A protocol for a randomized controlled trial comparing Sleepwell, EMPOWER, and treatment-as-usual for benzodiazepine receptor agonist discontinuation in older adults: the your answers when needing sleep in New Brunswick (YAWNS NB) study

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A B S T R A C T

Background: Chronic benzodiazepine receptor agonist (BZRA) use among older adults is a public health concern given cognitive and physical risks. One in four older adults in New Brunswick, Canada, is a long-term user of BZRAs. Previous studies using a direct-to-patient approach as the primary intervention target have shown promise in reducing BZRA use. The Your Answers When Needing Sleep in New Brunswick (YAWNS NB) study aims to reduce the long-term use of BZRAs in older adults and increase the use of cognitive behavioural therapy for insomnia (CBTi), which is the recommended first line treatment.

Methods: The trial (ClinicalTrials.gov registration NCT04406103) is a three arm, open-label, parallel randomized controlled trial in NB, Canada. Eligible participants 65 years and older using BZRAs long-term will be randomly allocated to: the Eliminating Medications through Patient Ownership of End Results (EMPOWER) information package group; the Sleepwell information package group; or treatment-as-usual (TAU). Information packages will be mailed via Canada Post. The primary outcome of BZRA discontinuation at 6 months will be compared across groups. Secondary outcomes include participants with ≥ 25% BZRA dose reduction, and switching to newly prescribed alternate sedative-hypnotics. Several exploratory outcomes will also be examined.

Discussion: Targeting participants with information packages informing them of appropriate use, dangers, and approaches to reducing BZRA use and increasing CBTi use may be beneficial in a region of Canada with the highest rate of chronic BZRA use in older adults. Comparing information packages and TAU will provide insights into the effectiveness of direct-to-patient interventions for BZRA reduction.

1. Introduction

New Brunswick, a Canadian province of just over 794,000 people,[1] has the highest prevalence nationally of chronic benzodiazepine receptor agonists (BZRAs) use.[2–4] The rate of chronic use among older adults is 10% across Canada, while in NB it is 25%.[2,4] For comparison, the rate in a neighbouring province, Nova Scotia, with a population of nearly one million people[1] is 16%.[2,5]

BZRAs, (e.g., lorazepam, temazepam, "Z-drugs" (e.g., zopiclone, zolpidem)), provide limited benefits for insomnia based on subjective and objective measures related to insomnia outcomes (e.g., sleep onset latency, sleep duration, insomnia remission).[6–8] Guidelines state that cognitive-behavioural therapy for insomnia (CBTi) be used first-line and BZRAs should be used for the shortest duration possible to limit risk and loss of effectiveness over time.[9–11] CBTi has a more favourable safety and effectiveness profile given limited risks and potential for long-lasting benefits.[9,10,12,13]

Avoidance of BZRAs in older adults has been long recommended by medication safety and geriatric medicine organizations.[14–16] The adverse cognitive and physical effects (e.g., reduced alertness, falls) of BZRAs lead to significant morbidity, and potentially mortality, of older adults.[17–25] Higher rates of dementia, pneumonia, and influenza-related death have also been reported.[21,23,26] Hip fractures occur more frequently among BZRA users leading to emergency department visits, hospitalizations, and possibly death.[20] Serious traffic accidents are also more common.[25,27,28] Chronic BZRA use is also perpetuated by dependence, making discontinuation difficult due to withdrawal symptoms including rebound insomnia and other adverse effects.[29–31] Finally, pharmacodynamic drug interactions occur with BZRAs and other sedating medications (e.g., opioids, gabapentinoids). Rates of concomitant BZRA and opioid use is climbing despite recommendations against the combination due to increased overdose-related hospitalizations and death.[32]

Various interventions, programs, and policies have targeted BZRA reduction in older adults.[33–35] Interventions have almost exclusively targeted prescribers (e.g., psychiatrists, family physicians), often with limited and unsustained decline in BZRA use. Prescribers and health care professionals frequently find it difficult to approach the topic of deprescribing BZRAs with patients, often understating their risks and can feel pressured to continue prescribing and providing BZRAs beyond their comfort.[34,36–38]

Studies directly targeting patients are uncommon. Direct-to-patient approaches have shown promise for BZRA reduction. The Eliminating Medications through Patient Ownership of End Results (EMPOWER) study was a randomized trial, conducted in Quebec, Canada, and that included an information package mailed to older adults (mean age 75 years, mean duration of BZRA use 10 years).[39] The information package encouraged BZRA gradual dose reduction and discontinuation.[40] After 6 months, the group receiving the information package were more likely to discontinue their BZRA (27%) versus non-recipients (4.5%).[39] The information packages used in the EMPOWER study were also sent to US Veterans using BZRAs and similarly showed reduction in use.[41]

The information package used in the EMPOWER study does not name, facilitate access to, or directly promote CBTi use to manage chronic insomnia. Sleepwell[42] is a resource that was developed in Nova Scotia, Canada, at a similar time to the EMPOWER study, and includes information about sedatives and CBTi, with the aim of promoting the reduction of long-term sedative use while recommending CBTi techniques, resources, and programs for people living with insomnia. Sleepwell's resources and recommendation are available online[42] and were transformed into print resources specifically targeting older adults. The effectiveness of Sleepwell on BZRA use has not been measured. Recognizing the success with the EMPOWER study, a randomized controlled trial (RCT) was designed to compare Sleepwell with the most recent versions of the information booklets used in the EMPOWER study and treatment-as-usual (TAU) with respect to BZRA discontinuation, access to CBTi resources, and insomnia outcomes. This study, known as Your Answers When Needing Sleep in New Brunswick (YAWNS NB), will be conducted in New Brunswick, Canada. There are three primary hypotheses for the study: 1) The Sleepwell mailed packages will lead to higher rates of: (i) BZRA discontinuation and (ii) BZRA dose reductions ($\geq 25\%$) within 6 months compared to TAU. Findings will be similar with the results of the EMPOWER information package; 2) Sleepwell will be more effective at promoting participant access to CBTi resources compared to the EMPOWER study's information package; and 3) The rate of new prescriptions for other sedative-hypnotics (e.g., trazodone, quetiapine) will not be increased with either the Sleepwell or EMPOWER information packages as compared to TAU. The exploratory hypotheses and outcomes can be found in Table 1.

2. Methods

2.1. Trial design

This protocol is reported according to the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT),[50] with the intervention

Table 1
Exploratory hypotheses & outcomes of the YAWNS NB study.

Exploratory hypotheses	Exploratory outcomes
1. A longer follow-up period is required to detect if a direct-to-patient health promotion intervention designed to reduce long-term prevalent BZRA use leads to fewer falls, visits to ED, and hospitalizations due to i) injurious falls, and ii) all causes. Preliminary data will suggest a benefit, however it will be inconclusive.	**Fall history:** measured by participant reports. **ED visits & hospitalisations:** Fall-related, injury-related, and all-cause ED visits and hospitalizations measured objectively by anonymized personal health information records.
2. After stopping BZRAs (without switching to other sedatives), people will have less daytime sleepiness.	**ISI:** A 7-item self-administered scale assessing the severity of daytime and nighttime components of insomnia.[43] **ESS:** An 8-item self-administered scale assessing a individuals proclivity for
3. Receiving booklets by mail that promote a self-directed approach to managing insomnia and reducing BZRA use will not lead to worse outcomes in terms of daytime sleepiness, insomnia severity, symptoms of anxiety, or reduced quality of life.	falling asleep under different conditions during the day.[44] **GAD-7:** A 7-item scale that measures the severity of anxiety symptoms common among various anxiety disorders.[45] **VES-13:** A 13-item self-administered tool that identifies older individuals at risk for
4. After stopping BZRAs, people will have less daytime sleepiness and anxiety and Symptoms of insomnia, anxiety, and quality of life will not be affected negatively.	health deterioration, considering age, self-rated health, limitations in physical function, and functional disabilities.[46] **SF-12v2:** A 12-item self-administered quality of life scale.[47]
5. After stopping BZRAs and using CBTi, people will have less daytime sleepiness, improvements in insomnia quality of life.	**BMQ:** A self-administered tool that assesses patient beliefs and worries about taking medications for their health condition(s). It is composed of a 10-item specific concerns section and an 8-item general concerns section.[48]
6. Based on the constructs of the theoretical framework of acceptability,[49] physicians and patients will consider the intervention as acceptable.	**Prescriber survey:** Prescriber acceptability of the direct-to-patient health promotion print material and its effect on their intended behaviour toward managing insomnia. **Sleepwell questionnaire:** Subjective evaluation of the Sleepwell intervention's components and their effectiveness for behaviour change related to BZRA use and insomnia management (for Sleepwell group only).
7. Multiple components of behaviour change will be identified, rather than a single component, in terms of BZRA use reduction and CBTi use.	**Non-pharmacological insomnia management:** Use of other non-pharmacological insomnia management strategies measured using participants reports. **Website visits:** Sleepwell website visits measured using Google Analytics.

BMQ: beliefs about medicines questionnaire. BZRA: benzodiazepine receptor agonist. CBTi: cognitive behavioural therapy for insomnia. ED: emergency department. ESS: Epworth sleepiness scale. GAD-7: generalized anxiety disorder scale. ISI: insomnia severity index. SF-12v2: quality of life short-form version 2. VES-13: vulnerable elders survey, 13-items.

description modeled after the components included in the Template for Intervention Description and Replication (TIDieR),[51] and the results will be reported according to the Consolidated Standards of Reporting Trials (CONSORT) Statement for randomized control trials.[52]

The trial (see Fig. 1 for the CONSORT flow diagram) is a three-arm, open-label, parallel, randomized controlled trial. The trial is designed as superiority for Sleepwell compared to TAU and noninferiority for Sleepwell compared to the EMPOWER information package for the composite outcome of BZRA dose reductions and discontinuations within 6 months.

2.2. Study setting

The Sleepwell and EMPOWER study information packages will be mailed directly to community-dwelling older adults' residences in NB,
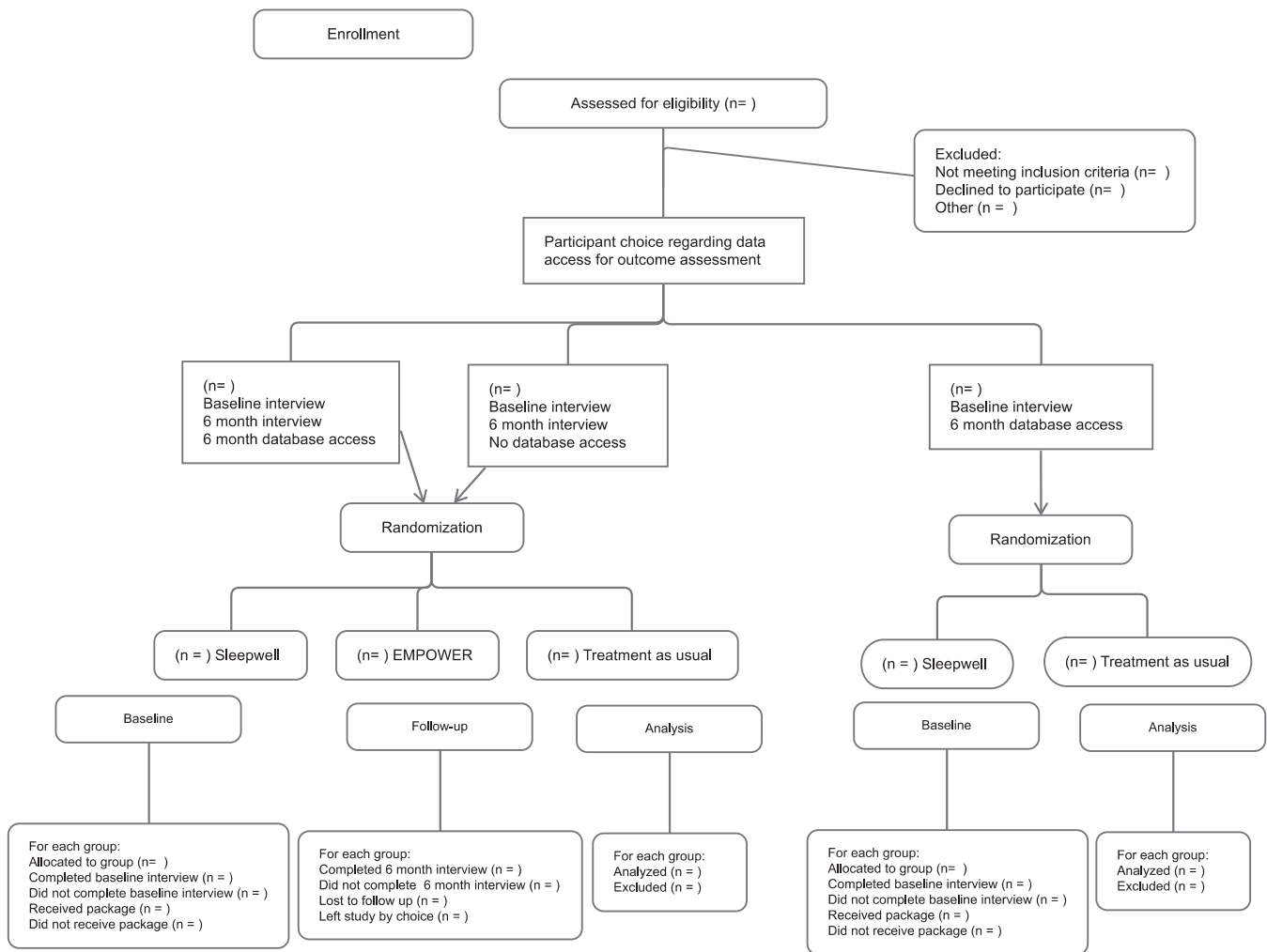
Fig. 1. CONSORT flow diagram for the YAWNS NB study.

Canada. Participants will be interviewed by telephone and personal health information contained in administrative databases are also housed in NB.

Table 2
Inclusion and exclusion criteria of the your answers when needing sleep in New Brunswick.

Inclusion criteria	Exclusion criteria
1. Community dwelling resident of New Brunswick, Canada, with no anticipated change of address for the next 6 months 2. Aged 65 years or older 3. Current (minimum use: 3 bedtime doses per week) and long-term (≥ 3 months) user of BZRAs 4. Indication for BZRA is or was insomnia (with or without mild to moderate anxiety)	1. Residing in a Long-Term Care facility 2. Using a non-BZRA prescription sedative-hypnotic for treating insomnia or related sleep problems (e.g., trazodone, quetiapine, low-dose tricyclic antidepressant) 3. Evidence of moderate-to-severe cognitive impairment assessed by telephone using the mini MoCA-T (with a score <10)[53] 4. The following self-disclosed diagnoses: anxiety disorder with severe symptoms, dementia, seizure disorder, spinal injury spasticity, psychotic disorder (e.g., schizophrenia), bipolar disorder, OCD 5. Receiving cancer chemotherapy or palliative care

BZRA: benzodiazepine receptor agonist. CBTi: cognitive behavioural therapy for insomnia. ED: emergency department. MoCA-T: mini-Montreal cognitive assessment. OCD: obsessive compulsive disorder.

2.3. Participants

The inclusion and exclusion criteria (Table 2) are intended to identify and enroll individuals where the risk of adverse effects of BZRAs with continued use outweighs the benefits, and thus, who may benefit from better understanding the risks with ongoing use, safer and effective alternatives, and ways to safely reduce and stop long-term use of BZRAs.

2.4. Interventions

The Sleepwell and EMPOWER information package groups will each receive the materials via Canada Post mail once during the study following randomization and after the baseline interview has been completed. The information packages are educational with various behaviour change techniques (BCTs)[54–58] embedded in the printed information provided to participants. Both information packages provide information in pictures and text about the harms of sleeping pills, approaches to reduce and stop BZRAs, and information on sleep management practices other than sleeping pills.

EMPOWER group: Mailed package contents will include two brochures: 1. You may be at risk (sedative-hypnotic medications); and, 2. How to get a good night's sleep without medication (available from https://www. deprescribingnetwork.ca/patient-handouts). The EMPOWER information brochure ("You May Be at Risk") was developed using social constructivist learning, self-efficacy, and social comparison theories to motivate the

recipient to reduce and stop using BZRAs.[39,40] Participants will not be provided with instructions on how to use the mailed information and it will be the individual participant's choice if they choose to use the information.

Sleepwell group: Mailed packages will include a cover letter and two Sleepwell booklets: 1. How to stop sleeping pills; and, 2. How to get your sleep back. Similar to EMPOWER information packages, Sleepwell was developed by embedding a combination of behaviour change techniques informed by the Theoretical Domains Framework and Behaviour Change Wheel into the content of the booklets.[55,57,58] Important differences from the EMPOWER information package is the direct identification and recommendation of specific CBTi techniques and resources as the preferred approach to managing insomnia while raising awareness of sedative-hypnotic harms and guiding treatment discontinuation collaboratively with health professionals. Also, Sleepwell uses a different, more flexible BZRA deprescribing guide recommendations compared to EMPOWER.

Treatment as Usual (TAU) group: No intervention will be provided to participants. Following the 6-month period, participants will be sent a copy of the Sleepwell information package.

3. Outcomes

The primary outcomes of the study aligns with that of the outcome of the EMPOWER study: (i) BZRA discontinuation at 6-months, and (ii) ≥25% BZRA dose reduction at 6-months.[39]

Patients will be considered to have discontinued their BZRA based on self-report if no BZRA use occurred in the past two weeks and without plans to continue.

Secondary outcomes include: i) patient reported use of CBTi techniques for treating insomnia; and ii) new starts of prescribed alternate sedative-hypnotics (e.g., new BZRA, trazodone, quetiapine) at 6 months. Table 3 provides details of the outcome measures and assessment schedule.

3.1. Participant timeline

Participants have options in terms of what data they would like to contribute to the study (Fig. 1). Participants will consent to participating in one of three options: baseline and 6-month telephone interview assessments and personal health data from databases; baseline and 6-month telephone interview assessments; or, baseline interview and personal health data from databases.

3.2. Sample size

Sample size requirements will depend on participant preferences for the participation options. Sample size was estimated based on two reports of discontinuation rates using the EMPOWER study. Assuming that the TAU rate of discontinuation at 6 months is 5% and that the intervention increases the discontinuation rate to 20%, 25%, or 30% (effect sizes of 15%, 20%, and 25%), based on the EMPOWER study findings, the respective estimated required sample sizes per group are 101, 65, or 47 (power: 90%, alpha: 0.05).[39] Additionally, based on the findings of Mendes and colleagues, discontinuation rates measured using dispensing records of 15% vs. 5% are estimated.[41] The sample size per group needed is 188 (power: 90%, alpha: 0.05). Based on the findings of these two studies, the adjusted target sample size for the YAWNS NB study is 705 (235 per group) with an estimated loss to follow-up rate of 15% to 25% (176 to 200 completers per group). This will allow for a robust analysis of the primary and secondary outcomes of the study.

3.3. Recruitment

Multiple approaches will be used to recruit participants to ensure sample size requirements are met. Partnerships with older adult organizations in New Brunswick (e.g., NB Senior Citizens Federation) will be established. It will be requested that they share information about the project with their

Table 3
Outcome measures and assessment schedule of the YAWNS NB study.

	Baseline	6 months
Insomnia, anxiety, quality of life, and safety		
Sleep parameters, ISI[43], ESS[44]	x	x
GAD-7[45]	x	x
VES-13[46]	x	x
SF-12v2[47]	x	x
Falls	x	x
Driving issues	x	x
Healthcare resource use		
Emergency department visits (all, injuries, falls)	x	x
Hospital admissions (all, injuries, falls)	x	x
Sedative medication use		
BZRA discontinuation		x
BZRA dose reduction ≥25%		x
Start quetiapine, trazodone, other BZRA		x
Start other sedatives		x
Patient engagement to support BZRA reduction/discontinuation		
Prescriber		x
Pharmacist		x
CBTi access and use		
Sleepwell access		x
CBTi use (sleep diary, % of program completed, components used)		x
Assessment of interventions on attitudes and behaviour change		
BMQ[48]	x	x
BZRA use (Sleepwell group only)		x
Sleep management (Sleepwell group only)		x
Prescribers		
Survey assessing prescriber acceptance of Sleepwell intervention (end of study survey)		x

BMQ: Beliefs about Medicines Questionnaire. BZRA: benzodiazepine receptor agonist. CBTi: cognitive behavioural therapy for insomnia. ED: emergency department. ESS: Epworth Sleepiness Scale. GAD-7: Generalized Anxiety Disorder Scale, 7-items. ISI: Insomnia Severity Index. SF-12v2: 12-item Short-Form Health Survey, version 2. VES-13: Vulnerable Elders Survey, 13-items.

members via their routine methods of communications (e.g., mailouts, email, newsletters, meetings, conferences).

The NB Pharmacists Association will share information with their community pharmacy members. This will include sending packages to pharmacies that will include notices that they can post and postcard notices that they can pass on directly to potentially eligible patients informing them of the study.

A private research company will use their call centre technology to contact potential participants by random digit dialing, informing call responders of the study and the opportunity to participate. Those who express interest and meet the basic study participant criteria used in the screening script will be referred to the research team for the full screening and informed consent process.

Television, newspaper, and online advertisements including social media platforms (e.g., Facebook) will be utilized to support awareness of the study for recruitment purposes. Upon learning of the study, participants can directly contact researchers toll free by phone to learn more or can visit a study website, which will also support information sharing and recruitment.

3.4. Assignment of interventions

3.4.1. Allocation

3.4.1.1. Sequence generation. The random allocation sequence will be generated by Study Randomizer.[59] Independent sequences will be generated for each study option with equal weighting for each of the three study arms using a fixed permuted block size of 12. The sequences will be uploaded to the study management software's randomization module.

3.4.1.2. Allocation concealment mechanism. Research electronic data capture (REDCap) will be used as the study management software.[60,61] Participant responses during telephone interviews are being entered directly into the study's online forms. After screening and consent processes are complete and the participant is enrolled, the researcher will input the date and time and will select "randomize" to determine the participant's group allocation. The researcher becomes aware of the participant's group allocation only after the REDCap randomization module has been instructed to "randomize" the participant. The researcher will inform the participant of their group allocation during the baseline interview.

3.4.1.3. Implementation. The principal investigator will be responsible for using Study Randomizer to generate the allocation sequence and upload it to the REDCap randomization module. The research staff (research assistant and research coordinator) will be responsible for screening, consenting, enrolling, and using REDCap's randomization module to allocate participants to their study group.

3.4.1.4. Blinding (masking). This study is being conducted as an open label trial and therefore participants will not be blinded. Participants will be notified what group they are randomly assigned to during the completion of the baseline interview. Analysts will be blinded to the group assignment of participants.

3.5. Data collection methods

3.5.1. Data collection direct from participants

Research staff will conduct participant interviews by telephone using a standard questionnaire at baseline and during a 6-month follow-up. Table 4 details the information to be collected directly from participants during interviews.

3.5.2. Data collection from administrative health data

Personal health information (PHI) records will be accessed at the New Brunswick-Institute for Research, Data, and Training (NB-IRDT) where data safeguards are in place for storage and use of administrative health records. Table 5 details the information that will be collected from the participants PHI records. They will be measured 3 months prior to enrollment (baseline), 3 months after enrollment (0–3 months), and 3–6 months after enrollment (3–6 months).

3.5.3. Data collected from google analytics

Google analytics will be used to collect information on the visits to the Sleepwell website. Data collected will include user count, visit count, visit duration, return visit rate, number of pages per session, bounce rate, and pages visited.

3.5.4. Retention

It is anticipated that participant retention could be problematic at the 6-month follow-up. If participants cannot be reached via telephone or electronic mail at the 6-month follow-up, a formal letter requesting their participation will be sent via Canada Post mail. For participants who are uninterested in completing the full interview at follow-up, they will be offered the opportunity to complete an abbreviated interview to meet the minimal participation requirements or partial participation requirements. Minimal participant requirements at the 6-month follow-up will include asking participants about their current BZRA use and assessing their sleep parameters, and confirmation that they have received their intervention package. Partial participation requirements will include asking participants to complete all interview questions without asking them to complete the surveys assessing exploratory outcome measures (ISI,[43] ESS,[44] GAD-7,[45] VES-13,[46] SF-12v2[47], BMQ[48]).

3.5.5. Data privacy and confidentiality

There is no remote access to the PHI from the NB-IRDT by the principal investigators or research staff. All de-identified PHI must be accessed in the

Table 4
Data collected directly from participants for the YAWNS NB study.

Information collected	Variables/explanation
Demographic information	Age, sex, location (urban vs. rural), marital status, living arrangement (alone, spouse, etc.), education level, household income, employment status, first spoken language.
Health-related information	Diagnoses of physical and mental health conditions, hospital admissions, emergency department visits, general use of substances (i.e., tobacco, nicotine, caffeine), relationships with healthcare providers.
Driving and fall history	Driving status, history of driving issues, use of mobility aids, history of falls.
Medication history	Number of daily medications, BZRA use history, use of other sedating medications (i.e., trazodone, quetiapine), use of other sedating substances (i.e., alcohol, cannabis), use of non-prescription sedatives (i.e., melatonin, antihistamines), experiences of medication withdrawal.
Non-pharmacological insomnia management	SBackspaceleep hygiene, stimulus control, bedtime restriction, relaxation, and cognitive therapy strategies.
Sleep parameters	SOL, WASO, TIB, TST, SE%
Survey responses	ISI,[43] ESS[44] GAD-7,[45] VES-13,[46] SF-12v2,[47] BMQ[48]
Health care provider collaboration	Reports of direct contact with prescribers and pharmacists regarding BZRA reduction
Assessment of Sleepwell package	Participants allocated to Sleepwell group will be asked to complete an additional questionnaire for a brief assessment of the contents of the Sleepwell intervention package.
Prescriber Contact Information	Participants will be given the option to provide the name and professional contact information of their BZRA prescriber.
Prescriber Survey	Prescribers identified by study participants will be contacted by letter and invited to complete an online survey. Each prescriber will be provided with a copy of the Sleepwell information package to review before completing the survey. The survey will assess prescribers' experiences with BZRA deprescribing in older adults, attitude toward BZRAs, and their acceptability of Sleepwell content and a direct-to-patient health promotion campaign. The prescriber survey will not identify the patients name or information (i.e., the study participants), but rather will state that one or more of their patients took part in the study. The prescriber survey is based on the Theoretical Framework of Acceptability (TFA)[49] as well as the APEASE criteria for designing and evaluating intervention.[62]

APEASE: Acceptability, Practicability, Effectiveness, Affordability, Side-effects, and Equity. BMQ: Beliefs about Medicines Questionnaire. BZRA: benzodiazepine receptor agonist. ED: emergency department. ESS: Epworth Sleepiness Scale. GAD-7: generalized anxiety disorder scale, 7-item. ISI: Insomnia Severity Index. SE%: sleep efficiency. SF-12v2: 12-item Short-Form Health Survey, version 2. SOL: sleep onset latency. TIB: time in bed. TST: total sleep time. VES-13: Vulnerable Elders Survey, 13-items. WASO: wake after sleep onset.

Table 5
Data collection from administrative health data of the YAWNS NB study.

Information collected	Explanation
BZRA dispensing data	To measure a change in BZRA use the following information will be collected from Pharmacare dispensing records: BZRA name, strength, amount, date.
Use of other sedatives	To identify new prescriptions for other target sedatives (i.e., quetiapine, trazodone, and sedating antidepressants (amitriptyline, doxepin, mirtazapine) and drug combinations of concerns (BZRAs and opioids), information will be collected from Pharmacare dispensing records including the drug name, strength, amount, date.
ED visits	To measure ED visits for fall-related injuries and other causes.
Hospital admissions	To measure hospitalizations due to a fall-related injury and all other causes.

BZRA: benzodiazepine receptor agonist. ED: emergency department.

NB-IRDT secure facility. A unique project folder will be created for the project and only the specific variables required for the proposed analysis are included in the project folder. They are provided in the minimum size necessary to address the research question at hand. All research staff members at NB-IRDT undergo security clearance (e.g., privacy training, criminal record check, sign a confidentiality agreement) and adhere to rigorous privacy protocols (i.e., secured destruction of data at the end of 10 years). All data results are be vetted prior to release and results are only released in aggregate form.

3.6. Statistical methods

Data analysis of interviewed participants include baseline and 6-month follow-up data. Data from participants that only provided baseline data will be compared to participants who completed the study follow-up to understand differences in study samples, and potential impacts on study findings. Participants that provide minimum required data for their 6-month assessment (i.e., BZRA use at 6-months, sleep diary) will be included. Baseline characteristics will be summarized using descriptive statistics (means, proportions) and will be inspected for any unexpected differences among treatment groups. If variables are identified that are different between treatment groups, those variables will be included as adjustments in the main analyses. Descriptive statistics will also be stratified by primary and secondary outcomes.

Statistical comparison of primary and secondary outcomes (BZRA discontinuation, dose reduction ($\geq 25\%$), and sedative switching) will be completed using test of proportions analysis. Superiority analyses will be applied to pairwise comparisons with the TAU group. Noninferiority analyses will be used when directly comparing the active treatment groups, Sleepwell (experimental group) and EMPOWER (control group), with a non-inferiority limit of 5%. If adjustments for imbalance between groups is required based on findings of our descriptive statistics, these analyses will be performed using multivariable logistic regression analyses instead, using dummy variables to represent treatment groups, with TAU as the reference group. Similar analyses will be used to conduct between-group comparison for the other outcomes. For outcomes involving continuous variables, *t*-test or ANOVA analyses will be used, or multivariable linear regression if needed.

Regression analyses will be used to examine impacts in specific subgroups of interest using interaction terms with main effects. These analyses will be completed to identify variables that predict differences in outcomes comparing Sleepwell with TAU as well as Sleepwell with EMPOWER. Subgroups of interest include but are not limited to: age (65–79, 80 years and older), sex, BZRA dose equivalency at baseline (diazepam equivalent 5 years), baseline intention of terminating BZRA use within 6 months (strong, moderate, no intention), and experiences of withdrawal symptoms with past BZRA dose reduction or stopping efforts.

Multivariable regression analyses will be used to address exploratory hypotheses to identify factors that are impacted by BZRA discontinuation, BZRA dose reduction or discontinuation, and use of CBTi techniques for insomnia management, irrespective of treatment group. Factors of interest include insomnia severity (e.g., ISI, sleep efficiency), daytime sleepiness (ESS), anxiety (GAD-7), quality of life (SF-12v2), and beliefs about the necessity and concerns of taking sleeping pills (BMQ-specific), and falls.

Descriptive statistics and an exploratory factor analysis of responses to the prescribers' survey of the acceptability of the Sleepwell intervention will be conducted.

3.7. Harms

The risks related to what participants are being asked to do in this study are expected to be very low. It is not expected that participants will experience any problems from participating in the two telephone interviews planned for this study. The information packages may prompt participants to examine their sleep management and BZRA use. Recipients of these information packages are directed to speak with their health care provider when considering making changes to the use of their BZRA. Based on insomnia management and BZRA use clinical practice guidelines, the Sleepwell and EMPOWER information packages inform participants of the risks of using BZRAs long-term. The packages also outline the process for how to gradually reduce the dose of the BZRA under the care of their health care provider.

Participants will be informed that the benefits of receiving one of the study's information packages by mail are not known. It is possible that they may learn about how to improve their sleep due to receiving the information. They may also learn new information about BZRAs and sleeping medications that they did not otherwise know. They will be informed that participating in the study might not benefit them, but the research may lead to information that ultimately benefit others. No compensation is being offered to participants for taking part in the study. A draw is being offered as an incentive to prescribers to complete the prescriber survey.

4. Research ethics approval

The authors assert that all procedures contributing to this work will comply with the ethical standards of the relevant national and institutional committees on human experimentation. All procedures involving human participants were approved by the Health Sciences Research Ethics Board (REB) at Dalhousie University (REB file number 2020–5184). The intervention is considered low risk. A safety monitoring board or other similar safeguard for this study is not required.

4.1. Participant consent

Consent will be obtained by telephone by research staff who follow a specific script that introduces the participation options, describes the consent process, reviews the consent details, and provides multiple pauses to ensure participants can ask questions.

4.2. Confidentiality

To mitigate the risk of personal health data being identifiable, participants will be given a study number. The study number will be used in the research dataset in which responses from participants are recorded and stored. Study data were collected and managed using REDCap electronic data capture tools hosted at Dalhousie University in Halifax, Nova Scotia, Canada.[60,61] REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies. Participant names and contact information will be kept separately in a different REDCap project folder that is not linked to the study's REDCap research database. As such, there will be two independent, unlinked REDCap projects for this study. Participant research data will be recorded in the former project database and their contact information will be recorded in the latter project database. The only information common to both databases will be the participant's study number.

Once the study is complete, a de-identified version of the study data will be kept on a password-protected and encrypted computer file for 10 years. This computer file will not include any personal identifiers of study participants. A separate computer file will include participant name and contact information. This file will be kept for 3 years. Upon their expiration (at 3 years and 10 years), these research computer files will be destroyed permanently and irreversibly deleting in accordance with the most up-to-date methods.

4.3. Ancillary and post-trial care

Participants will be encouraged to call the study's toll-free telephone number if they have any questions or concerns regarding the intervention during their participation in the study. Participants receiving the intervention at the end of the trial (TAU) will be encouraged to reach out to the researchers by phone or email if they have any questions or concerns regarding the materials after they have completed the trial. If a participant

reports an adverse reaction to the intervention (e.g., withdrawal side effects from reducing their BZRA dosage) they will be encouraged to discuss this further with their health care providers (i.e., family physician, nurse-practitioner, pharmacist). The findings of this research will be made public via peer-reviewed journal publications, presentations at conferences, media interviews, and other knowledge translation mechanisms.

5. Generalizability

BZRAs pose a serious threat to the health and wellbeing of older adults. Statements from various national and international groups recommend against the use of BZRAs for older adults with insomnia and recommend non-pharmacological alternatives for the treatment of insomnia. Despite clear recommendations against their use, the current standard of practice for managing insomnia in older adults often includes the prescription of sedative-hypnotics, primarily BZRAs and increasingly, other medications that have sedating properties (e.g., trazodone, quetiapine).

Implementing an intervention mailed to older adults with the goal of reducing BZRAs has the potential to improve older adults' independence, quality of life, and promote a healthier lifestyle. In this area, there is particular interest in avoiding acute, potentially life-threatening injuries because of BZRA use, such as injurious falls. Panneman et al. estimated that 30% and 40% of falls causing injuries, mostly hip fractures, in men and women 80 years of age and older, respectively, are causally attributable to the use of BZRAs.[20] For older adults, their loved ones, communities, and taxpayers, these injuries, which are preventable, lead to costly hospitalizations, loss of independence, loss of the older adults' ability to contribute to their community, and unfortunately, can also lead to mortality.

6. Limitations

The study will measure the effect of the interventions to reduce or stop BZRAs and if older adults change their insomnia management strategies using non-pharmacological (e.g., CBTi) or with other medications. While the time frame and scope of this study are too small to detect differences between groups for all identified outcomes, the changes in participant insomnia management behaviours will be examined to see if there are corresponding changes in insomnia severity, daytime sleepiness, falls, injuries, and the related visits to the emergency department or inpatient units. A larger scale initiative is needed for a more precise estimate of the impact of the interventions on health resource utilization and changes in quality of life.

7. Discussion

Mailing information that recommends evidence-based, non-pharmacological approaches to treat insomnia to long-term BZRA users could prove to be a cost-effective, efficient, and equitable intervention to reduce the overuse of BZRAs and reduce patient harm. Scalability of interventions such as the Sleepwell and EMPOWER information packages are feasible nationwide in Canada, and in other countries, and have relevance to community-based practitioners including pharmacy teams, physicians, nurse practitioners, and other health care professionals (e.g., physiotherapists, occupational therapists).

A campaign to disseminate the results of this trial across NB, to healthcare providers and, equally importantly, to older adults is expected to change perceptions around insomnia management, the use of BZRAs, and the availability of a preferred alternative intervention CBTi. It is expected that this study in and of itself will substantially raise awareness of CBTi as a preferred treatment for insomnia and potentially contribute to changing patient expectations of their healthcare providers in how insomnia is treated.

8. Conclusion

This RCT protocol details innovative research regarding direct-to-patient mailing of information packages aimed at decreasing prevalent BZRA use in New Brunswick, Canada. The mailings of the intervention can help to target patients directly and alter expectations of how insomnia is treated in older adults. By encouraging a reduction in the dominant pharmaceutical approach, which poses serious risks, and promoting a more effective and safer non-medication approach (i.e., CBTi) directly to patients, the potential for improvement of numerous patient-centred and health system relevant outcomes is substantial.

Author contributions

All authors meet the criteria for authorship based on each the following ICMJE criteria:

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND.

Drafting the work or revising it critically for important intellectual content; AND.

Final approval of the version to be published; AND.

Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Data availability

Data availability is not applicable to this article as no new data were created or analysed in this protocol. The data from the trial will not be publicly available due to the presence of information that could compromise the privacy of research participants.

Declaration of Competing Interest

None.

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