A targeted psychological treatment for sleep problems in young people at ultra-high risk of psychosis in England (SleepWell): a parallel group, single-blind, randomised controlled feasibility trial

*Felicity Waite, Emma Černis, Thomas Kabir, Ellen Iredale, Louise Johns, Daniel Maughan, Rowan Diamond, Rebecca Seddon, Nicola Williams, Ly-Mee Yu, Daniel Freeman, SleepWell lived experience advisory group**

Summary

Background Sleep disturbance is common and problematic for young people at ultra-high risk of psychosis. Sleep disruption is a contributory causal factor in the occurrence of mental health problems, including psychotic experiences, anxiety, and depression. The implication is that treating sleep problems might have additional benefits on mental health outcomes in individuals at high risk. The present study had two aims: first, to establish the feasibility and acceptability of a randomised controlled trial to treat sleep problems with the aim of reducing psychotic experiences in young people at ultra-high risk of psychosis; and second, to provide proof of concept of the clinical efficacy of the treatment.

Methods We did a parallel group, single-blind, randomised controlled feasibility trial in two National Health Service trusts in England. Eligible participants were aged 14–25 years, a patient of mental health services, assessed as being at ultra-high risk of psychosis on the Comprehensive Assessment of At-Risk Mental States, and having current sleep problems (score of ≥15 on the self-report Insomnia Severity Index [ISI]). Participants were randomly assigned (1:1) to either a targeted psychological therapy for sleep problems (SleepWell) plus usual care or usual care alone via an automated online system, with non-deterministic minimisation that balanced participants for ISI score and referring service. The SleepWell therapy was delivered on an individual basis in approximately eight 1-h sessions over 12 weeks. Assessments were done at 0, 3, and 9 months, with trial assessors masked to treatment allocation. The key feasibility outcomes were the numbers of patients identified, recruited, and retained, treatment uptake, and data completion. Treatment acceptability was measured with the Abbreviated Acceptability Rating Profile (AARP). In preliminary clinical assessments, the primary clinical outcome was insomnia at 3 and 9 months assessed with the ISI, reported by randomised group (intention-to-treat analysis). Safety was assessed in all randomly assigned participants. The trial was prospectively registered on ISRCTN, 85601537, and is completed.

Findings From Nov 18, 2020, to Jan 26, 2022, 67 young people were screened, of whom 40 (60%) at ultra-high risk of psychosis were recruited. Mean age was 16·9 years (SD 2·5; range 14–23), and most participants identified as female (n=19 [48%]) or male (n=19 [48%]) and as White (n=32 [80%]). 21 participants were randomly assigned to SleepWell therapy plus usual care and 19 to usual care alone. All participants provided data on at least one follow-up visit. 39 (98%) of 40 participants completed the primary outcome assessment at 3 and 9 months. 20 (95%) of 21 participants assigned to SleepWell therapy received the prespecified minimum treatment dose of at least four sessions. The median treatment acceptability score on the AARP was 48 (IQR 46 to 48; n=17; maximum possible score 48). At the post-intervention follow-up (3 months), compared with the usual care alone group, the SleepWell therapy group had a reduction in insomnia severity (ISI adjusted mean difference –8·12 [95% CI –11·60 to –4·63]; Cohen's d=–2·67 [95% CI –3·81 to –1·52]), which was sustained at 9 months (ISI adjusted mean difference –5·83 [–9·31 to –2·35]; Cohen's d=–1·91 [–3·06 to –0·77]). Among the 40 participants, eight adverse events were reported in six participants (two [11%] participants in the usual care group and four [19%] participants in the SleepWell therapy group). One serious adverse event involving hospital admission for a physical health problem was reported in the SleepWell therapy group, and one patient in the usual care alone group transitioned to psychosis. None of these events were classed as being related to trial treatment or procedures.

Interpretation A randomised controlled trial of a targeted psychological sleep therapy for young people at ultra-high risk of psychosis is feasible. Patients can be retained in the trial and assessments done by masked assessors. Uptake of the sleep therapy was high, and we found preliminary evidence of sustained reductions in sleep problems. A definitive multicentre trial is now needed.

Funding NIHR Research for Patient Benefit and NIHR Oxford Health Biomedical Research Centre.

Lancet Psychiatry 2023

Published Online
August 7, 2023
https://doi.org/10.1016/S2215-0366(23)00203-1

See Online/Comment
https://doi.org/10.1016/S2215-0366(23)00254-7

*Members listed at the end of the Article

Department of Experimental Psychology, University of Oxford, Oxford, UK (F Waite DClinPsych, E Černis DPhil, E Iredale MSc, R Diamond DClinPsych, Prof D Freeman PhD); **Oxford Health NHS Foundation Trust, Oxford, UK** (F Waite, E Černis, E Iredale, R Diamond, Prof D Freeman); **Early Intervention in Psychosis Service, Oxford Health NHS Foundation Trust, Oxford, UK** (L Johns DPhil, D Maughan MD); **Psychological Therapies Theme, NIHR Oxford Health Biomedical Research Centre, Oxford, UK** (F Waite, Prof D Freeman); **McPin Foundation, London, UK** (T Kabir PhD); **Oxford Primary Care Clinical Trials Unit, Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK** (R Seddon MSc, N Williams MSc, L-M Yu DPhil)

Correspondence to:
Dr Felicity Waite, Oxford Cognitive Approaches to Psychosis, Department of Experimental Psychology, University of Oxford, Oxford OX2 6GG, UK
felicity.waite@psy.ox.ac.uk

Introduction

The presence of attenuated psychotic symptoms and disruption to everyday life are key criteria used to identify young people (aged 14–25 years) at ultra-high risk of psychosis. This group of young people are also at increased risk of other mental health problems, such as depression, and often experience poor long-term outcomes. Although these young people often seek help, current treatment effects are limited.[1,2] New approaches are needed. Our focus is on identifying and targeting causal mechanisms that are developmentally important, and problematic in their own right, and that young people want treated, such as sleep disruption.

Sleep problems are widespread in young people at ultra-high risk of psychosis, with estimates of prevalence exceeding 75%.[3] Sleep problems in early psychosis are not only common but also complex.[4] The rates of comorbidity are high between different sleep disorder presentations, including insomnia, nightmares, circadian rhythm disruption, and hypersomnia.[4] In qualitative accounts, young people at ultra-high risk of psychosis describe a range of sleep problems, including disrupted sleep timing and an irregular sleep schedule, difficulties getting to sleep and sustaining sleep, and distressing nocturnal experiences such as night-time worry, hallucinatory experiences, and nightmares.[5] The daytime effects include poor attendance and engagement at school or work, difficulties sustaining friendships and interacting in social situations, and a decline in mental health.[5]

Longitudinal,[6] experimental,[7] and interventionist[8,9] studies have identified sleep disturbance as a putative contributory causal factor in the occurrence of psychotic experiences, including paranoia and hallucinations.[10,11] In young people at ultra-high risk of psychosis, sleep problems might also be predictive of transition to psychosis.[12] Therefore, treating sleep problems might lead to improvements in wider mental health outcomes. However, to successfully tackle sleep disturbance in this group, treatment needs to address the complexity of sleep presentations, via techniques to improve sleep pressure, align circadian timing, and reduce hyperarousal.

The gold standard treatment for insomnia, cognitive behavioural therapy (CBT),[13] has been successfully adapted for people with psychosis.[9,14,15] Across the spectrum of severity of psychosis, our team have

Research in context

Evidence before this study

Chronic sleep disruption is common in patients with mental health conditions, and is a contributory causal factor in the occurrence of mental health disorders. It can be successfully treated by cognitive behavioural approaches, which might lead to reductions in anxiety, depression, and psychotic experiences. This relationship has relevance in young patients at ultra-high risk of psychosis, who are especially vulnerable to a range of poor mental health outcomes. On Dec 21, 2022, we searched PubMed without date or language restrictions using the following search terms: ("sleep"[All Fields] OR "insomnia"[All Fields] OR "circadian rhythm disruption"[All Fields]) AND ("clinical high risk"[All Fields] OR "ultra high risk"[All Fields] OR "at risk mental state"[All Fields] OR "prodromal"[All Fields]) AND ("treatment"[All Fields] OR "intervention"[All Fields]). 50 papers were identified. We found no randomised controlled trial that had evaluated the treatment of sleep disruption in young patients at ultra-high risk of psychosis. We identified six potentially informative studies. Four longitudinal studies found that sleep disturbance in patients at ultra-high risk of psychosis predicted the persistence of psychotic experiences over time. Another study, reported by our team, described the results of a case series in which a targeted sleep treatment was tested in 12 young people at high risk of psychosis, which provided an initial indication of feasibility and potential benefit. An accompanying qualitative study detailed that the treatment of sleep problems was highly valued by patients and that it had a meaningful effect on psychological wellbeing.

Added value of this study

To our knowledge, this is the first randomised controlled trial of a targeted psychological intervention (SleepWell) to treat sleep problems in young people at ultra-high risk of psychosis. All feasibility markers were achieved. Patients were successfully recruited, treatment uptake and follow-up rates were high, and all assessments were completed by assessors masked to group allocation. Acceptability of the SleepWell intervention was also high. Preliminary clinical outcomes indicated improvements in sleep after the intervention (3 months), which were sustained at follow-up (9 months). We also found indications of potential benefits on other mental health symptoms, including anxiety, depression, and paranoia. The present clinical data provide proof of concept for the potential benefits of treating sleep in young people at ultra-high risk of psychosis.

Implications of all the available evidence

A randomised controlled clinical trial testing the addition of psychological sleep therapy to standard care is feasible. Consistent with trials in patients with diagnosed psychosis, our findings suggest that psychological therapy can improve sleep in young people at ultra-high risk of psychosis. The intervention might also have benefits on wider mental health outcomes, including psychotic experiences. A definitive multicentre trial to establish the full range of effects of cognitive behaviour therapy for sleep disturbance, particularly on psychotic experiences, is warranted.

consistently demonstrated large treatment effects on sleep problems (effect size range d=0·9–1·9).[9,14,15] Potential further benefits have been indicated for depression, anxiety, and psychotic experiences.[9] Treatment effects on psychotic experiences might be mediated by affective symptoms.[6–8]

The common, non-specific occurrence of sleep problems across mental health problems[11] might hold particular meaning when considered from a network perspective, in which the presentations of mental health problems are understood to reflect dynamic networks of interacting symptoms.[16] The implication is that targeting these common factors might lead to a reduction in the specific treatment target and also to benefits across the network of symptoms. This position is consistent with the clinical staging approach, in which sleep disturbance is identified as a potential early treatment to reduce the likelihood of a range of severe mental health problems.[17]

We adapted our CBT for insomnia treatment specifically for young people at ultra-high risk of psychosis. In an uncontrolled case series with 12 young patients (aged 15–22 years), we found large improvements in sleep, with smaller benefits on depression and psychotic experiences.[18] The treatment was popular (for example, 74 [88%] of 84 sessions attended) and in qualitative accounts, the young patients described the importance and value of gaining both knowledge ("learnt a lot") and skills ("developed a repertoire of skills") to improve sleep.[5]

In this Article, we report on a randomised controlled trial that aimed to assess the feasibility, acceptability, and preliminary clinical efficacy of a targeted intervention to improve sleep (SleepWell) and reduce psychotic experiences in young people at ultra-high risk of psychosis. Our hypotheses related to preliminary clinical outcomes were that, compared with usual care, SleepWell therapy added to usual care would, firstly, reduce insomnia and other sleep disruption (post-treatment); secondly, reduce psychotic experiences (a key marker of psychosis risk) and rates of transition to psychosis (post-treatment); thirdly, reduce psychiatric symptoms (depression, anxiety, worry, and suicidal ideation), increase activity and social functioning, improve physical health, and enhance quality of life (post-treatment); and fourthly, treatment effects would be maintained at follow-up. As this was a feasibility trial, it was not powered to test for statistical significance with regard to these preliminary clinical outcomes.

Methods

Study design

We did a prospective, parallel group, single-blind, randomised controlled feasibility trial of the SleepWell intervention with 3-month and 9-month follow-up in two National Health Service (NHS) mental health trusts in England: Oxford Health NHS Foundation Trust (Oxfordshire and Buckinghamshire, UK) and Berkshire Healthcare NHS Foundation Trust (Berkshire, UK). The study received ethical approval from the Health Research Authority and Health and Care Research Wales in the UK (Integrated Research Application System reference number 281235, The SleepWell Trial) and NHS South Central – Oxford A Research Ethics Committee (reference number 20/SC/0281). The study was done in accordance with CONSORT guidelines.[19] The trial was prospectively registered with the ISRCTN registry (ISRCTN85601537), and the protocol[20] was published at the start of the trial (and before patient recruitment; accepted for publication Oct 7, 2020) and is provided in appendix 1. A lived experience advisory group, facilitated by the McPin Foundation (London, UK), advised on the conduct of the trial throughout.

See **Online** for appendix 1

Participants

Participants were eligible if they were aged 14–25 years, a patient of mental health services at the time of referral to the study, met diagnostic criteria for ultra-high risk of psychosis on the Comprehensive Assessment of At-Risk Mental States (CAARMS),[21] were having current sleep problems (identified by a score of ≥15 on the Insomnia Severity Index [ISI][22]), wanted help to improve sleep, and were willing and able to give informed consent (or assent with parent or guardian consent for participants aged 14–15 years) for participation in the trial. Exclusion criteria were diagnosis of a primary severe mental health problem (including psychosis, bipolar disorder, and personality disorder), probable primary diagnosis of sleep apnoea, a primary diagnosis of alcohol or substance use disorder, organic syndrome, or clinically significant learning disability, or current engagement in any other individual psychological therapy. All participants provided written informed consent, or assent with parent or guardian written consent for participants aged 14–15 years, before participation.

Randomisation and masking

Participants were randomly assigned (1:1) to either SleepWell therapy in addition to usual care for patients at ultra-high risk of psychosis, or to usual care alone. Randomisation was done by the trial coordinator (EČ) with use of a validated and automated online system, Sortition, designed by the University of Oxford Primary Care Clinical Trials Unit (Oxford, UK). Allocation used a non-deterministic minimisation to ensure balance across groups with respect to severity of sleep disturbance (ISI score ≤21 *vs* ≥22) and referring service (early intervention in psychosis service [EIS] *vs* child and adolescent mental health service [CAMHS] *vs* improving access to psychological therapies service [IAPT]). Trial assessors were masked to group allocation for all assessments. The trial coordinator informed all patients of the randomisation outcome, to ensure the trial assessors remained masked to group allocation. If group allocation was revealed, the assessment was completed by another

For **Sortition** see https://www.phc.ox.ac.uk/research/resources/sortition-clinical-trial-randomisation-software

masked assessor. Assessors were unmasked on three occasions (two by 3 months and one additional assessor by 9 months) and all assessments were successfully remasked.

Procedures

The SleepWell therapy was designed to be delivered on an individual basis in approximately eight 1 h-sessions over a 12-week period. Additional contact between sessions (eg, text messages and email) was provided to support the implementation of treatment strategies. The treatment was delivered by clinical psychologists (EČ, RD, and FW). Weekly clinical supervision of treatment was provided by FW. The treatment sessions were done at the patient's home, at an NHS clinic at the study sites, or adapted in consideration of COVID-19 restrictions for remote delivery. Flexibility in the location, duration, and number of sessions was provided to maximise engagement and uptake with this clinical group.

The SleepWell therapy is a psychological intervention designed for young people (14–-25 years) and targets three mechanisms that regulate sleep: sleep pressure, circadian rhythm, and hyperarousal.[23] To address sleep pressure (the need or propensity for sleep), we promote daytime activity to increase night-time tiredness. We use the motivational benefits of fitness-trackers and focus on morning routines to also assist with circadian alignment. To address circadian alignment (the timing of sleep), we realign sleep patterns with the environment by using light and dark exposure, which is the key zeitgeber, or time cue, for the sleep–wake cycle. We also re-establish circadian rhythms using daily activity timepoints (ie, a specific activity at a set time), social connection, and mealtimes. To address hyperarousal, which can disrupt sleep despite high sleep pressure and circadian entrainment, the key strategy is stimulus control, in which patients relearn the association between bed and sleep. We also use worry reduction strategies, cognitive restructuring techniques, and night-time relaxation. The treatment is informed by standard CBT sleep protocols[24,25] and protocols for treating sleep disruption in patients with psychosis,[26,27] with specific adaptations for the unique aspects of sleep in young people. These include biological changes in sleep architecture during adolescence, such as delayed circadian sleep phase, and lifestyle factors such as exam pressure, social networks, and environmental constraints (eg, shared accommodation with siblings or at university).[18]

The SleepWell intervention is manualised in a modular format and covers five core modules. The format and manuals were developed in collaboration with our lived experience advisory group. The first module covers psychoeducation about sleep disruption and the key factors needed for good sleep, assessment of current sleep difficulties and maintaining factors, formulation, and goal setting. The assessment includes a checklist of factors that commonly disrupt sleep (eg, absence of a consistent sleep schedule; inactivity in the daytime; worry at night; nightmares; hearing voices at night; and environmental and lifestyle factors such as too much light in the bedroom at night or high caffeine intake).[26,27] This enables the young person to self-identify maintaining factors, which can be used to build the formulation and to identify treatment targets. Within the goal setting segment, we aim to establish an ideal sleep window, which is the ideal time the young person would like to be asleep. Achieving sleep within the ideal sleep window is often a primary focus of treatment. To achieve the treatment goals there are three core treatment modules, with four additional modules that can be selected by patients on the basis of individual need, enabling the intervention to be personalised. The first core treatment module focuses on establishing the environmental and lifestyle context for sleep; the second focuses on stimulus control and strategies to reduce hyperarousal; the third focuses on circadian entrainment (using light and dark exposure, establishing the sleep window, and boosting zeitgebers such as meal and activity times). Given the common shift in adolescence to a delayed-phase circadian pattern, additional emphasis was put on establishing a consistent sleep window and then adjusting the timing of this window to align with the young person's ideal time. For many young people there are societal constraints on this, such as school start times or working night shifts. The additional treatment modules cover night-time worry, nightmares, relaxation, and unusual experiences such as hearing voices or seeing shapes or figures. The final core module focuses on consolidating learning, setting future goals, and relapse prevention. The key adaptions for individuals at ultra-high risk of psychosis include: addressing the developmental issue of delayed-phase circadian patterns; establishing a sleep team to support the young person by engaging family, friends, and school teachers; addressing psychotic experiences that affect sleep; problem solving around constraints on stimulus control due to the sleep environment (eg, sharing a bedroom with a sibling, or the bedroom needing to be used for study or socialising); and navigating external stressors that affect sleep (eg, living independently for the first time or taking exams). Formal sleep restriction was not used due to not wanting to cause any large reduction in sleep time on any given night during treatment.

With patient consent, sessions were audiorecorded to check the quality of the therapy. Tapes were rated for fidelity and competence using the Revised Cognitive Therapy Scale.[28] All assessed tapes were scored as providing satisfactory cognitive therapy or above (ie, a score of ≥3 on each item of the Cognitive Therapy Scale).

SleepWell was provided in addition to usual care. Usual care was recorded with the Client Service Receipt Inventory (CSRI),[29] with information on psychiatric admissions and medication collected from electronic medical records. Usual care typically consisted of

infrequent contact with a general practitioner or mental health professional for assessment, and prescription of psychotropic medication (most often antidepressant medication) as needed. There were no changes to usual care as a result of participating in the trial.

Study assessments were conducted at 0 months (baseline, before randomisation), 3 months (post-intervention), and 9 months after randomisation. At the end of their participation in the study, participants in the usual care alone group were offered a one-off session with a clinical psychologist (EČ or FW). This session briefly identified a plan to improve sleep, which participants could then implement independently. The importance of offering this session was emphasised by the lived experience advisory group.

Demographic and clinical data were collected by self-report and screening medical records. Gender was self-reported according to the options: male, female, other, or prefer not to say. With regard to protocol amendments, COVID-19 restrictions were in place throughout the recruitment period, including two periods of national lockdown in England (starting in November, 2020, and January, 2021). Remote working practices were used when necessary, and measures such as wearing personal protective equipment were in place throughout recruitment and follow-up. Being at moderate or high risk of a severe course of COVID-19 was added as an exclusion criterion on Sept, 1, 2020. This was modified on Feb 18, 2021, so that when an individual at moderate or high risk had been fully vaccinated (two doses), they could then enter the trial. In a separate amendment, the sleepiness and fatigue scale listed in the protocol was excluded from the statistical analysis plan as it had not been published at the time of creating the analysis plan.

Outcomes

Our aims were to assess the feasibility and acceptability of a targeted sleep intervention to prevent psychosis in young people at ultra-high risk of psychosis, and to provide a preliminary indication of clinical efficacy. The key markers of feasibility were the numbers of patients identified, recruited, and retained at 3 and 9 months, treatment uptake, and data completion at 3 and 9 months. These markers were considered the most important parameters for the design of a future trial. For assessment of treatment uptake, the prespecified minimum treatment dose was defined as four SleepWell therapy sessions, consistent with previous studies.[9,18] Treatment acceptability was measured with the Abbreviated Acceptability Rating Profile (AARP; higher scores indicate greater acceptability, maximum total score 48).[30] Other feasibility and acceptability measures are listed in the protocol (appendix 1 pp 12–13). Qualitative feedback collected via interviews is not reported herein and will be reported separately.

The primary outcome for our preliminary clinical hypotheses was insomnia at 3 and 9 months, assessed with the ISI[22] (a seven-item self-report measure scored on a 5-point Likert scale [0–4] with established clinical cut-offs: absence of insomnia [0–7]; subthreshold insomnia [8–14]; moderate insomnia [15–21]; and severe insomnia [22–28]).[22] In addition, three key secondary outcomes were selected to test our preliminary hypotheses (appendix 2 pp 8–9). These outcomes were psychotic experiences, measured with the CAARMS (Global Rating Scale for symptom severity)[21] and Revised Green et al Paranoid Thoughts Scale (R-GPTS),[31] and depression and anxiety symptoms (shown to be a mediator of the relationship between sleep disturbance and psychotic experiences[6–8]) measured with the Depression Anxiety Stress Scales–21 items (DASS-21).[32] The depression and anxiety subscales of the DASS-21 were used as key outcomes as they related to the clinical hypothesis. Higher scores on each of these measures indicates greater severity.

See Online for appendix 2

Other secondary clinical outcomes for sleep were based on a sleep diary and a second measure focused on circadian rhythm (SLEEP-50 Circadian Rhythm Disruption subscale[33]). Participant-reported information in sleep diaries was used to calculate total sleep time per night, sleep onset latency per night, sleep efficiency, and sleep regularity. Sleep efficiency was calculated as the total time spent asleep in a night as a percentage of total amount of time spent in bed, and sleep regularity as the standard deviation of the mean sleep midpoint time across the sleep diary. Additional secondary outcomes on psychotic experiences included hallucinatory experiences (Specific Psychotic Experiences Questionnaire–Hallucinations subscale [SPEQ-H][34]) and dissociation (Černis Felt Sense of Anomaly scale[35]). Further outcomes on psychiatric symptoms included suicidal ideation (Columbia Suicide Severity Rating Scale [CSSRS][36]), worry (Dunn Worry Questionnaire[37]), and beliefs about the self (Brief Core Schema Scale[38]). Outcomes on activity and social functioning included daily activity (time budget[39]), functioning (Work and Social Adjustment Scale[40]), and agoraphobic avoidance (Oxford Agoraphobic Avoidance Scale[41]). Outcomes on physical health included body-mass index (BMI), step count, body esteem (Body Esteem Scale for Adults and Adolescents[42]), substance use (Maudsley Addiction Profile[43]), and overall physical health (Patient Health Questionnaire[44]). Outcomes on quality of life included recovery (Questionnaire about the Process of Recovery[45]) and quality of life (Recovering Quality of Life[46] and Euroqol 5D questionnaire[47]). Outcomes related to service use (CSRI[29]) and medication and hospital admissions (from electronic medical records) were also recorded. The stress subscale of the DASS-21 was recorded for completeness. The CAARMS, CSSRS, time budget, and CSRI were administered by assessors. BMI was calculated from patient-reported height and weight. Step count was measured using an actigraph wearable device (Garmin Vivofit 4; Garmin,

Olathe, KS, USA). All other measures were self-reported by patients. All clinical outcome measures were collected at each assessment timepoint. A summary of all outcome measures is provided in the protocol (appendix 1 pp 12–13).

Safety outcomes included patient-reported adverse events during trial participation. At the end of trial participation, we checked electronic medical records for serious adverse events, defined as any untoward medical occurrence that results in death, is life-threatening, requires or prolongs hospital admission, or results in persistent or clinically significant disability or incapacity.

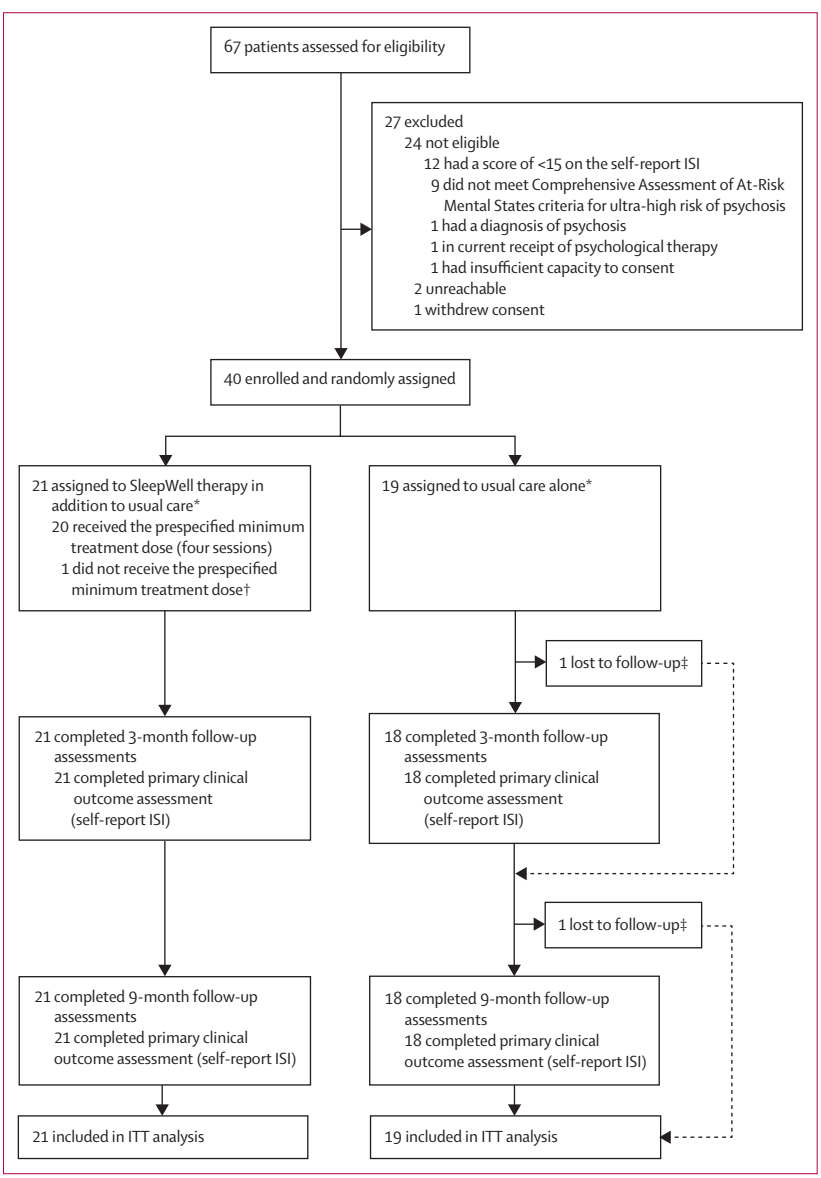

Figure 1: **Trial profile**
ISI=Insomnia Severity Index. ITT=intention-to-treat. *Summaries of the usual care received are provided in appendix 3 (pp 56–57). †Patient received two sessions. ‡Two separate participants; each of these participants provided data at one follow-up timepoint, meaning 19 participants were included in the ITT analysis overall.

We also recorded formal complaints about therapy, and transition to psychosis. An independent data monitoring and ethics committee chair rated whether any serious adverse event was related to the trial procedures or intervention.

Statistical analysis

The sample size was calculated in accordance with the feasibility aims of the trial. A sample size of 20 participants per randomised group (40 in total across the study) was calculated to be sufficient to estimate a recruitment rate of 50% with 95% CI 35–65 and a retention rate of 80% at 3 months and 9 months with 95% CI 65–90 (PASS software version 12). This sample size was also determined to be sufficient to estimate the variability of outcome measures for future sample size calculations, with 12 per arm sufficient for estimation of the variability for the purpose of sample size calculations.[48] The trial was not powered to detect a significant difference between treatment groups.

For the feasibility markers, analysis was descriptive in nature and no hypothesis testing was done. Numbers and proportions were presented for binary feasibility measures (ie, recruitment and retention, uptake of treatment, and data completion) overall and by randomised group. Continuous measures were presented as the mean (SD), or as the median (IQR) when required. For feasibility markers, there were prespecified progression criteria to inform the design of a future definitive trial including stop, amend, or proceed. For recruitment, the proceed criterion for a future trial was a mean rate of at least two participants per month. For treatment uptake, consent by eligible participants, retention, and data collection, the proceed criterion for a future trial was a rate of at least 75%.

For preliminary clinical outcomes, statistical analysis was restricted to the primary outcome and three key secondary outcomes, as outlined in the statistical analysis plan (appendix 2 pp 9, 19–20). Linear mixed-effects models were used, with baseline score of the outcome of interest, time, treatment group, and a time by treatment group interaction included as fixed effects and participant as a random effect. We report the treatment effect estimate as the adjusted mean difference between groups with 95% CIs. In addition, we report estimates for Cohen's *d* effect sizes, at each timepoint, as the adjusted mean difference of the outcome (between the groups) divided by the baseline SD of the outcome for both groups combined. An effect size of 0·2 is considered a small effect, 0·5 a medium effect, and 0·8 or higher a large effect.[49,50] Results were graphically presented in a forest plot. No p-values are reported for any outcomes as this is a feasibility trial. For other clinical outcomes, the analysis was descriptive with no hypothesis testing.

Receipt of the intervention, participation to follow-up, and adverse events were fully documented among all recruited participants. Clinical outcomes are reported by

randomised group for all participants randomly assigned (intention-to-treat analysis). All participants with available data were included in all analyses of feasibility and clinical outcomes in the treatment group to which they were randomised. Safety was assessed in all randomly assigned participants.

All analyses were done in Stata (version 16.1). The forest plot was produced in Microsoft Excel (version 2306). The statistical analysis plan (appendix 2) was approved by the data monitoring and ethics committee before any inspection of post-randomisation data. A full statistical report is provided in appendix 3.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Recruitment took place from Nov 18, 2020, to Jan 26, 2022 (including approximately 48 weeks with restrictions on face-to-face contact due to the COVID-19 pandemic), with final follow-up data collected on Sept 21, 2022. Of 163 patients referred to the study, 67 patients completed screening, and 40 were enrolled and randomly assigned to the SleepWell intervention in addition to usual care (n=21) or usual care alone (n=19; figure 1).

At baseline, the mean age of participants was 16·9 years (SD 2·5; range 14–23). Most participants identified as either female (n=19, 48%) or male (n=19, 48%). 32 (80%) participants were White, 35 (88%) were living with their parents or caregivers, 27 (68%) were a full-time school or college student, and 17 (43%) were currently being prescribed psychotropic medication, predominantly antidepressants (table 1). ISI scores at baseline indicated that most participants had moderate insomnia (mean 18·9 [SD 3·0]), with nine (23%) participants in the severe range (score ≥22). Measured on the DASS-21, participants had levels of depression (mean 29·0 [SD 11·4]) and anxiety (mean 23·3 [SD 11·6]) in the extremely severe range (score of ≥28 on the depression scale and ≥20 on the anxiety scale),[32] and, measured on the R-GPTS, levels of paranoia (R-GPTS part A, ideas of reference: mean 18·2 [SD 9·1]; and R-GPTS part B, ideas of persecution: mean 16·9 [SD 11·80]) in the moderately severe range (score of 16–20 [part A] and 11–17 [part B]).[31] Measured on the SPEQ-H, 26 (65%) participants heard voices at least once a week. 20 (50%) participants were having active suicidal ideation, as measured on the CSSRS.

All progression criteria to inform future trial design related to rates of recruitment, retention, data collection, and treatment uptake were achieved. 67 patients were screened for eligibility, and 40 (60%) were enrolled at a mean rate of 2·85 participants per month. No eligible individuals declined enrolment into the trial. Two eligible participants were unreachable after screening. One eligible participant withdrew consent before randomisation. No participants withdrew after randomisation. All participants provided data on at least one follow-up visit at 3 and 9 months. However, one assessment was missed at each follow-up timepoint, giving a follow-up rate of 98%. Of 163 patients referred, 116 (71%) referrals were received from Oxford Health NHS Foundation Trust and 47 (29%) from Berkshire Healthcare NHS Foundation Trust. Most referrals were received from EIS (n=104, 64%) or CAMHS (n=39, 24%), with the

See Online for appendix 3

	Usual care alone (n=19)	SleepWell therapy plus usual care (n=21)	All participants (n=40)
Age, years	16·8 (2·8; 14–22)	17·0 (2·2; 14–23)	16·9 (2·5; 14–23)
Gender			
Female	8 (42%)	11 (52%)	19 (48%)
Male	9 (47%)	10 (48%)	19 (48%)
Other	2 (11%)	0	2 (5%)
Ethnicity			
White	15 (79%)	17 (81%)	32 (80%)
Black British	0	1 (5%)	1 (3%)
Black Caribbean	0	1 (5%)	1 (3%)
Indian	1 (5%)	0	1 (3%)
Pakistani	1 (5%)	0	1 (3%)
Other	2 (11%)	2 (10%)	4 (10%)
Age at first contact with mental health services, years	14·5 (3·2; 7–21)	15·0 (3·3; 10–23)	14·8 (3·2; 7–23)
Living situation			
Living with parents or caregivers	17 (89%)	18 (86%)	35 (88%)
Living with partner	1 (5%)	2 (10%)	3 (8%)
Living with others	1 (5%)	0	1 (3%)
Missing	0	1 (5%)	1 (3%)
Employment type			
Full-time school or college student	11 (58%)	16 (76%)	27 (68%)
Higher education institution student or full-time training	2 (11%)	1 (5%)	3 (8%)
Employed full-time (paid)	2 (11%)	3 (14%)	5 (13%)
Employed part-time (paid)	1 (5%)	0	1 (3%)
Unemployed (receiving state benefits)	0	1 (5%)	1 (3%)
Unemployed (not receiving state benefits)	2 (11%)	0	2 (5%)
Other	1 (5%)	0	1 (3%)
Currently prescribed psychotropic medication			
Individuals prescribed psychotropic medication	7 (37%)	10 (48%)	17 (43%)
Mean number of prescribed psychotropics	1·6 (0·5)	1·3 (0·5)	1·4 (0·5)
Type of psychotropic medication prescribed			
Antipsychotic medication	1 (5%)	0	1 (3%)
Antidepressant medication	7 (37%)	10 (48%)	17 (43%)
Anxiolytic medication	0	0	0
Mood stabiliser	1 (5%)	0	1 (3%)
Hypnotic medication	2 (11%)	2 (10%)	4 (10%)

Data are n (%), mean (SD; range), or mean (SD). Percentages do not always add up to 100% due to rounding.

Table 1: **Baseline characteristics**

remaining referrals from other adult mental health services (n=9 [5%] from IAPT). The rates of recruitment by service type and month are included in appendix 3 (p 39). Among the 40 enrolled patients, 39 (98%) completed the primary clinical outcome assessment at each follow-up timepoint. All participants completed the primary clinical outcome assessment on at least one follow-up visit. For other clinical outcome measures at 3 months, assessments were completed by at least 35 (88%) participants per measure for self-report clinical assessments, with lower numbers providing data for the sleep diary (n=26, 65%), step count with the actigraph device (n=26, 65%), and BMI (n=30, 75%). Clinician assessments were completed by at least 34 (85%) participants per measure. At 9 months, data completion rates remained high (≥37 participants per measure; ≥93%) for self-report measures. At baseline, most clinical assessments were completed remotely (either fully, n=25, 63%; or partially, n=12, 30%). The mean time to complete the assessments, including self-report and clinician-administered items (excluding the sleep diary and actigraphy) was 171·8 min (SD 55·0) at baseline, 117·9 min (46·8) at 3 months, and 104·7 min (43·9) at 9 months. Service use data are presented in appendix 3 (pp 46, 56–57).

Among participants assigned to the SleepWell intervention, 20 of 21 received the prespecified minimum

	n	Minimum rating by patients	Maximum rating by patients	Mean (SD)
This was an acceptable treatment for me	17	4	6	5·71 (0·686)
This treatment has been effective in alleviating my sleep problems	17	3	6	5·59 (0·870)
My sleep problems were severe enough to justify the use of the treatment	17	4	6	5·65 (0·606)
I would be willing to undergo this treatment again	17	4	6	5·82 (0·529)
This treatment did not have bad side-effects	17	4	6	5·59 (0·712)
I liked this treatment	17	4	6	5·76 (0·664)
The treatment was a good way to handle my sleep problems	17	4	6	5·76 (0·664)
Overall, the treatment was helpful	17	5	6	5·88 (0·332)
Treatment Acceptability scale totals*	17	33	48	45·76 (4·409)

Treatment acceptability was measured on the Abbreviated Acceptability Rating Profile.[29] Each item is rated on a scale of 1–6, giving an overall total maximum score of 48. *Median total score was 48 (IQR 46–48).

Table 2: **SleepWell treatment acceptability**

	Usual care alone (n=19)	SleepWell therapy plus usual care (n=21)	Adjusted mean difference (95% CI)*	Standardised effect size, Cohen's *d* (95% CI)
Insomnia Severity Index total score				
Baseline	18·7 (3·3); n=19	19·2 (2·8); n=21	..	..
3 months	14·3 (5·8); n=18	6·3 (4·9); n=21	−8·12 (−11·60 to −4·63)	−2·67 (−3·81 to −1·52)
9 months	13·9 (5·8); n=18	8·3 (6·3); n=21	−5·83 (−9·31 to −2·35)	−1·91 (−3·06 to −0·77)
Comprehensive Assessment of At-Risk Mental States symptom severity total score				
Baseline	45·4 (12·1); n=19	50·8 (11·2); n=21	..	..
3 months	44·6 (21·6); n=16	42·2 (20·9); n=19	−6·83 (−20·60 to 6·94)	−0·58 (−1·75 to 0·59)
9 months	39·3 (26·6); n=18	38·8 (21·4); n=20	−3·44 (−16·81 to 9·92)	−0·29 (−1·43 to 0·84)
R-GPTS-A (ideas of reference) total score				
Baseline	17·6 (9·5); n=19	18·7 (8·9); n=21	..	..
3 months	15·9 (11·1); n=17	13·2 (8·9); n=20	−4·70 (−10·03 to 0·63)	−0·52 (−1·10 to 0·07)
9 months	15·9 (11·2); n=18	10·4 (9·5); n=21	−5·90 (−11·11 to −0·69)	−0·65 (−1·22 to −0·08)
R-GPTS-B (ideas of persecution) total score				
Baseline	14·7 (11·9); n=19	18·9 (11·7); n=21	..	..
3 months	14·5 (13·3); n=17	14·4 (11·7); n=20	−4·51 (−10·99 to 1·97)	−0·38 (−0·93 to 0·17)
9 months	15·5 (15·5); n=18	10·3 (10·1); n=21	−7·73 (−14·07 to −1·39)	−0·65 (−1·19 to −0·12)
DASS-21 depression scale total score				
Baseline	27·5 (12·4); n=19	30·4 (10·5); n=21	..	..
3 months	21·3 (14·6); n=17	19·5 (13·4); n=19	−4·00 (−11·47 to 3·47)	−0·35 (−1·01 to 0·31)
9 months	19·8 (14·8); n=16	14·7 (10·2); n=21	−7·66 (−15·09 to −0·22)	−0·67 (−1·33 to −0·02)
DASS-21 anxiety scale total score				
Baseline	20·3 (12·6); n=19	26·0 (10·1); n=21	..	..
3 months	17·9 (14·0); n=17	15·9 (13·3); n=19	−6·22 (−12·60 to 0·16)	−0·54 (−1·09 to 0·01)
9 months	18·6 (11·4); n=16	13·7 (11·0); n=21	−9·55 (−15·91 to −3·19)	−0·83 (−1·38 to −0·28)

Scores are mean (SD), with number of patients with available data shown. R-GPTS=Revised Green et al Paranoid Thoughts Scale. DASS-21=Depression Anxiety Stress Scales–21 items. *SleepWell therapy plus usual care versus usual care alone; mean difference was estimated from a linear mixed-effects model adjusting for outcome measure at baseline, time, treatment group, and a time by treatment group interaction as fixed effects, and participant as a random effect; standardised effect size (Cohen's *d*) was calculated as the estimated mean difference divided by baseline standard deviation.

Table 3: **Summary statistics for primary and key secondary clinical outcome data**

treatment dose of at least four sessions of the intervention, representing a treatment uptake of 95%. The remaining patient received two sessions. The mean number of sessions attended was 7·71 (SD 2·12; range 2–12; n=21). The mean number of sessions missed (not attended or cancelled) was 1·19 (1·69). In total, 162 sessions were provided. These sessions were held at the patient's home (n=54 sessions, 33%), in the clinic (n=43, 27%), or remotely (n=65, 40%). Remote sessions were held by videocall (n=56, 86% of 65 remote sessions, 35% of 162 total sessions) or by telephone (n=9, 14% of remote sessions, 6% of total sessions). Personal protective equipment was used in all in-person sessions. All participants received between-session contact as part of the therapy. The frequency of contact was determined by patient choice. The median treatment acceptability score, measured on the AARP, was 48 (IQR 46–48; n=17; table 2). Within the treatment, all participants collaboratively developed a maintenance cycle formulation of the sleep problem and received psychoeducation about sleep. The most common active treatment techniques were establishing a sleep window (ie, the key anchor times for sleep and wakefulness) coupled with creating a wind-down routine to prepare for sleep and a rise-up routine to promote being active in the morning (n=20 [95%]). All participants engaged in active practice of the treatment techniques between sessions on at least one occasion (with implementation of techniques reviewed in 125 [77%] of 162 sessions).

We summarised preliminary clinical outcome data on the primary outcome (insomnia, assessed with the ISI) and key secondary outcomes (psychotic experiences, measured with the CAARMS and R-GPTS; and affective symptoms, measured with the DASS-21; table 3, figure 2). Available data in the ITT population were assessed. Compared with the usual care alone group, the SleepWell therapy group had notable reductions in insomnia severity, with large effect size estimates, at 3 months (ISI adjusted mean difference –8·12 [95% CI –11·60 to –4·63], Cohen's *d*=–2·67 [95% CI –3·81 to –1·52]) and 9 months (ISI adjusted mean difference –5·83 [–9·31 to –2·35], Cohen's *d*=–1·91 [–3·06 to –0·77]). At the post-intervention follow-up (3 months), 15 (71%) of 21 participants in the SleepWell treatment group had an ISI score lower than the cut-off for insomnia (score <8), compared with two (11%) of 18 participants in the control group. The SleepWell intervention was also associated with reductions in depression and anxiety (DASS-21), and paranoia (RGPTS-A and RGPTS-B), although confidence intervals crossed the null at 3 months (table 3, figure 2). Larger effect sizes were observed at 9 months for these measures and confidence intervals did not cross the null. Although small-to-medium effect sizes were observed for the effect of the SleepWell intervention on CAARMS score, the confidence intervals at both timepoints were wide and covered a range from potentially increasing to decreasing scores. Descriptive statistics for secondary clinical outcome measures are provided in table 4.

During the 9 months of follow-up, six participants had a total of eight adverse events. Three events were reported in two (11%) of 19 participants (both male participants) in the usual care group, and five events were reported in four (19%) of 21 participants (three female participants, one male participant) in the SleepWell intervention group. Three of the events in the SleepWell group occurred during the period of SleepWell provision. There was one serious adverse event (SleepWell group; female participant) which involved hospital admission for a physical health problem during

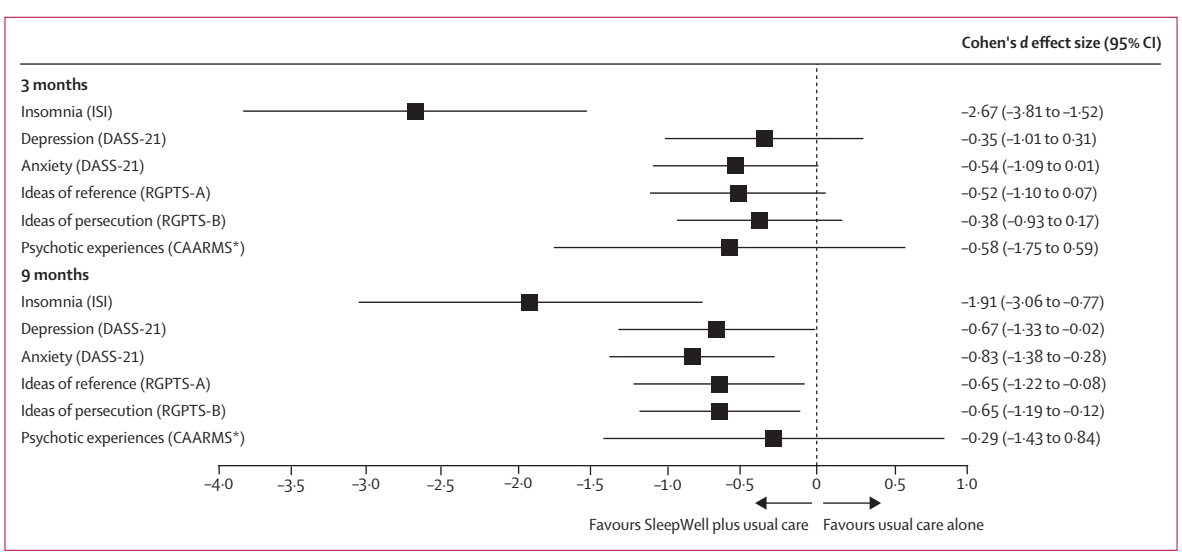

Figure 2: **Forest plot of Cohen's *d* effect sizes**
ISI=Insomnia Severity Index. DASS-21=Depression Anxiety Stress Scales–21 items. R-GPTS-A=Revised Green et al Paranoid Thoughts Scale, part A. R-GPTS-A=Revised Green et al Paranoid Thoughts Scale, part B. CAARMS=Comprehensive Assessment of At-Risk Mental States. *Symptom severity (Global Rating Scale) on CAARMS.

	Usual care alone (n=19)	SleepWell therapy plus usual care (n=21)
Sleep variables		
Sleep-50 Circadian Rhythm Disruption subscale total score		
Baseline	6·8 (2·0); n=19	7·4 (2·3); n=21
3 months	6·9 (2·5); n=17	4·6 (1·7); n=19
9 months	6·4 (2·2); n=17	6·2 (2·5); n=21
Total sleep time per night, minutes		
Baseline	407·1 (124·7); n=14	387·3 (93·0); n=15
3 months	447·3 (119·1); n=14	461·4 (83·2); n=12
9 months	460·8 (54·8); n=13	497·2 (65·3); n=13
Sleep onset latency per night, minutes		
Baseline	68·1 (42·2); n=14	72·0 (61·2); n=15
3 months	60·2 (77·1); n=14	36·7 (27·2); n=12
9 months	36·9 (26·4); n=13	24·8 (16·0); n=13
Sleep efficiency		
Baseline	63·7 (16·6); n=14	63·9 (17·0); n=14
3 months	68·6 (24·0); n=14	79·4 (10·5); n=11
9 months	75·8 (9·8); n=13	81·2 (9·4); n=12
Sleep regularity ≤1 h		
Baseline	7 (50%); n=14	7 (50%); n=14
3 months	6 (50%); n=12	9 (75%); n=12
9 months	7 (54%); n=13	6 (46%); n=13
Psychiatric symptom variables		
Specific Psychotic Experiences Questionnaire–Hallucinations subscale total score		
Baseline	23·8 (9·2); n=19	23·8 (9·6); n=21
3 months	18·3 (12·4); n=18	18·8 (12·2); n=20
9 months	16·7 (14·0); n=18	14·6 (10·5); n=21
Černis Felt Sense of Anomaly total score		
Baseline	74·0 (31·8); n=19	75·8 (41·2); n=21
3 months	65·6 (38·4); n=17	63·2 (37·0); n=19
9 months	60·7 (41·4); n=17	53·0 (41·2); n=21
Columbia Suicide Severity Rating Scale score (most severe suicidal ideation)		
Baseline	1·5 (1·7); n=19	2·1 (1·5); n=21
3 months	1·4 (1·9); n=16	1·2 (1·3); n=18
9 months	1·0 (1·6); n=16	0·9 (1·3); n=18
Dunn Worry Questionnaire total score		
Baseline	29·8 (9·7); n=19	34·8 (6·5); n=21
3 months	24·9 (13·5); n=17	25·9 (12·3); n=19
9 months	26·2 (10·7); n=17	21·4 (12·3); n=21
Brief Core Schema Scales–negative-self subscale total score		
Baseline	12·6 (8·0); n=19	15·2 (5·4); n=21
3 months	10·4 (7·2); n=17	9·5 (6·8); n=19
9 months	9·7 (6·6); n=17	7·9 (6·1); n=21
Brief Core Schema Scales–positive-self subscale total score		
Baseline	6·7 (4·2); n=19	5·2 (4·2); n=21
3 months	7·9 (5·2); n=17	9·8 (4·5); n=19
9 months	9·1 (6·1); n=17	10·2 (5·6); n=21

(Table 4 continues in next column)

(Continued from previous column)

	Usual care alone (n=19)	SleepWell therapy plus usual care (n=21)
Activity, social functioning, and recovery measures		
Time budget total score		
Baseline	63·2 (19·5); n=18	75·5 (14·3); n=21
3 months	63·3 (20·0); n=16	81·4 (11·3); n=19
9 months	69·7 (17·6); n=15	74·5 (14·0); n=18
Work and Social Adjustment Scale total score		
Baseline	22·4 (9·5); n=19	27·4 (6·0); n=21
3 months	22·4 (13·0); n=17	18·3 (12·0); n=19
9 months	19·8 (9·5); n=19	11·1 (9·2); n=20
Oxford Agoraphobic Avoidance Scale total avoidance score		
Baseline	2·0 (2·2); n=17	3·0 (2·4); n=21
3 months	2·4 (2·3); n=17	2·2 (2·4); n=19
9 months	1·3 (1·6); n=17	1·1 (1·9); n=20
Oxford Agoraphobic Avoidance Scale total distress score		
Baseline	35·9 (19·7); n=18	42·8 (23·2); n=21
3 months	35·6 (20·5); n=17	31·2 (23·9); n=19
9 months	30·9 (20·5); n=15	20·4 (19·1); n=21
Daily step count		
Baseline	4823 (3685·0); n=16	6700 (3746·7); n=16
3 months	6169 (1958·2); n=11	5527 (3137·4); n=15
9 months	7649 (4792·1); n=13	7402 (5242·0); n=14
Questionnaire about the Process of Recovery total score		
Baseline	28·2 (13·5); n=19	28·9 (13·5); n=21
3 months	31·2 (13·7); n=17	34·7 (11·6); n=19
9 months	31·9 (11·1); n=17	36·6 (10·7); n=21
Recovering Quality of Life total score		
Baseline	28·5 (16·3); n=19	20·3 (8·1); n=21
3 months	35·4 (17·4); n=16	39·8 (18·8); n=19
9 months	32·1 (17·2); n=17	44·6 (14·3); n=21

Data are mean (SD) or n (%), with number of patients with available data shown. Other preliminary clinical outcomes are provided in appendix 3 (pp 54–57).

Table 4: **Descriptive statistics for secondary clinical outcomes**

the intervention period. No adverse events were classed as being related to trial treatment or procedures. One patient transitioned to psychosis, in the usual care alone group, which was deemed to be unrelated to trial involvement.

Discussion

To our knowledge, this is the first randomised controlled trial of a sleep treatment in young people at ultra-high risk of psychosis. Overall, the study indicates the feasibility of testing a psychological sleep intervention adapted for this population. Recruitment targets were met, despite the additional challenges of the COVID-19 pandemic. Retention was high with all participants providing follow-up data. Uptake and acceptability of the therapy were also very high. Furthermore, we found preliminary indications of clinical benefit. After the brief targeted psychological intervention, we observed large reductions in sleep problems, which were sustained at follow-up. There were also reductions in ratings of depression, anxiety, and paranoia at follow-up.

The uptake of treatment and attendance at therapy sessions were high. All but one participant received the minimum treatment dose of four sessions. The assessments and therapy were delivered in a hybrid format including both remote and in-person meetings. Although this hybrid approach was initially a response to the restrictions of the COVID-19 pandemic, treatment uptake and trial retention remained high during remote contact, and this hybrid approach is likely to be incorporated in future service delivery models, which has the potential to increase the range of options available to patients. We also aimed to offer flexibility and patient choice in the timings of sessions, which might be facilitated by online delivery. Overall treatment acceptability and engagement were high. The modular treatment could be personalised following assessment and formulation. The most common treatment techniques were establishing a sleep window and creating wind-down and rise-up routines. These techniques address circadian alignment and hyperarousal. All participants engaged in active practice of the treatment techniques. This finding is consistent with previous qualitative accounts of the SleepWell therapy in which young patients described a process of "trying things out" and valuing the experience.[5]

The preliminary clinical effects of the intervention on sleep are consistent with the large effects reported in numerous trials of CBT for insomnia. For example, in a meta-analysis of 87 trials of CBT for insomnia, the reported effect size for improvement in ISI was large (Hedge's g=0·98).[51] Although fewer studies have been done in the adolescent population, a meta-analysis of nine randomised controlled trials showed similar large effect sizes for the effect of CBT for insomnia on global sleep quality (Cohen's d=0·92).[52] Large effects have consistently been reported when treating sleep problems across the spectrum of severity of psychosis (effect size range d=0·9–1·9).[9,14,15] Although only preliminary findings, the effect sizes in the current study are larger than those reported previously, and therefore encouraging. The effects of CBT for insomnia on depression are well recognised,[53] with the approach recently adapted for adolescents.[54] The meta-analysis of trials of CBT for insomnia in adolescents also reported outcomes on depression and anxiety, with larger effects at later follow-up,[52] which is again consistent with findings in the current study and further indicates the potential mechanistic effect of improving sleep on mental health. The preliminary outcomes in relation to psychotic experiences are encouraging, especially given the small size of the study. The levels of paranoia in the participant group at baseline were similar to those seen in patients with a diagnosis of psychosis (eg, the gameChange trial[55]). The size of treatment effects on paranoia in the current trial is promising. The preliminary treatment effects on psychotic experiences, depression, and anxiety were larger at the later follow-up (9 months) compared with the post-intervention follow-up (3 months). This finding is consistent with the theoretical rationale that sleep disruption is a causal factor in the occurrence of these mental health problems, and these affective symptoms (ie, anxiety and depression) might mediate the relationship between sleep disturbance and psychotic experiences.[6–8] A definitive trial with embedded mediation and moderation tests is required to identify the wider effects of the SleepWell intervention (including preventative effects on psychotic experiences), how it works, and for whom it might work best.

The main limitation when considering the potential clinical effects is that this feasibility trial was not designed or powered to detect clinical effects. No active comparison was used to control for elements of the treatment that might have benefit, such as contact time with a clinician. This design gives an overall indication of the benefit of the approach when added to standard care, but not which elements are necessary or if another treatment might be more effective. Notably, no specific at-risk mental health services for young people at ultra-high risk of psychosis were available at the recruiting sites, and therefore usual care was limited. Recruitment was predominantly via EIS and CAMHS. Working with CAMHS has been identified as a potential avenue for early preventative interventions for psychosis.[56] Given the drive to increase current service provision for young people at ultra-high risk of psychosis in England[57] in consideration of the often sparse availability of services for this group, identifying brief and effective implementable treatments should be a key priority for policy makers. In accordance with our focus on subjective experiences of sleep disruption and psychotic experiences, we primarily used self-report assessments. We used actigraphic measurements as a marker of activity due to the potential physical health benefits of improved sleep, but remain cautious about the precision of actigraphy to determine sleep-wake parameters. The study was done across two NHS trusts in England and the participants will not be representative of all young people at ultra-high risk of psychosis or accessing mental health services.

In conclusion, the outcomes of this trial are promising regarding the potential benefits of treating sleep problems at the early stages of psychosis. A definitive trial, with embedded mediation and moderation, is now needed to assess the clinical benefits suggested in this feasibility study. Such a trial by our team is due to begin in 2024.

SleepWell lived experience advisory group
Abreen Rebello, Steven Evans, Jummy Otaiku, and Tom Sharpe (McPin Foundation, London, UK).

Contributors
FW was the chief investigator and wrote the first draft of the manuscript. FW and DF conceived the study and led the design of the trial and treatment. TK led the Patient and Public Involvement work, including facilitating the SleepWell lived experience advisory group. The SleepWell lived experience advisory group provided lived

experience expertise that informed the design and delivery of the trial. EČ coordinated the trial. EČ, RD, and FW delivered the treatment. FW provided treatment supervision. LJ and DM were the local clinical service leads. EI recruited participants and conducted assessments. EČ and FW led the data management. RS and NW did the statistical analysis. L-MY led the statistical analysis and input from the Oxford Primary Care Clinical Trials Unit. All authors had full access to all the data in the study. FW, RS, and NW accessed and verified the data and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors contributed to critical review and editing of the manuscript and had final responsibility for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

Deidentified participant data will be available with publication in anonymised form from the corresponding author (felicity.waite@psy.ox.ac.uk) on reasonable request (including a study proposal), subject to review and contract with Oxford Health National Health Service (NHS) Foundation Trust.

Acknowledgments

The trial was funded by the NHS Research for Patient Benefit programme (grant reference number NIHR200481). The trial was also supported by the National Institute for Health and Care Research (NIHR) Oxford Health Biomedical Research Centre (grant numbers BRC-1215–2000 and NIHR203316). FW is supported by a Wellcome Trust Clinical Doctoral Fellowship (award number 102176/B/13/Z). DF is an NIHR Senior Investigator. The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care. We thank the participants who took part in this study. We also thank members of the research team not listed as authors, including Sapphira McBride, Simone Saidel, Kira Williams, Helen Beckwith, and Ariane Beckley. We express our gratitude to The McPin Foundation in facilitating patient and public involvement, including Roya Kamvar and colleagues. We thank the independent members of the data monitoring and ethics committee, chaired by Matthew Broome, including Rory Byrne, Sophie Parker, and Natalie Rowland. We thank members of the Oxford Health NHS Foundation Trust research and development team, Nick Raven and Bill Wells; and members of the Berkshire Healthcare NHS Foundation Trust research and development team, Emma Donaldson and Rachel Stevenson. Finally, we would like to thank the clinical teams in the participating NHS trusts.

References

1 Yung AR. Treatment of people at ultra-high risk for psychosis. *World Psychiatry* 2017; **16:** 207–08.

2 Davies C, Cipriani A, Ioannidis JPA, et al. Lack of evidence to favor specific preventive interventions in psychosis: a network meta-analysis. *World Psychiatry* 2018; **17:** 196–209.

3 Poe S-L, Brucato G, Bruno N, et al. Sleep disturbances in individuals at clinical high risk for psychosis. *Psychiatry Res* 2017; **249:** 240–43.

4 Reeve S, Sheaves B, Freeman D. Sleep disorders in early psychosis: incidence, severity, and association with clinical symptoms. *Schizophr Bull* 2019; **45:** 287–95.

5 Waite F, Bradley J, Chadwick E, Reeve S, Bird JC, Freeman D. The experience of sleep problems and their treatment in young people at ultra-high risk of psychosis: a thematic analysis. *Front Psychiatry* 2018; **9:** 375.

6 Zaks N, Velikonja T, Parvaz MA, et al. Sleep disturbance in individuals at clinical high risk for psychosis. *Schizophr Bull* 2022; **48:** 111–21.

7 Reeve S, Emsley R, Sheaves B, Freeman D. Disrupting sleep: the effects of sleep loss on psychotic experiences tested in an experimental study with mediation analysis. *Schizophr Bull* 2018; **44:** 662–71.

8 Freeman D, Sheaves B, Goodwin GM, et al. The effects of improving sleep on mental health (OASIS): a randomised controlled trial with mediation analysis. *Lancet Psychiatry* 2017; **4:** 749–58.

9 Freeman D, Waite F, Startup H, et al. Efficacy of cognitive behavioural therapy for sleep improvement in patients with persistent delusions and hallucinations (BEST): a prospective, assessor-blind, randomised controlled pilot trial. *Lancet Psychiatry* 2015; **2:** 975–83.

10 Waite F, Sheaves B, Isham L, Reeve S, Freeman D. Sleep and schizophrenia: from epiphenomenon to treatable causal target. *Schizophr Res* 2020; **221:** 44–56.

11 Freeman D, Sheaves B, Waite F, Harvey AG, Harrison PJ. Sleep disturbance and psychiatric disorders. *Lancet Psychiatry* 2020; **7:** 628–37.

12 Ruhrmann S, Schultze-Lutter F, Salokangas RKR, et al. Prediction of psychosis in adolescents and young adults at high risk: results from the prospective European prediction of psychosis study. *Arch Gen Psychiatry* 2010; **67:** 241–51.

13 National Institute for Health and Care Excellence. Insomnia. May, 2022. https://cks.nice.org.uk/topics/insomnia/ (accessed March 15, 2023).

14 Sheaves B, Holmes EA, Rek S, et al. Cognitive behavioural therapy for nightmares for patients with persecutory delusions (Nites): an assessor-blind, pilot randomized controlled trial. *Can J Psychiatry* 2019; **64:** 686–96.

15 Sheaves B, Freeman D, Isham L, et al. Stabilising sleep for patients admitted at acute crisis to a psychiatric hospital (OWLS): an assessor-blind pilot randomised controlled trial. *Psychol Med* 2018; **48:** 1694–704.

16 Borsboom D, Cramer AOJ. Network analysis: an integrative approach to the structure of psychopathology. *Annu Rev Clin Psychol* 2013; **9:** 91–121.

17 McGorry P, Keshavan M, Goldstone S, et al. Biomarkers and clinical staging in psychiatry. *World Psychiatry* 2014; **13:** 211–23.

18 Bradley J, Freeman D, Chadwick E, et al. Treating sleep problems in young people at ultra-high risk of psychosis: a feasibility case series. *Behav Cogn Psychother* 2018; **46:** 276–91.

19 Montgomery P, Grant S, Mayo-Wilson E, et al. Reporting randomised trials of social and psychological interventions: the CONSORT-SPI 2018 extension. *Trials* 2018; **19:** 407.

20 Waite F, Kabir T, Johns L, et al. Treating sleep problems in young people at ultra-high-risk of psychosis: study protocol for a single-blind parallel group randomised controlled feasibility trial (SleepWell). *BMJ Open* 2020; **10:** e045235.

21 Yung AR, Yuen HP, McGorry PD, et al. Mapping the onset of psychosis: the Comprehensive Assessment of At-Risk Mental States. *Aust N Z J Psychiatry* 2005; **39:** 964–71.

22 Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med* 2001; **2:** 297–307.

23 Borbély AA. A two process model of sleep regulation. *Hum Neurobiol* 1982; **1:** 195–204.

24 Espie CA. Overcoming insomnia and sleep problems: a self help guide using cognitive behavioural techniques. London: Constable and Robinson, 2006.

25 Harvey AG. A cognitive model of insomnia. *Behav Res Ther* 2002; **40:** 869–93.

26 Waite F, Myers E, Harvey AG, et al. Treating sleep problems in patients with schizophrenia. *Behav Cogn Psychother* 2016; **44:** 273–87.

27 Waite F, Sheaves B. Chapter 20—Better sleep: evidence-based interventions. In: Badcock JC, Paulik G, eds. A clinical introduction to psychosis. Cambridge, MA: Academic Press, 2020: 465–92.

28 Blackburn I, James I, Milne D, et al. The Revised Cognitive Therapy Scale (CTS-R). *Behav Cogn Psychother* 2001; **29:** 431–46.

29 Beecham J, Kanpp M. Costing psychiatric interventions. In: Thornicroft G, ed. Measuring mental health needs. London: Gaskell, 1992: 163–84.

30 Tarnowski KJ, Simonian SJ. Assessing treatment acceptance: the Abbreviated Acceptability Rating Profile. *J Behav Ther Exp Psychiatry* 1992; **23:** 101–06.

31 Freeman D, Loe BS, Kingdon D, et al. The revised Green et al., Paranoid Thoughts Scale (R-GPTS): psychometric properties, severity ranges, and clinical cut-offs. *Psychol Med* 2021; **51:** 244–53.

32 Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther* 1995; **33:** 335–43.

33 Spoormaker VI, Verbeek I, van den Bout J, et al. Initial validation of the SLEEP-50 questionnaire. *Behav Sleep Med* 2005; **3:** 227–46.

34 Ronald A, Sieradzka D, Cardno AG, Haworth CMA, McGuire P, Freeman D. Characterization of psychotic experiences in adolescence using the Specific Psychotic Experiences Questionnaire: findings from a study of 5000 16-year-old twins. *Schizophr Bull* 2014; **40:** 868–77.

35 Černis E, Beierl E, Molodynski A, Ehlers A, Freeman D. A new perspective and assessment measure for common dissociative experiences: 'felt sense of anomaly'. *PLoS One* 2021; **16:** e0247037.

36 Posner K, Brown GK, Stanley B, et al. The Columbia-Suicide Severity Rating Scale: initial validity and internal consistency findings from three multisite studies with adolescents and adults. *Am J Psychiatry* 2011; **168:** 1266–77.

37 Freeman D, Bird JC, Loe BS, et al. The Dunn Worry Questionnaire and the Paranoia Worries Questionnaire: new assessments of worry. *Psychol Med* 2020; **50:** 771–80.

38 Fowler D, Freeman D, Smith B, et al. The Brief Core Schema Scales (BCSS): psychometric properties and associations with paranoia and grandiosity in non-clinical and psychosis samples. *Psychol Med* 2006; **36:** 749–59.

39 Jolley S, Garety PA, Ellet L, et al. A validation of a new measure of activity in psychosis. *Schizophr Res* 2006; **85:** 288–95.

40 Mundt JC, Marks IM, Shear MK, Greist JH. The Work and Social Adjustment Scale: a simple measure of impairment in functioning. *Br J Psychiatry* 2002; **180:** 461–64.

41 Lambe S, Bird JC, Loe BS, et al. The Oxford Agoraphobic Avoidance Scale. *Psychol Med* 2023; **53:** 1233–43.

42 Mendelson BK, Mendelson MJ, White DR. Body-esteem scale for adolescents and adults. *J Pers Assess* 2001; **76:** 90–106.

43 Marsden J, Gossop M, Stewart D, et al. The Maudsley Addiction Profile (MAP): a brief instrument for assessing treatment outcome. *Addiction* 1998; **93:** 1857–67.

44 Kroenke K, Spitzer RL, Williams JBW. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. *Psychosom Med* 2002; **64:** 258–66.

45 Law H, Neil ST, Dunn G, Morrison AP. Psychometric properties of the Questionnaire about the Process of Recovery (QPR). *Schizophr Res* 2014; **156:** 184–89.

46 Keetharuth AD, Brazier J, Connell J, et al. Recovering Quality of Life (ReQoL): a new generic self-reported outcome measure for use with people experiencing mental health difficulties. *Br J Psychiatry* 2018; **212:** 42–49.

47 Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res* 2011; **20:** 1727–36.

48 Julious SA. Sample size of 12 per group rule of thumb for a pilot study. *Pharm Stat* 2005; **4:** 287–91.

49 Cohen J. A power primer. *Psychol Bull* 1992; **112:** 155–59.

50 Cohen J. Statistical power analysis for the behavioral sciences, 2nd edn. Hillside, NJ: Lawrence Erlbaum Associates, 1988.

51 van Straten A, van der Zweerde T, Kleiboer A, Cuijpers P, Morin CM, Lancee J. Cognitive and behavioral therapies in the treatment of insomnia: a meta-analysis. *Sleep Med Rev* 2018; **38:** 3–16.

52 Blake MJ, Sheeber LB, Youssef GJ, Raniti MB, Allen NB. Systematic review and meta-analysis of adolescent cognitive-behavioral sleep interventions. *Clin Child Fam Psychol Rev* 2017; **20:** 227–49.

53 Cunningham JEA, Shapiro CM. Cognitive behavioural therapy for insomnia (CBT-I) to treat depression: a systematic review. *J Psychosom Res* 2018; **106:** 1–12.

54 Orchard F, Pass L, Chessell C, Moody A, Ellis J, Reynolds S. Adapting brief CBT-I for depressed adolescents: a case illustration of the Sleeping Better program. *Cognit Behav Pract* 2020; **27:** 336–46.

55 Freeman D, Lambe S, Kabir T, et al. Automated virtual reality therapy to treat agoraphobic avoidance and distress in patients with psychosis (gameChange): a multicentre, parallel-group, single-blind, randomised, controlled trial in England with mediation and moderation analyses. *Lancet Psychiatry* 2022; **9:** 375–88.

56 Kelleher I. Psychosis prediction 2.0: why child and adolescent mental health services should be a key focus for schizophrenia and bipolar disorder prevention research. *Br J Psychiatry* 2023; **222:** 185–87.

57 NHS England. Implementing the early intervention in psychosis access and waiting time standard: guidance. Feb 16, 2023. https://www.england.nhs.uk/mentalhealth/wp-content/uploads/sites/29/2016/04/eip-guidance.pdf (accessed March 15, 2023).