data were interpreted using the ActiGraph Actilife software (Version 6.13.4). Sleep logs were also completed during the period of actigraph wearing, which supported the cleaning of actigraph data.

2.6 | Fatigue outcomes

Fatigue was measured using the Short Form Fatigue Severity Scale.¹⁷ This 30-item self-report tool measures fatigue across five domains: Overall Fatigue, Physical Fatigue, Mental Fatigue, Emotional Fatigue and Vigour. An overall fatigue score is obtained by subtracting the combined fatigue components from the overall vigour score.

2.7 | Data analysis

Descriptive statistical analysis was undertaken to describe sample population. Qualitative data derived from the post-intervention focus groups informed the acceptability of the pilot intervention. Qualitative data were audio recorded and transcribed verbatim into textual format. Transcription was undertaken by one researcher (SA) and verified by another researcher for accuracy (AS). Descriptive coding was utilised to categorise data, and content analysis described and summarised the findings from the focus group interviews.

Preliminary efficacy of the intervention was assessed via quantitative analysis of continuous variables related to sleep and fatigue. Mean and standard error of the mean is presented for each variable. Comparison between pre- and post-intervention measures was undertaken via paired t-test analysis, with effect size measured, where appropriate, via Cohens D. Statistical significance threshold was set as $p < 0.05$. Numerical data were analysed in IBM SPSS (Version 26).

3 | RESULTS

Eleven participants attended all three sessions. The participant group consisted of five male (45%) and six female participants (55%), with an average age of 71.5 years and BMI of 25.5.

3.1 | Feasibility

Feasibility was measured by recruitment, attendance, retention and data collection, as depicted in Figure 1. A total of 33 potential participants expressed their interest via completion of an online contact form. Thirteen participants were recruited to the intervention resulting in a recruitment rate of 39%. Retention throughout the entire intervention was 85% with 11 of the 13 participants completed the entire intervention, resulting in a 15% attrition rate with two (15%) participants not completing the three sessions and their data were omitted from analysis. One of these participants could not attend the remaining sessions due to illness, while the other participants did not provide an explanation for withdrawal. Of the remaining participants, all attended the three intervention sessions and successfully adhered to the actigraph-wearing period, with periods of sleep data completion ranging from three to six, with an average of four nights' data collected. Sleep diary completion rates were 100%. Questionnaire measures were fully completed by all participants.

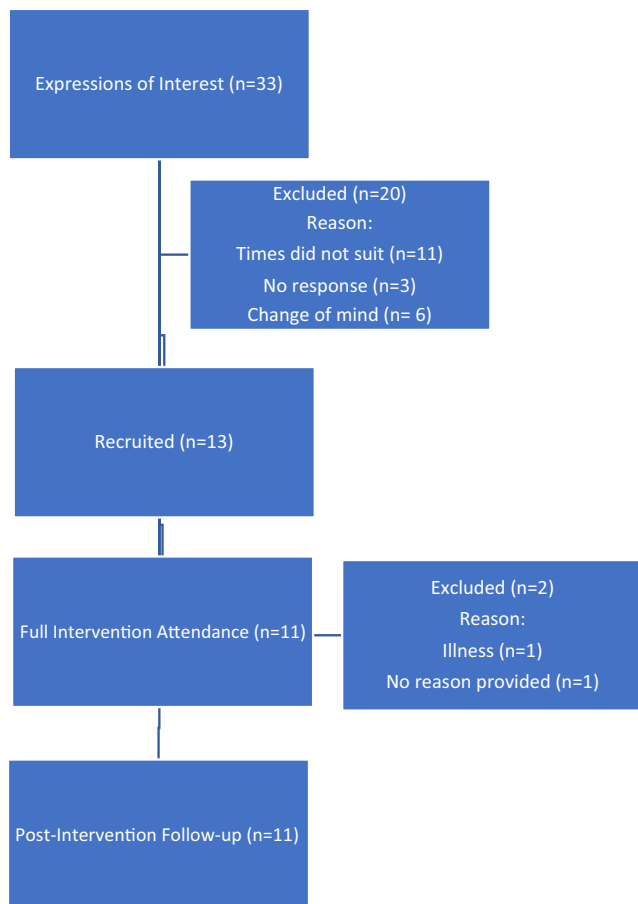


FIGURE 1 Overview of study recruitment, retention and attrition.

3.2 | Acceptability

Acceptability was explored in a post-intervention focus group with all participants which covered their own experiences of the intervention including adherence, satisfaction and data collection (Table 1).

Three major interrelated themes were identified. Theme one, 'The expediency of CBT-1 intervention' reflected the acceptability and feasibility of cognitive behavioural therapy for insomnia amongst the participants. The second theme, 'The value of sleep education' encapsulated an increased awareness and understanding of sleep patterns, hygiene and habits following the intervention. 'The positive impact on sleep' emerged as the third theme, capturing the participants' experiences of improved sleep quality, increased sleep quantity and lessened fatigue while applying purposeful changes to their sleep habits.

3.2.1 | The expediency of CBT-I intervention

Most of the participants indicated that they were able to commit the time for the program, despite having busy schedules (Table 1). Participants also appreciated the informality and pace of the program, while others found it to be well-balanced. The participants had differing opinions on the preferred delivery method of the sleep-promoting intervention. Some preferred face-to-face interaction as they believed it allows for more effective communication and the sharing of ideas, with the benefits of being able to interact with others and receive a more personal experience. However, others favoured online delivery due to the ease of access and convenience it offers. Prior motivation to learn about sleep hygiene was mentioned as a further reason for the preference for the online version.

The experiences of the participants when using the questionnaires were mixed (Table 1). The first questionnaire received positive feedback for asking in-depth questions about sleep. Some participants found it easy to fill out and comprehensive in coverage. However, the other questionnaire received criticism for not asking the right questions and being ambiguous. Some participants found the sleep log confusing and not well-defined, while others found it helpful in tracking their sleep patterns. Overall, the questionnaires helped some participants understand the importance of sleep and their own sleep needs.

The participants had mainly positive experiences using the actigraph as part of the sleep-promoting intervention. Some participants found wearing the sleep watch to be no inconvenience at all, with one of them nearly forgetting to take it off before a shower and another participant forgetting to put it back on after a shower. Other participants expressed concern about the accuracy of the data

TABLE 1 Exerts from post-intervention acceptability focus group.

Theme 1: The expediency of CBT-1 intervention

- 'Yes, I've committed the time because I wanted the results, and it was well worth it.' (Penny)
- '(...) Monday was a perfect day for me and slotted in with my program for the week... So, it was good.' (Derek)
- 'I got my own business and I have a really busy life. I did find it difficult, but worthwhile.' (Hattie)
- '(...) I like the pace it was presented at, and it is easy to assimilate what was conveyed. I think it was a very good balance.' (Brian)
- 'I liked the informality of it all, it wasn't a class, it was a workshop, and I enjoyed it.' (Penny)
- 'That's the crux, the informality, and the class is such that we can all work at our own pace and assimilate with you (...).' (Derek)
- 'I think face-to-face is more beneficial because you can share your ideas with other people.' (Penny)
- 'Yes, I would concur completely with that. I think you get far more out of something when it's a face-to-face situation.' (Derek)
- 'You benefit from hearing people's stories.' (Eloise)
- 'I would certainly embrace an online workshop.' (Rita)
- 'Online. Just because I'm always so busy now.' (Hattie)
- 'Public mode again...I guess I'm already motivated to learn about sleep, sleep hygiene, and importance of sleep.' (Lorraine)
- 'First questionnaire was fine, but the other questionnaire we got did not seem to quite ask the right questions.' (Heidi)
- 'The initial questionnaire...which has been filled out for me... that was good and easy, and good coverage as well. But the sleep log gave me many problems. It did not seem to define what I was telling you...like "all sleep or partly waking"...yeah, I was confused.' (Penny)
- 'I found the whole thing quite understanding to me, it was all helpful...because it led you to a situation where...oh, well that's what it's all about is it. And I think after it... especially with the sleep one, when you could log it for a week and you could see how you'd actually done and at the end of it, when you saw that you actually needed 7 ½ hours. I needed 7 ½ hours of sleep a night... it was just spot on. Just unbelievable...No, that was good.' (Derek)
- 'Absolutely [worth it] yes!' (Rita)
- 'I thought it was unbelievable.' (Derek)
- '(...) The process of being involved in this which is an observation kind of thing. We do feel a little differently, we try not to, but we do.' (Rita)

Theme 2: The value of sleep education

- 'I've found it very informative...showed you what we get out of sleep...because before we came here and the sleep, the importance of sleep hygiene. It makes a lot of sense to me (...).' (Andy)
- '(...) Understanding sleep cycles, how much sleep we need and that there's a variety of need (...).' (Charlie)
- 'I like the same thing...just sleep pattern. I had no idea. I thought you fell asleep and then it was down there (gesturing like a dip), and then you woke up.' (Heidi)
- '(...) Knowledge, knowing what is normal and you are not abnormal... yes, [the content of the intervention] has been helpful.' (Charlie)
- '(...) I had no idea that TV was as bad as iPad and phones. So...just having that knowledge is absolutely fantastic.' (Heidi)
- '(...) I would wake up and have a look at my phone, do the crochet, and get up and have a cup of tea, and go to bed and do more crocheting. And yeah, then trying to fall asleep crocheting, which I did. Now, I actually do not do any of those things (...).' (Eloise)
- '(...) All that sleep hygiene stuff, I like the idea...because like me, I have a lot of worries that we all have, that keep me awake. So, like putting my worries on a leaf and letting it float away (...).' (Charlie)
- 'I've found the leaf ...tremendously helpful.' (Eloise)
- '(...) I did try to incorporate all...most of the information that was given to us, but I wasn't aware of the sleep cycle thing. And I thought you went to sleep and then you woke up in the morning. And I worried because I woke up during the night, and now I do not worry about that anymore. That's probably major.' (Penny)
- '(...) I think it made me realise that my four ¾ and five hours sleep a night is normal or within the range, and it's normal to wake up, which...all of that was worrying me... when I'd wake up two three times a night... not getting the long sleep that everybody seems to get (...).' (Hattie)

Theme 3: The positive impact on sleep

- '(...) I'm having deeper sleep. (...) And, I actually woke up yesterday...and I actually feel refreshed which I do not necessarily ask myself that question. It's a little bit interesting, because of this influence.' (Rita)
- 'I've changed several things. If I wake up at a reasonable hour, like 5:30, 6 o'clock, I do not try and go back to sleep. I then stay awake, I go out in the garden, water the garden and come inside, have breakfast, get ready for the day. Whereas before... I would go and try to get back to sleep and I'd just lie there thinking I need to sleep for another 2½ hours. Yeah. And I'm not getting tired during the night. I'm not having a nanna nap, I only have a nanna nap, if I'm really, really exhausted. I do not need that nanna nap, and I'm going to bed about the same time always about 9:30, ten o'clock 10:30 around 9:30 to 10:30. I'm just waking up a lot earlier... and it's beautiful out there early in the morning.' (Eloise)
- 'Try not to sleep in the day. Knowledge is knowledge. I think it's certainly helped. Anything I've tried, it kinda helps.' (Andy)
- '(...) So, I do not use my phone in bed now. Just realising that I do not have to lie awake in the middle of the night and freak out because I think I'm never going to go back to sleep. I can kind of like put that aside and relax (...).' (Charlie)
- '(...) During the last two weeks, I've had a couple of days where I've had things happen in my life that have caused anxiety. But, this morning we were talking about it, and this idea of putting the problems on a leaf and watching it float...I'm actually looking forward to doing that the next time it happens. I'm really pleased I've learned about the leaf in the water.' (Heidi)
- '(...) I also do find that being in a relationship, husband or partner or whatever, you have to change them as well. So, it's not just about you. So, changing that is difficult(...)' (Lorraine)

recorded by the sleep watch. One participant felt that the process of observing and recording their sleep patterns through the sleep watch may have affected their natural sleep patterns.

3.2.2 | The value of sleep education

Participants found the information about sleep patterns, sleep cycles and sleep hygiene to be helpful and informative (Table 1). The participants appreciated the information about the negative effects of activities like watching TV or using phones before bedtime and the benefits of sleep hygiene practices such as turning off electronics before bed and reading in bed. The knowledge provided has been helpful in reducing stress associated with sleep disturbances. Some participants found the sleep-promoting techniques, such as the visualisation, to be useful in reducing anxiety and improving sleep.

The participants found the cognitive aspect of the information on sleep to be the most useful and important. This includes topics such as cognitive distortions and sleep cycle information. The behavioural information on sleep hygiene was also noted as useful, but not as impactful as the cognitive aspect. The information provided helped to relieve the pressure and worry some participants had regarding their sleep patterns, such as waking up during the night, and made them realise that their sleep patterns were normal.

Overall, the participants found that knowledge about sleep hygiene and normal sleep patterns was helpful in making changes to their sleep habits (Table 1). Participants found the questionnaires beneficial in understanding the importance of adequate sleep and the amount of sleep they needed. The educational part of the intervention helped participants identify areas of improvement and allowed them to track their progress.

3.2.3 | The positive impact on sleep

Participants reported improved sleep quality, such as deeper sleep and waking up feeling refreshed following the intervention (Table 1). The content provided has led to some of the participants making purposeful changes in their sleep habits. The changes made included adjusting sleep schedules, avoiding naps and implementing sleep hygiene practices like not using the phone in bed.

Some participants tried different methods, but only found success with some of them. One implementation was the 'leaf' method which stood out in particular as many participants using it experienced a reduction of anxiety (Table 1). Others reported a lack of change and that changing their sleep habits is difficult, especially when it involves their partners.

3.3 | Preliminary evidence of efficacy

As illustrated below, paired sample *t*-tests depicted significant improvements post-intervention in measures of subjective sleep, objective sleep and fatigue.

Pre- and post-intervention measures revealed significant improvements in self-reported sleep across three domains: Global PSQI scores, Sleep Latency and Sleep Duration (Table 2). Global PSQI scores reduced 3.09 points from 12.1 to 9.0 ($p=0.01$) with improvements revealed to have large effect size ($d=0.965$). Sleep latency and sleep duration scores improved significantly with mean scores decreasing from 1.5 to 1.09 ($p=0.05$) and 1.72 to 1.18 ($p=0.05$) and medium effect sized effects ($h=0.660$; $h=0.664$ respectively). All domains of subjective sleep assessment illustrated improvements post-intervention (Table 2).

Objective measures of sleep, as measured by actigraphy, identified improvements across all measures of

TABLE 2 Pre- and Post-intervention Pittsburgh Sleep Quality Index scores.

PSQI domain	Pre-Intervention (<i>n</i> = 11) Mean (SE)	Post-Intervention (<i>n</i> = 11) Mean (SE)	Pre-intervention vs. Post-intervention (<i>n</i> = 11) <i>T</i> -tests; Effect size (95% confidence intervals)
Global score	12.18 (0.651)	9.09 (0.638)	$p=0.01$; d 0.964 (0.225 to 1.67)
Sleep quality	1.81 (0.226)	1.36 (0.203)	$p=0.096$
Sleep latency	1.54 (0.247)	1.09 (0.250)	$p=0.05$; d 0.687 (−0.09 to 1.3)
Sleep duration	1.72 (0.194)	1.18 (0.226)	$p=0.05$; d 0.820 (−0.05 to 1.3)
Sleep efficiency	3.00 (0)	2.72 (0.272)	$p=0.341$
Sleep disturbance	1.81 (0.121)	1.63 (0.152)	$p=0.167$
Sleep medication	1.36 (0.432)	0.363 (0.278)	$p=0.03$; d 0.745 (0.05 to 1.40)
Daytime dysfunction	0.90 (0.162)	0.727 (0.140)	$p=0.341$

Note: Paired *t*-test, Cohens *D* Effect size. Cohens *D* and CI shown for values $p=0.05$ or below.

sleep, however, only Total Sleep Time (TST) revealed statistically significant improvements. Total time in bed increased by 37.7 mins ($p=0.2$), Total Sleep Time increased by 53.7 mins ($p=0.04$), Sleep Efficiency increased by 1.85 ($p=0.3$) with decreased Wake After Sleep onset time and number of overnight awakenings (Table 3).

Lastly, total fatigue scores improved significantly from 12.8 to 3.6 ($p=0.04$; $h=0.678$) illustrating lower levels of fatigue, with domains of general fatigue, emotional fatigue and invigoration showing greatest improvement (Table 4).

4 | DISCUSSION

This pilot study sought to determine the feasibility, acceptability and potential effectiveness of a sleep-promoting intervention for older adults.

During the study, acceptability and feasibility were evident via the recruitment, retention and adherence to the intervention. Completion rates of outcome measure tools and actigraph completion were high. Focus group qualitative data indicated that participants were satisfied with the intervention and highlighted the components from which they most benefitted. One of the recurring themes was the normalisation of sleep cycles and waking among peers, and normative age-related sleep changes.

Preliminary data supported the potential effectiveness of the group intervention in significantly improving several measures of sleep and fatigue. Importantly, PSQI Global scores reduced by over three points with greatest improvements in the domains of sleep duration, sleep quality and sleep latency. Significant improvements were also noted in objective measures of sleep, as per actigraph data, in total sleep time with participants gaining almost an extra hour of sleep each night, post-intervention. This improvement in sleep increased the mean sleep time from 6.6 to 7.5 h, which was now within the National Sleep Foundation's recommendations of between 7 and 8 h of sleep for older adults. These positive improvements in sleep measures mirror improvements in experiences of fatigue. Overall fatigue scores reduced, significantly, by 9.18 points. Together, these preliminary results indicate that the sleep-promoting intervention improved objective and subjective measures of sleep quality and quantity, resulting in reduced levels of fatigue experienced by the participants.

As this study was an uncontrolled pilot study, further investigation is required to determine the efficacy of the group intervention in older adults, utilising a randomised controlled trial study design, with an appropriately powered sample size. Whilst the participants generally were satisfied with the intervention, the final session may be best used to target individual sleep concerns with a personalised approach. Future research would include a later post-intervention data collection point to determine

TABLE 3 Pre- and Post-intervention actigraphy measures; Paired *T*-test.

Actigraphy domain ($n=12$)	Pre-intervention ($n=11$) Mean (\pm SEM)	Post-intervention ($n=11$) Mean (\pm SEM)	Pre-intervention vs. Post-intervention (p value)
Total time in bed (mins)	456.5 (\pm 20.1)	494.3 (\pm 22.2)	+37.7 mins ($p=0.34$)
Total sleep time (mins)	400 (\pm 21.7)	453.6 (\pm 24.8)	+53.6 mins ($p=0.04$)
Wake after sleep onset (mins)	44.1 (\pm 8.9)	40.7 (\pm 6.9)	-3.4 mins ($p=0.69$)
Number of awakenings	12.76 (\pm 2.08)	12.5 (\pm 2.05)	-0.25 ($p=0.90$)

Abbreviation: SEM, standard error of mean.

TABLE 4 Pre-and Post-intervention Fatigue Severity Index scores.

FSI domain	Pre-intervention ($n=11$) Mean (SE)	Post-intervention ($n=11$) Mean (SE)	Pre-intervention vs. Post-intervention ($n=11$) <i>T</i> -tests; Effect size (95% confidence intervals)
Total fatigue	12.81 (4.69)	3.36 (2.77)	$p=0.04$; $d=0.678$ (0.005 to 1.32)
General fatigue	9.09 (2.29)	6.45 (0.927)	$p=0.20$
Physical fatigue	2.81 (0.829)	2.63 (0.576)	$p=0.74$
Emotional fatigue	6.54 (2.17)	3.72 (1.02)	$p=0.15$
Mental fatigue	4.63 (1.39)	3.54 (1.07)	$p=0.33$
Invigoration	10.54 (1.47)	12.7 (1.26)	$p=0.05$; $d=-0.651$ (-1.29 to 0.14)

Note: Paired *t*-test, Cohens *D* Effect size. Cohens *D* and CI shown for values p 0.05 or below.

the long-term adherence and effect of the intervention. Future work should consider the use of a pre-screening tool prior to recruitment as, whilst some participants scored high on their PSQI scores, they concurrently rated their sleep quality moderately positively. This group of participants may not receive the same benefits from the intervention. Actigraph fitting was very time-consuming and onerous, so future study design may need to take this into account. Lastly, in order to mitigate potentially undiagnosed sleep apnoea, a screening tool, such as STOP-BANG, could be utilised. Given the target population, delivering the intervention, on site, in retirement village settings may support ease of recruitment and delivery to larger audiences, thus ensuring greater time efficiency.

5 | CONCLUSIONS

Given the low-cost, low-risk nature of delivering the intervention, coupled with the preliminary positive results experienced by the participants in this study, group CBT-I is an appropriate tool in educating older adults about managing their own sleep.

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CONFLICT OF INTEREST STATEMENT

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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