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There's an App for That: Mobile Applications to Improve Sleep

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Table of Contents

Abstract

Purpose: About 65% of Americans regularly get the Center for Disease Control (CDC) (2017) recommended seven hours of sleep per night. Inadequate sleep impacts physical, mental, and emotional health and the mission and safety of military service members. Cognitive-behavioral therapy (CBT-I) is the gold standard of insomnia treatment. CBT-I based sleep applications (apps) use accessible technology to improve sleep. The purpose of this project was to determine if an educational intervention utilizing CBT-I based sleep apps increased app usage and improved sleep quality over a five-week timeframe among military service members.

Methods: CBT-I groups were held weekly over a five-week period at three military behavioral health clinics at a military base serving over 25,000 beneficiaries. In the first group session, the team provided ten minutes of education on CBT-I-based sleep app usage and benefits. During the first and last group sessions, group facilitators administered a survey to attendees inquiring about their familiarity, use of CBT-I based sleep apps and subjective perception of their sleep. Facilitators administered the Insomnia Severity Index (ISI), a clinically proven instrument measuring sleep quality, during the first and last group sessions.

Results: Of the 31 service members surveyed, 27 completed all group sessions. After the educational intervention, 35% participants reported use of the CBT-I base sleep app. While statistically insignificant differences in ISI score between groups were found, the participants who used a CBT-I sleep app reported more improvements than non-users in multiple subjective sleep quality metrics.

Implications: A brief educational intervention of CBT-I based sleep apps given during CBT-I groups may improve sleep quality for service members. The team provided clinic staff with data collected on app usage before and after patient education and reported changes in nighttime and daytime symptoms associated with insomnia. Brief CBT-I app educational intervention provided to clinic staff has a potential to promote the sustainment of this practice in future CBT-I groups.

Keywords: sleep, cognitive behavioral therapy for insomnia, service member, mobile applications

Introduction

The Centers for Disease Control (CDC) (2017) recommends that adults sleep for at-least 7 hours per night, yet only about 65% of Americans regularly get the required amount. Even a greater number of Americans experience poor quality sleep, with 72% feeling fatigued most of the week (Breus, 2020). Lack of sleep negatively impacts physical health, emotional well-being, productivity, and overall quality of life. In the military, the negative impacts of poor sleep can be even more profound. Members of the military face life-threatening situations where mental haze and delayed reaction times could compromise the mission and safety of troops. While the stress of deployments may lead to poor sleep initially, symptoms often persist long after service members return home (Pietrzak et al., 2010). Poor sleep can contribute to numerous mental and physical health conditions, placing a strain on the military health system. Cost, accessibility, and safety are critical factors when considering treatment for sleep. Cognitive Behavioral Therapy for Insomnia, or CBT-I, is the gold standard in insomnia treatment according to the American Academy of Sleep Medicine (2009). Capitalizing on widely used technology may increase the accessibility of this type of treatment. Research studies by Pulantara et al. (2018), Horsch et al. (2017), and Koffel et al. (2018) show that the utilization of a CBT-I based smartphone sleep application (app) led to improved sleep quality in study participants. In addition to current treatment methods, educating service members about the use and benefits of CBT-I sleep apps can further improve their sleep quality.

Significance of the Problem

In addition to sleep quantity, poor sleep quality can have detrimental effects. Approximately 25% of adults report dissatisfaction with their sleep, including difficulty falling asleep, frequent or early awakenings, and nightmares (Ohayon, M., 2009). The daytime effects of poor sleep, including decreased energy, poor concentration, and irritability, are the most

common causes for people to seek treatment (Morin et al., 2006). Sleep disturbances are linked to a plethora of adverse physical and mental conditions. Chronic sleep deficit is associated with depression, anxiety, hypertension, obesity, diabetes, stroke, and coronary artery disease (CDC, 2018). These diseases put a strain on America's healthcare system, costing billions of dollars in medical treatment and loss of productivity. With 72% of Americans feeling fatigued for most of the week (Breus, 2020), medical providers will encounter patients with illnesses impacted by sleep problems. It is critical the healthcare field is prepared to effectively treat this common yet debilitating problem using the most appropriate treatment modalities for affected individuals.

Pharmacological interventions may have side effects, drug interactions, and inconsistent patient compliance. Common prescription sleep medications include sedative-hypnotics, like zolpidem (Ambien) and eszopiclone (Lunesta), and benzodiazepines, like temazepam (Restoril) and Triazolam (Halcion). These medications work by depressing neural firing in the respiratory center (Kripke, 2018). Common side effects include dizziness and amnesia, and in case of overdose they could cause respiratory arrest (Kripke, 2018). Non-prescription options such as antihistamines are known for longer half-lives and potentially serious adverse effects such as cognitive impairment, confusion, and lightheadedness (Bourcier et al., 2018). Even over-the-counter supplements like melatonin and valerian are poorly regulated. They may contain unwanted ingredients and have highly variable dosing (Mayo Clinic, 2019). While medications may be appropriate in some situations, the American Academy of Sleep Medicine (AASM, 2009) recommends non-pharmacological interventions as first line treatment. Improving service members' sleep without pharmacology can help maintain optimal performance of the armed forces while minimizing unwanted effects.

The AASM (2009) recommends cognitive behavioral therapy for insomnia (CBT-I) as the non-pharmacological treatment modality most effective in addressing sleep-related issues.

CBTI is a technique for treating insomnia without or alongside medication. Clinicians use CBT-I to explore the connection between thoughts, actions in daily life, and sleep patterns. CBT-I is equally effective if delivered in person or through telemedicine (Arnedt et al., 2017). The literature review demonstrated equal or improved CBT-I efficacy compared to pharmacological interventions. A randomized controlled trial (RCT) comparing CBT-I alone with CBT-I and zolpidem (Ambien) showed near equivalent outcomes with 60% and 61% over an acute six-month period (Morin, Vallières, & Guay, 2009). The six-month follow up showed a higher insomnia remission rate for CBT-I alone at 56%, compared to the CBT-I and medication at 43%. Considering its long established efficacy in improving sleep, providers in this modern age must explore using technology to increase access to CBT-I.

Technology has unlimited potential to facilitate providers' ability to offer care to more people. Telehealth, in particular assists in "the exchange of medical information from one site to another via electronic communications to improve a patient's clinical health status" (American Telemedicine Association [ATA], 2020). Since its initial recorded use at the Nebraska Psychiatric Institute in 1959, telephone and video technologies have expanded access to behavioral health (BH) care in various settings (Deslich, Stec, Tomblin, & Coustasse, 2013). Emergency departments, schools, prisons, rural areas, and other locations with BH provider shortages continue utilizing telepsychiatry to serve difficult to reach populations. Telehealth assists in overcoming the challenges of transportation to appointments, time limitations, distance considerations, and high cost of treatment (Deslich et al., 2013). During the ongoing Covid-19 pandemic, telehealth has been instrumental in maintaining access to care in various clinical settings.

Adapting virtual healthcare delivery allowed the facilitators to reach more participants while minimizing risk of Covid-19 exposure to the patients or healthcare team members.

Smartphones in particular provide users portable means of communications, education, and entertainment. An estimated 91% of US citizens between the ages of 18 and 49 have smartphones (Hitlin, 2018). While these digital devices are sometimes the cause of sleep deficit, the same technologies enable healthcare providers to improve outcomes related to sleeplessness.

The convenience of CBT-I apps minimizes disruption to servicemembers' work schedules and even allows for use in deployed environments. Smartphones alone may not be enough to deliver interventions that improve sleep, as providers must personalize the modality that best suits individual patients. A CBT-I based smartphone app downloaded to patient mobile phones or tablets empowers users in improving sleep without risky medications, costly treatments, or time-consuming interventions. Capitalizing on mobile technology has great potential to enable the medical community to increase access to care and improve patient outcomes innovatively.

The project implementation occurred between September 2020 and March 2021 at a military base in Washington state. During the first CBT-I group sessions, facilitators provided a brief 10-minute education about the benefits and use of CBT-I based sleep apps. In order to provide specific examples when discussing app use, facilitators introduced the CBT-I coach app. CBT-I Coach is a free smartphone app developed by the United States Department of Veterans Affairs (VA) for use by patients engaged in CBT-I with a treating provider or who would like to improve their sleep (Department of Veterans Affairs, 2021). The benefits of CBT-I apps, in general, were discussed without promoting any specific app, and data collected from participants was not specific to any particular app. Although the CBT-I Coach app was only used for demonstration purposes, the project data showed it was the only app participants utilized during the five-week CBT-I sessions.

The evidence-based project (EBP) facilitators surveyed participants before and after the educational intervention about the benefits and use of CBT-I based sleep apps. The group designed survey questions to produce nominal level data about the effectiveness of sleep apps at improving sleep quality based on the participant's subjective opinion. See pre-and post-intervention survey examples in Appendix I. The Lee and Jung (2018) study conducted over four weeks guided the timeframe for this EBP. Standard CBT-I protocol and established medical treatment facility (MTF) clinical practice guidelines (CPGs) also influenced the intervention timeline.

Relevance to Military Nursing

Service members must be in peak physical and mental condition to accomplish the mission. Rigorous training prepares each unit for its mission, and every service member has an integral role to play. Sleep deficits can lead to diminished concentration, irritability, impaired problem solving, forgetfulness, poor judgment, and decreased productivity (Morin et al., 2006). When service members are not at their peak level of performance, they could endanger the mission and their teams' safety. Service members face numerous factors that can compromise their sleep. They work under extreme stress, maintain nontypical hours and night shifts, pull 24-hour duty, and are often away from their families. This dynamic intensifies sleep problems in the military to rampant proportions with detrimental impacts. Sleep problems are comorbid symptoms of depression, anxiety, PTSD, and other psychiatric conditions often seen in war veterans (Hoge et al., 2004). While the high stress and optempo of deployment environments have clear negative impacts on sleep, symptoms often persist months or years after returning to a garrison environment, even in service members who do not meet the criteria for a mental health diagnosis (Pietrzak et al., 2010). As service members reintegrate into post-deployment life, the

military health care system faces the strain of recognizing and treating sleep problems and the host of physical and mental conditions with which they are associated.

One study found that as high as 64% of veterans who have served in Iraq and Afghanistan endorsed insomnia symptoms (Amin et al., 2010). Another study of 750 service members found that the average amount of sleep per night was 5.7 hours (Roehrs, 2015). They also found that 24.7% of these service members meet diagnostic criteria for insomnia. Additionally, those with post-traumatic stress disorder (PTSD) were twice as likely to suffer from insomnia. Insomnia also had a strong correlation with depression and chronic pain (Roehrs, 2015). Many patients presenting to mental health clinics report dissatisfaction with sleep. Thus, providers in mental health clinics are in an ideal position to treat insomnia symptoms among members of the military. The military needs force-multiplying sleep interventions with minimal side effects to keep service members in peak mental and physical health. Augmenting sleep treatment in the military with a CBT-I based sleep app utilizes smartphones that most service members already have. CBT-I is inexpensive, has minimal side effects, takes little time, and is found very effective as a first line treatment for difficulties with sleep (AASM, 2009).

Clinical Question

PICOT: (P) In adult behavioral health patients, (I) does an educational intervention about CBT-I sleep apps lead to (C) increased app usage compared with pre-intervention, and (O) improve quality of sleep in app-users compared with non-app-users, (T) over a 5-week period?

Literature Review

The EBP team searched PubMed and PsychINFO databases to gather data and articles for a review of the current literature addressing the best practices utilized in using mobile app technology to address sleep problems. PubMed and PsychINFO searches combined the keywords “CBT” and “sleep app.” CBT associated key words were "Cognitive Behavioral Therapy"[Mesh]

OR “Cognition Therapy” OR “Cognition Therapies” OR “Cognitive Therapy” OR “Cognitive Behavior Therapy” [tiab] OR “Cognitive Therapies” OR “Cognitive Behavior Therapies” OR “Cognitive Behavioral Therapy” OR “Cognitive Behavioral Therapies”. Sleep app associated search included the keywords (("mobile applications"[mesh] or "mobile application" or "mobile apps" or "mobile app" or app OR apps or "portable software apps" or "portable software app" or "software app" or "software apps" or "software application" or "software applications"]) and ("sleep"[mesh] or sleep*)).

The search was limited to all articles published between 01 February 2015 and 31 January 2021. As of 05 February 2021, the search strategy resulted in 25 articles from PubMed and 27 from PsychINFO for a group of 52 results. A total of 11 duplicate articles were removed to yield 42 unique articles for review. Reasons including editorials and articles with studies that focused on juveniles, the elderly, and psychosis-related comorbidities excluded a total of 20 articles.

The EBP team utilized the Uniformed Services University of the Health Sciences (USUHS) online Learning Resource Center (LRC) to conduct a literature search. Utilizing Power Search, the LRC's all-in-one search engine, allowed the group to find articles, full-text e-books, e-journals, databases, digitized holdings, and print holdings on campus (Allard, 2014). The search was limited to include peer-reviewed journal articles written in English published between January 2014 and November 2019. As shown in Appendix G, the PRISMA flow diagram, the team first searched for “sleep app” and “CBT” and “military,” which yielded 770 results. Included in the first group of results were research articles referenced in systematic reviews of CBT-I mobile apps. The project limited the subject term to “adults,” which narrowed the number of articles to 46. From the 46 articles produced, the team reviewed and excluded 42 text articles to suit the purpose of our evidence-based project (EBP). The team selected four

primary research articles for this literature review, with two articles using the Insomnia Sleep Index (ISI) as an outcome measurement tool. Therefore, the EBP team used the ISI as a measurement tool during the project implementation.

Focus Areas

The primary focus of this project was to evaluate the efficacy of CBT-I apps as an evidence-based non-pharmacological intervention to lower the Insomnia Severity Index (ISI) scores and the prescription of medications for sleep after five weeks of sleep hygiene group attendance. Another aim was to determine whether a brief educational intervention about the use and benefits of a CBT-I app would increase usage in this population. A multidisciplinary approach involving psychiatrists, social workers, behavioral health technicians, and nurse practitioners supported the EBP by referring patients to the CBT-I groups. The sustainment plan included disseminating project findings to sleep group leaders with all installation-wide behavioral health providers and overseeing the implementation of this education at the CBT-I groups.

Organizing Framework

The Iowa Model of Evidence-Based Practice (IMEBP) to Promote Quality Care was the best-suited framework for implementing this project. It aligned well with this project as the IMEBP begins with a problem or knowledge-focused trigger that initiates a need for change and is a framework that links practice changes within the system (Iowa Model Collaborative, 2017). The Iowa model guides evidence-based literature into practice to improve outcomes. As seen in Figure 1, this collaborative model was applied because the EBP goals of "expansion of piloting, implementation, patient engagement, and sustaining change" were supported (IMC, 2017). Using an evidence-based team-oriented approach, the IMEBP ensured evidence-based interventions are priorities when implemented in organizations seeking to improve care outcomes. The military

healthcare system (MHS) supports interventions that improve mission readiness and deployability.

The IMEBP allowed intervention adjustments before implementation and increased success of the EBP follow through (IMC, 2017). A framework model that allows flexibility is especially important while working within the hierarchical structural limitations of the MHS. Starting with step 1, the project facilitators worked with the interdisciplinary behavioral health (BH) providers to select a problem focused trigger. The interdisciplinary team consisted of clinic psychiatrists, psychiatric nurse practitioners, licensed clinical social workers, psychologists, and psychiatric technicians, who worked together to identify sleep deficiency as a significant clinical problem triggering a need for change.

In step 2, the same interdisciplinary team agreed that improving sleep in servicemembers was a priority for the organization. CBT-I based smartphone apps were identified as a potential solution to this significant problem. In step 3, the existing EBP team worked to identify stakeholders within the MTF. These stakeholders included clinic leadership and staff providers as well as affected servicemembers and their leadership.

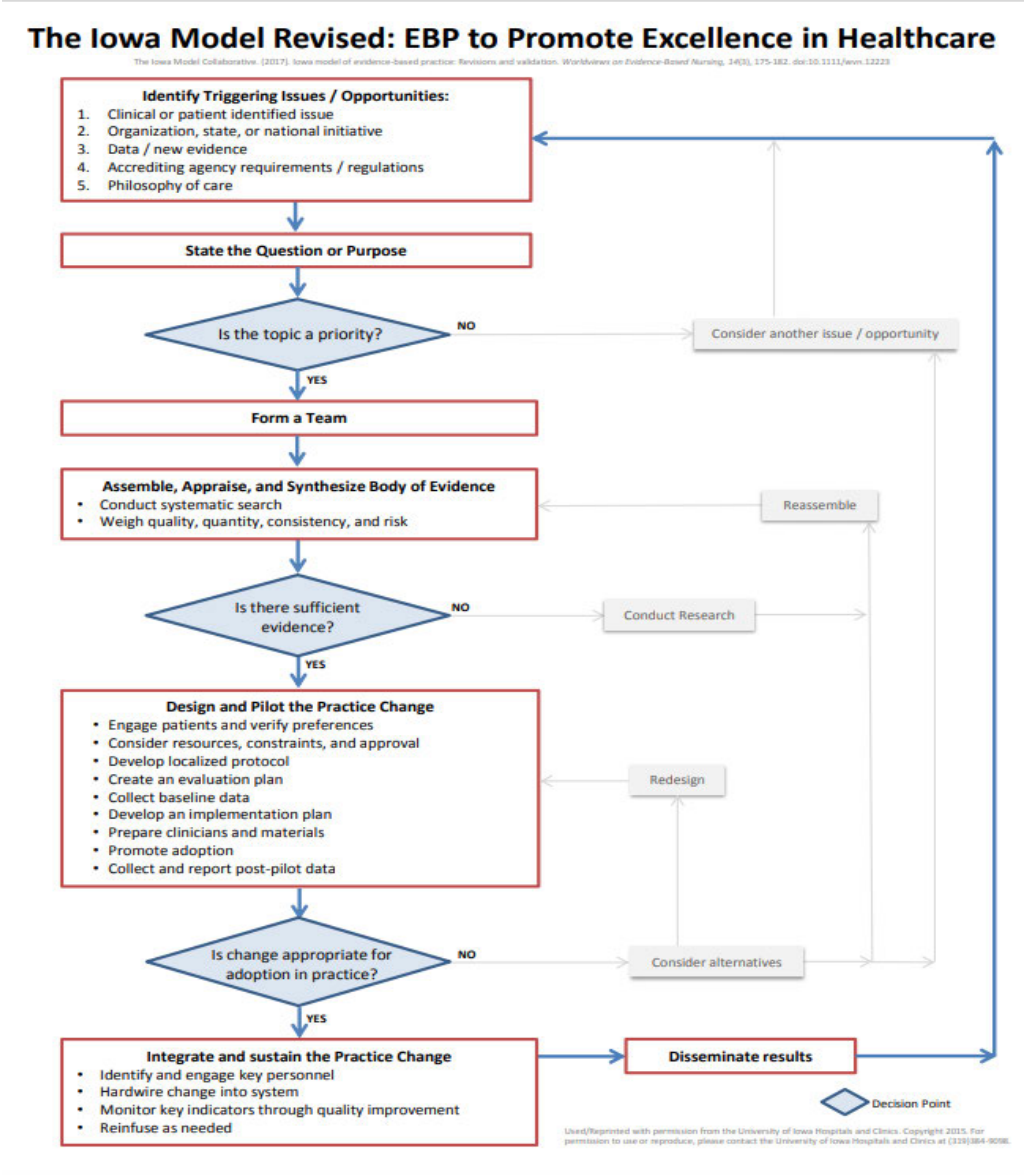
Steps 4, 5, and 6 involve literature review, evaluation, and synthesis. The EBP team first assembled relevant research and related literature. The literature was appraised, and determined to have sufficient evidence to support incorporating CBT-I apps as treatment for sleep difficulties. The findings and processes from research literature guided the project intervention.

In step 7, the change was piloted in practice. ISI scores were selected as outcome measures, pre- and post-intervention surveys were created to measure baseline data, and the five-week CBT-I protocol was adopted as the EBP guideline. The EBP was implemented on pilot units within three BH clinics. The process and outcomes were evaluated, and practice guidelines were modified due to some encountered barriers.

In step 8, the facilitators evaluated if the change was appropriate, and considered the need for adoption in practice. Based on the results of this study, findings were disseminated to BH clinics throughout the joint base. Step 9 remains ongoing, as the EBP team continues to evaluate quality of care and evaluate new research. The Iowa Model of Research-Based Practice to Promote Quality Care provided a practical framework to guide this project from beginning to end.

Figure 1

Iowa Model of Research Based Practice (The Iowa Model Collaborative, 2017)



Project Design

General Approach

This project was a pre- and post-education intervention to evaluate usage and benefits of CBT-I based apps. CBT-I classes were held at two outpatient behavioral health clinics at the military installation. Participants were surveyed regarding their use of CBT-I apps before educational intervention during the first group session and again at the final group session. Prior to prescribing prescription hypnotics, providers were encouraged to promote participation in the CBT-I groups as a non-pharmacological behavioral intervention to improve sleep. While CBT-I alone is proven effective for insomnia, promoting technology utilization through CBT-I based apps may further enhance sleep quality.

Setting and Population

CBT-I classes were held in outpatient behavioral health clinics across a military installation serving over 35,000 beneficiaries. This intervention focused on three outpatient behavioral health clinics where approximately over 20,000 service members were eligible to receive mental health care. Clinic therapists and prescribers referred patients to these CBT-I groups. Credentialed providers at each clinic facilitated between one and three closed CBT-I groups per month for up to 20 active-duty service members. Covid-19 pandemic restrictions were implemented before the beginning of project implementation, with six feet minimum physical distancing CDC (2020) guidelines reducing the group sizes to a maximum of eight.

The last three CBT-I sessions for this project were hybrid, with virtual and in-person sessions to reduce the risk of the airborne transmitted Covid-19 virus while maximizing attendance. A MHS approved video conference system was utilized, and attendees were individually invited to ensure privacy. The project facilitators screened individual participants before accepting requests to join secure virtual sessions. For both in-person only and hybrid formats, the EBP team adopted a five-week CBT-I protocol that included an orientation week and four weekly follow up sessions.

There were no control groups as all CBT-I group participants received the educational intervention about sleep apps.

Procedural Steps

The EBP facilitators solicited buy-in from clinic leadership and group facilitators explaining the intent to gather data on the efficacy of CBT-I sleep apps already promoted in the class. MTF BH providers were educated individually and in groups on the EBP project intent and request for patient referrals. With the support from the existing CBT-I group facilitators, facilitators obtained informed consent from patients who chose to participate. After conducting a pre-intervention survey, the facilitators provided the educational intervention during the first group session. This ten-minute intervention involved education on the benefits of CBT-I based apps and the usage of a free VA-developed app called CBT-I coach. During the final group session at week five, the team conducted a post-intervention survey using any CBT-I based app and subjective improvements in sleep. The team also reviewed ISI scores of participants collected by group facilitators during the first and last weeks of the group to assess for changes related to the education intervention.

Data Analysis Plan

The project facilitators used analyzed survey results to track recruitment, dropout, and completeness of interventions. Fisher's exact test, which assesses for non-random correlations between two variables, was to be used for analyzing the efficacy of CBT-I education with and without sleep apps (Weissman, 2021). Fisher's exact was the most appropriate statistical test due to the low sample size, and its use highlighted the results closest to being significant for several of the quality-of-life sleep improvements. The facilitators compared ISI scores, improvements in daytime tiredness, nightly awakenings, time spent asleep, and sleep quality as reported in the pre and post-intervention surveys.

The project facilitators calculated the efficacy of the brief educational intervention at increasing usage of CBT-I based apps. The second analytical step compared differences in survey

scores and ISI scores of participants who utilized the app compared with those who did not. The facilitators further broke this down by participant answers to the survey question about their app usage frequency. Appendix G describes the data collection and analysis plan.

Potential Barriers

The EBP was concerned that there may be resistance to implementation of the intervention, particularly due to fear over longer-term policy change related to CBT-I group protocol. The team presented evidence from the literature regarding the use of sleep-related technological interventions and expected clinical leaders to support a project that improved patient outcomes. To minimize resistance to intervention implementation, the project facilitators worked with faculty advisors and clinical site director in assessing the relevance of the topic for the population served. Overlooking a key person in the chain of command could be detrimental, and the facilitators were careful to involve identified stakeholders in the topic and intervention selection process. The MTF leadership supported the sleep-related topic and suggested PICOT over one year before intervention implementation. After obtaining the required institutional review board (IRB) approval, the project facilitators solicited buy-in from individual BH clinic leadership and group facilitators explaining the intent to gather data on the efficacy of CBT-I sleep apps already promoted in the class.

The project facilitators expected clinic providers to be cautious about referring participants to CBT-I sessions that also aimed to assess smartphone app utilization. Many clinic providers already incorporated meditation mobile apps into their practice and welcomed the EBP project facilitators who wanted to promote CBT-I sleep apps. The EBP leaders observed three cycles of the existing clinic CBT-I sessions before facilitating their classes under clinical supervision from credentialed providers. Ultimately, most clinicians supported the project through patient referrals to the CBT-I groups that promoted and assessed mobile sleep apps.

The COVID-19 pandemic created significant challenges in the implementation and data collection process. COVID-related changes in the daily lives of servicemembers may have impacted engagement in sleep treatment. Many service members were faced with sick family members, loss of family income, or unintended homeschooling that impacted their stress levels and free time. Altered access to healthcare and increased reliance on telemedicine may have prevented service members who prefer in-person appointments from seeking care (Wynn et al., 2020). The CDC (2021) estimated 10.3% of Americans may have delayed getting medical care during the first months of project implementation in September 2020. Local policy requiring quarantine periods after travel or suspected COVID-19 exposure also limited group attendance and may have contributed to the lower CBT-I group participation rate.

Per local policy, CBT-I group therapy was temporarily halted in early 2020. Groups were held virtually by mid-2020. Group therapy remained a low priority for many possible attendees during this uncertain time. Technical difficulties were common for both participants and facilitators, and the virtual format may have also impacted interest and engagement. In late 2021, hybrid groups allowed a small number of participants to choose in-person attendance, while others elected to attend virtually. This dual-format combined with physical distancing and mandatory face masks for in-person attendees limited the cohesiveness of each group. Only a single participant out of the total 31 tested positive for Covid-19 during the course of this project. This positive Covid-19 service member was infected between weekly sessions outside of the clinic, and no additional participant or clinic staff infections were linked to the CBT-I groups.

Provider referrals played a crucial role in recruiting enough project participants to help generate generalizable data. Beginning with the maximum group capacity of eight participants was ideal, as the project facilitators expected some attrition. Due to occupational obligations, many service members were not expected to return after their first week. The project facilitators accepted the challenge of a potentially high dropout rate, as the literature review showed completion rate

averages of 64.2% for veterans in individual and group psychotherapy (Doran et al., 2017). The facilitators accommodated work schedules that did not allow attending all five sessions to stem the dropout rate while still collecting quality data. During the first week, participants were educated about the critical role their follow-up survey completion played in helping improve care for other service members. Verbal encouragement sought to inspire some participants, but no objective methods were used to measure what motivated service members to attend all sessions until completion.

After receiving initial education during the first week, participants completed a pre-and post-implementation survey along with the ISI. The pre-and post-implementation surveys (included under Appendix I) assessed CBT-I app usage before and after the educational intervention, frequency of app use, and changes in total time spent asleep, awakenings, daytime tiredness, and overall sleep quality as a result of app utilization. The participants were also asked about the name of any non-CBT-I Coach apps they used.

Participants having their own smartphones was central to this project because participants needed to have the ability to download and use a phone app. All of the CBT-I group participants had smartphones, and the clinics had a free wireless network. The EBP promoted CBT-I Coach app functioned without wireless connectivity once downloaded on the smartphone. Although this project kept no official data on the number of participants interested in using the CBT-I Coach but lacking the capability, two individuals informed the facilitators phone data storage limits prevented them from downloading the app.

Though healthcare professionals are cognizant of the substantial number of Americans who are not getting enough quality sleep, service members may feel alone in facing this issue. Military culture has grown vastly more open to mental health treatment in recent years, but some stigma remains. The reviewed literature reported inconclusive data related to military, cultural attitudes in

initiating and retaining mental health care (Cerully, Acosta, & Sloan, 2018). Anecdotally, four CBT-I participants reported stigma delays in seeking professional help. The project facilitators created CBT-I flyers advertising a "sleep group" that made it easier for the participants to attend the interventions despite its locations in behavioral health clinics. Using their CBT-I group participating as a segue, the facilitators make three referrals to a psychiatric prescriber for service members without prior behavioral health care histories. While the stigma associated with military culture was expected to be the primary factor limiting attendance of the CBT-I groups, the Covid-19 pandemic starting in spring 2020 played a larger role in the structure and frequency of iterations.

Sustainment and Dissemination Plan

Reaching the highest number of participants possible was essential for successfully implementing this project and only made possible due to referrals from BH clinic providers. This was difficult due to COVID-19 restrictions placed on therapy groups. Groups were halted entirely in early 2020, and later opened in virtual format. This limited the pool of potential participants available for this study. The MTF had seven behavioral health clinics, all of which with providers that conducted sleep interventions using pharmacology and individual or group therapy. The project was focused on data collected from sleep groups at three BH clinics, and information from the findings was disseminated to the MTF leadership and clinician stakeholders. The project facilitators published the evidence-based data gathered from the literature and results of the intervention in a research week poster presentation available to all MTF staff.

The project facilitators published the evidence-based data gathered from the literature and results of the intervention in a research week poster presentation, a powerpoint presentation, and a paper. The project results dissemination plan also included a command brief for the MTF leadership, with recommendations and a sustainment plan. This increased project exposure and

overall sustainment of this teaching to service members suffering from sleep problems. Many clinicians outside of the behavioral health specialty were not aware of CBT-I groups available to service members at their respective BH clinics. This project improved provider knowledge about the benefits of sleep apps, ensured consistent delivery of the evidence-based solution and increased clinician awareness of non-pharmacological sleep groups that may benefit patients. The project facilitators also utilized this opportunity to present the findings to their peers and professors prior to graduation.

HIPAA Concerns/Ethical Considerations

To maintain the confidentiality of all participants, information gathered was available only to clinicians directly involved in patient care. Paper surveys were shredded as soon as the information was digitally compiled. The project facilitators stored collected data on clinic computers located in secure MTF buildings with double locked doors. Information was stored electronically with encryption and password protection on secure Department of Defense (DoD) network drives with only CAC (common access card) access. Collected health data was not reused for any additional purposes outside of this project. No personally identifiable data was used to mitigate risk of privacy violations.

Many Americans are concerned about protecting their personal information due to the recent increase in reports of large security breaches that lead to identity and data theft. In the last five years alone, healthcare data breaches affected 157.40 million individuals (Seh et al., 2020). Increased apprehension about information security as cybercriminals become more advanced could hinder study participation. Anticipating user hesitancy to download an app or input their personal information, the CBT-I group facilitators emphasized the built-in privacy measures. The specific app discussed in our group, CBT-I Coach, is developed by the VA and many of its functions can be used without inputting any information.

Project Results

A total of 31 service members participated in an initial CBT-I session and completed the preliminary surveys. Of those participants, 26 attended all five weeks of the CBT-I group. A total of 25 participants completed both the pre- and post- intervention surveys. The military branch affiliation included 21 Soldiers, nine Airmen, and one Marine. All study participants were enlisted service members and 71% were males. The average age of the participants was 29. Most fell between the ages of 21 and 35, while the oldest outlier was 53. MTF regulations related to the Covid-19 pandemic limited the number of participants in the CBT-I groups, which contributed to limiting the project sample size.

From the five dropouts, one participant stopped attending after the second week due to a Covid-19 infection. Three participants dropped out due to lack of interest, and the last service member was dropped due to his co-enrollment in a treatment modality incompatible with CBT-I recommendations. Virtually all the service members possessed smartphones, but a few study participants commented during groups about disliking apps in general, not wanting to download more apps, or not having sufficient data storage space on their phones.

All patients received educational intervention on CBT-I smartphone apps, and there were no control groups in this EBP. Individuals self-selected in excluding themselves when it came to participating in the app-based intervention. Other participants received psychiatric prescriber referrals for further mental health evaluation or a sleep apnea evaluation after CBT-I group completion. Underlying physical or mental health conditions may have impacted ISI and survey scores. Some participants also reported situational factors like getting a new puppy or fluctuating work hours throughout the study that may have impacted scores.

Analysis of Results

Fisher's exact tests were used to identify differences in demographics and sleep quality between app/coach users. Correlations were tested using a point-biserial correlation test. There was no significant difference in the distribution of sex between app/coach users and non-users (p-value = 0.429). While there was no statistically significant difference in the distribution of ranks between the app-user and non-user groups, a larger sample size likely would identify a difference. It seems likely that while age and rank are correlated, it is age and not rank that most strongly affects app usage (p-value = 0.0508). This demonstrates that older participants had a higher engagement in app use and showed greater improvements in ISI score and sleep quality. The initial ISI score did not differ between the app user group and the non-app user group (p-value = 0.4726).

Results confirmed that the brief educational intervention led to an increase in CBT-I app use among group participants. However, between the app-use and no app-use groups, there was no statistically significant difference in our primary metric of post-group ISI score (p-value = 0.08539). The lack of ISI score difference between groups may be due to the low sample size as Fisher's exact tests were close to being significant in several other quality metrics comparing app-users with non-app-users. App users reported a reduction in nightly awakenings, increased time spent asleep, and improved overall sleep quality. While these results were not statistically significant, they may have reached statistical significance with a larger sample size.

Regardless of app usage, participants who completed the study endorsed an average improvement in ISI score of 17%. The ISI score results may be attributed to CBT-I skills learned in the group, individuals applying newly acquired knowledge to improve sleep, or the therapeutic group dynamic. Participants who attended all 5 CBT-I group sessions had a higher incidence of app usage. Engagement with an app outside of the weekly group sessions seemed to impact

participant commitment to group completion positively. Based on the improvement in ISI score for participants who completed the group, lower group dropout rate may directly improve patient outcomes. This ancillary benefit magnifies the positive effects of app use on sleep quality.

This EBP project had several strengths. This intervention improved the MTF access to care by decreasing the wait time for service members seeking treatment for sleep problems. The hybrid CBT-I class made behavioral health care available to service members while reducing the risk of exposure to the Covid-19 virus during a pandemic. Standardized tools were utilized to measure objective improvements in a subjective behavioral health field. It cost nothing to implement, as the CBT-I coach app is free to use, and CBT-I classes already existed at one BH clinic. The EBP team efforts may have also contributed to a higher group rate, improving patient adherence with treatment and clinical outcomes.

The small number of participants allowed the facilitators to provide personal feedback and appropriate referrals for follow-up care. The EBP team members made individual reminder phone calls before each session, resulting in 26 of 31 participants completing all five weekly CBT-I sessions. According to the literature, the 83% completion rate in this project was higher than the average completion rate found in other group modalities. Although this sleep psychoeducation group differed in goals, a large-scale logistics regression of VA PTSD patients found only a 64.2% completion rate after reviewing a database of 142,620 veterans for early termination in individual and group therapy (Doran et al., 2017). The individualized attention to each group member allowed the facilitators to determine appropriate referrals at the end of the group sessions, including referrals to behavioral health prescribers for further evaluation or the specialty sleep providers to rule out obstructive sleep apnea (OSA).

Organizational Impact / Implications to Practice & Policy

While study results did not reach statistical significance, they did reveal notable improvements in sleep quality. Based on these findings, mental health providers should educate patients attending group therapy for sleep about the use and benefits of CBT-I based apps. These apps allow patients to explore principles of CBT-I outside of group therapy, reinforcing the ideas learned during the group. Their functions may include allowing users to log their sleep, setting reminders to help them adhere to CBT-I protocol, and trying different app-guided relaxation techniques. CBT-I apps may help to improve sleep quality without costing any money or requiring direct oversight from a trained provider.

Providers should also introduce CBT-I apps to individual patients hoping to improve their sleep. CBT-I apps can help familiarize patients with basic concepts before committing to in-person CBT-I sessions. For providers whose patients have completed CBT-I treatment in the past, app use promotion may help refresh previously learned sleep hygiene concepts. The convenience of apps allows patients to learn at their own pace and spend as much or as little time as they would like with an app. In this manner, CBT-I apps promote patient-centered healthcare. Educating patients about CBT-I based sleep apps may improve patient outcomes long after group or individual therapy is over.

Introduction to CBT-I apps might be more optimal while individuals actively work with BH providers to overcome sleep difficulties. The project facilitators carefully avoided promoting any single CBT-I app over others but utilized the VA-developed CBT-I Coach due to its thorough content design and ease of use. Once downloaded on a smartphone, the CBT-I Coach app required no data, and a few participants even reported using it without connectivity during field training exercises. If service members at remote military outposts without BH providers

experience sleeping difficulties, they may greatly benefit from having an easily accessible intervention tool on hand, even in austere environments.

Future Directions for Research and Practice

The relatively small sample size likely contributed to the lack of statistical significance in this study. A similar study with a larger sample size would limit the impact of outliers on the findings and possibly result in statistically significant improvements in outcome measures and more generalizable results. Additionally, more research is needed to determine the full impact of CBT-I based sleep apps when used in different manners. CBT-I apps may prove beneficial when used in conjunction with individual therapy, other sleep treatments, or on their own.

In this study, CBT-I app usage was directly correlated with a decreased dropout rate among group participants. Future studies may further analyze the impact of app use on participant engagement in group therapy. With the wide availability of behavioral health apps, therapeutic groups focusing on numerous topics outside of sleep may benefit from integrating app education into their program.

The oldest two participants in this study had high app engagement and notable improvements in ISI score and sleep quality based on the study surveys. These two participants were in their 40's and 50's, significantly older than the average participant age of 29. Due to the small sample size in this study, these participants may have been outliers, but future researcher could analyze the correlation between participant age and use of CBT-I sleep apps or other therapeutic apps.

Another noteworthy finding in the military demographic of this study included the lack of officer personnel as all participants were enlisted service members. Enlisted personnel make up the majority of the military. They are specially trained in job-specific duties and are directly responsible for accomplishing the mission. Officers tend to work in managerial and planning

roles. The EBP team discussed this unexpected finding with regular CBT-I group facilitators who confirmed that officers often attend CBT-I groups, however they tend to make up a smaller percentage of group members. The study team hypothesized that the differing work responsibilities and beliefs about mental health care may contribute to the demographic differences, but more research is needed. The reasons the self-selected participants in the study were entirely enlisted remains unclear.

The EBP team did not collect data about reasons why participants did or did not use a CBT-I app. Barriers to app use may include limited phone storage, privacy concerts, ease of use, or personal preference. Understanding these factors may contribute to more effective therapeutic app development. Future research could also analyze the specific components of CBT-I apps that participants found to be the most or least useful. Most CBT-I apps have numerous functions which may include sleep monitoring, information about CBT-I concepts, sleep hygiene tips, and guided relaxation techniques to name a few. Focusing on the most beneficial app components may increase app use and improve treatment outcomes.

Conclusion

Inadequate sleep negatively impacts physical and mental health. Many patients suffering from poor sleep seek treatment for daytime symptoms including decreased energy, poor concentration, and irritability (Morin et al., 2006). Left untreated, poor sleep can contribute to depression, anxiety, hypertension, obesity, diabetes, stroke, and coronary artery disease (CDC, 2018). With 72% of Americans feeling tired most of the week, it is critical that providers are prepared to address this debilitating problem (Breus, 2020).

While poor sleep has detrimental impacts on the physical and mental health of all Americans (CDC, 2018), its effect on servicemembers can be even more profound. Servicemembers work in demanding jobs, maintain unusual hours and night shifts, and are often

away from their families. The intense stress of deployment environments has negative impacts on sleep that often persist long after service members return home (Pietrzak et al., 2010). As high as 64% of veterans who have served in Iraq and Afghanistan may suffer from symptoms of insomnia (Amin et al., 2010). This places a heavy burden on the military health system to recognize and treat sleep problems and the numerous physical and mental conditions with which they are associated.

CBT-I based sleep applications (apps) combine Cognitive Behavioral Therapy techniques and readily available technology to effectively treat poor sleep. Cognitive behavioral therapy for insomnia is the gold standard of insomnia treatment according to the AASM (2009). This technique looks at the connections between how patients think, act, and sleep to develop new thinking patterns and healthy sleep habits (Arnedt et al., 2017). Mobile apps on smartphones and tablets allow access to content from any location. CBT-I apps are convenient, cost effective, safe. They may be used to introduce hesitant patients to CBT-I concepts, augment in-clinic sleep treatment, or to refresh previously learned ideas long after therapy has concluded.

Education about CBT-I apps increased participant use which led to improvement of multiple sleep quality metrics. When used in conjunction with CBT-I group therapy, app users noted an increase in perceived time asleep, a decrease in nightly awakenings, and an improvement in overall sleep quality. CBT-I app use was also correlated with a decreased group therapy dropout rate. Regardless of sleep app use, participants who completed the five CBT-I group sessions noted a 17% improvement in ISI score. This indicates that encouraging CBT-I app use may improve treatment adherence with group therapy protocol and enhance patient outcomes.

Poor sleep quality impacts up to 72% of Americans and can have debilitating consequences for both mental and physical health (Breus, 2020). CBT-I is the gold standard in

insomnia treatment due to its proven efficacy and low propensity for side effects (AASM, 2018). CBT-I smartphone apps are cost effective and can be used in a variety of settings, making them ideal options for sleep treatment in service members. Use of CBT-I sleep apps can improve sleep quality, decrease nightly awakenings, and increase perceived time spent asleep in military BH patients. They may also lead to greater adherence with treatment protocol, thus further improving patient outcomes. Improving sleep in service members decreases the burden of the military health system to identify and treat mental and physical conditions associated with poor sleep. It allows servicemembers to focus on the mission and improves the overall readiness of the Armed Forces.

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Appendix A. CITI Certificates for All Students

CITI PROGRAM

Completion Date 20-Aug-2018
Expiration Date 19-Aug-2021
Record ID 28232019

This is to certify that:

Yosef Fufa

Has completed the following CITI Program course:

OUSD P&R Human Research (Curriculum Group)
Biomedical Investigators and Research Study Team (Course Learner Group)
1 - Biomedical Investigators (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w674f0802-901f-45bd-808c-a35a45599352-28232019

CITI PROGRAM

Completion Date 20-Aug-2018
Expiration Date 19-Aug-2021
Record ID 28232021

This is to certify that:

Yosef Fufa

Has completed the following CITI Program course:

Responsible Conduct of Research (RCR) (Curriculum Group)
Responsible Conduct of Research (RCR) (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wf30c6e49-6c17-4cef-b8dd-477ecc307a8f-28232021

CITI PROGRAM

Completion Date 28-Aug-2018
Expiration Date 27-Aug-2021
Record ID 28328218

This is to certify that:

Megan Buehler

Has completed the following CITI Program course:

Good Clinical Practice (U.S. FDA Focus) (Curriculum Group)
GCP for Clinical Trials with Investigational Drugs and Medical Devices (U.S. FDA Focus) (Course Learner Group)
1 - GCP (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

CITI PROGRAM

Completion Date 28-Aug-2018
Expiration Date 27-Aug-2021
Record ID 28328218

This is to certify that:

Megan Buehler

Has completed the following CITI Program course:

OUSD P&R Human Research (Curriculum Group)
Biomedical Investigators and Research Study Team (Course Learner Group)
1 - Biomedical Investigators (Stage)

Under requirements set by:

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w525643e7-8736-4555-89f6-78eedac06f30-28328218

CITI PROGRAM

Completion Date 28-Aug-2018
Expiration Date 27-Aug-2021
Record ID 28328218

This is to certify that:

Megan Buehler

Has completed the following CITI Program course:

Responsible Conduct of Research (RCR) (Curriculum Group)
Responsible Conduct of Research (RCR) (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set b Cut

Office of the Under Secretary of Defense (Personnel and Readiness)

CITI
Collaborative Institutional Training Initiative

Appendix B. USU (VPR) Form 3202N (final copy from USU (VPR)

USU
Uniformed Services University

OFFICE OF RESEARCH
4301 JONES BRIDGE ROAD
BETHESDA, MAYLAND 20814
PHONE: (301) 295-3303; FAX: (301) 295-6771

NOTICE OF PROJECT APPROVAL

Change Number: Original

VPR Site Number:	GSN-61-11593
Principal Investigator:	Buehler-Brazas, Megan
Department:	Graduate School of Nursing
Project Type:	Student
Project Title:	There's an app for that: Smartphone applications to improve sleep
Project Period:	11/6/2020 to 3/31/2021

Assurance and Progress Report Information:

Name	Sup	Approval Type	Status	Approved On	Forms Received
Progress Report	0			To be Submitted	N/A

Remarks:
This Notice Of Project Approval has been reviewed and approved. Please remember that you must submit a final Progress Report (Form 3210) upon completion of this project.

Questions regarding this approval should be directed to the following person in the Office of Research: Sharon McIver, (301) 295-9814.

[redacted]

Toya V. Randolph, Ph.D., MSPH Date
Acting Vice President for Research
Uniformed Services University of the Health Sciences

cc: File
Dr. Kennett Radford
Laura, Taylor

Appendix C. MTF IRB/PI Letter of Determination

DEPARTMENT OF THE ARMY
MADIGAN ARMY MEDICAL CENTER
9040 JACKSON AVENUE
TACOMA, WA 98431-1100

MCHJ-ISI 2 September 2020

MEMORANDUM FOR MAJ Yosef Fufa, AN, and CPT Megan Buehler-Brazas, AN, USUHS DNP PMH Students

SUBJECT: Determination of Not Research for, "Smartphone Applications to Improve Sleep," Reference No. 32

1. The Madigan Army Medical Center Human Research Protections Office received the above-referenced project on 28 August 2020 to review for applicability of human subjects protections regulations.

2. This project aims to educate sleep hygiene class facilitators about the benefits of sleep apps to obtain buy-in for the project intervention. The intervention involves adding ten minutes of sleep app education on the proper use and benefits of CBT-i based sleep apps to supplement the existing sleep hygiene content of the scheduled class during week one of the project. During weeks two and four of the class, participants will be given a survey related to their usage of the sleep app. Team Leaders will also review the Insomnia Severity Index (ISI) scores located in the Behavioral Health Data Portal (BHDP) before and after sleep app education to assess for changes that may be related to the sleep app intervention. These surveys are administered as part of standard care upon enrollment in any Behavioral Health classes.

3. This study does not constitute research as defined under the human subject protections regulations, as it is not "a systematic investigation . . . designed to develop or contribute to generalizable knowledge." [32 CFR 219.102(l)] Additionally, per DoD Instruction (DoDI) 3216.02, "activities, including program evaluation, customer satisfaction surveys, user surveys, outcome reviews, and other methods, designed solely to assess the performance of DoD programs where the results of the evaluation are only for the use of Government officials responsible for the operation or oversight of the program being evaluated and are not intended for generalized use beyond such program" are not research involving human subjects, and as such, are not covered under the requirements of DoDI 3216.02..

4. **This determination should not be construed as approval to conduct this project**. It is your responsibility to identify and obtain any necessary permissions or approvals to conduct the project prior to initiation. This activity may proceed with no further requirement for review by the Madigan Army Medical Center Human Research Protections Office, pending other required approvals (at the department level).

5. In addition, your project may become research subject to IRB review if it becomes and/or includes a systematic investigation to develop or contribute to generalizable knowledge. In the event there is a change to the above-described project that may affect its determination, please submit a modification form for review and determination. No change to this activity may be implemented until the review is completed and you have been notified that there is no revision to our determination that your activity is still deemed not to be research. A request for our review does not need to be submitted for the following changes to your activity: (1) personnel conducting the activity; (2) location or site at which activities will be conducted; (3) number of respondents; or (4) period of time over which the activity will be conducted. You are not authorized to take project data away from the institution.

6. All publications, presentations or abstracts arising from this work must be cleared through appropriate publication clearance procedures prior to publication IAW your institutions local publication clearance policy. Many journals are interested in publishing projects that are not research. If you do decide to publish your findings, please use paragraph headings such as: "issue," "procedures for collecting and evaluating information," "information found," "lessons learned," etc. and avoid using headings such as "research questions or hypothesis," "methods," "results," "study limitations," etc.

7. The Madigan Army Medical Center Human Research Protections Office point of contact for this review is Mary McCarthy, PhD, RN, FAAN, at [redacted] or [redacted]

[redacted]

Mary S. McCarthy, PhD, RN, FAAN
Exempt Determination Official
Center for Nursing Science & Clinical Inquiry
Madigan Army Medical Center

Appendix D. PAO Clearance for archiving final report to "*USU Archives*"

CLEARANCE APPROVAL FORM v5.4

Requirements based on MAMC Reg 360-2 = http://go.usa.gov/xkMbx

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Submission Title:* There's an App for That: Mobile Applications to Improve Sleep

Submission Type:* Published abstract

Project Type:* ○ Human Subjects Research ○ Animal Subjects Research
● Quality improvement ○ Other:

Author List:

Yosef Fufa, MAJ; Megan Buehler-Brazas, CPT

Enter all authors in the form of firstname lastname, suffix, separated by a semicolon (;).

First Madigan Author:

Email: yosef.fufa2.mil@mail.mil

Dept/Serv: Nursing

Other Dept/Serv: MCED

Chief Email: tommy.l.thompson58.mil@mail.mil

Item is intended for publication: ○ NO ● YES

Destination of Item:

1. Abstract submitted for USU Research Days (Virtual,13 May 2021)
2. Poster presented for USU Research Days (Virtual, 30 April 2021)
3. Oral podium presentation of the final report (Virtual on13 May 2021)
4. Final report sent to USU Archives (Archived on or after 13 May 2021)

Journal name or Conference, Date, Location or Destination (whichever is applicable)

Protocol/Determination: # N/A IRB Exempt *Enter protocol/determination number*

Provide e-signature & your department chief e-signature on the next page before submitting.

Title: There's an App for That: Mobile Applications to Improve Sleep

Signatures

Signature of author:

[redacted]

Signature of author's department chief:

[redacted]

Signature of Public Affairs Officer rep:

[redacted]

Signature of OPSEC rep:

[redacted]

Department of Clinical Investigation (DCI) Administrator:

[redacted]

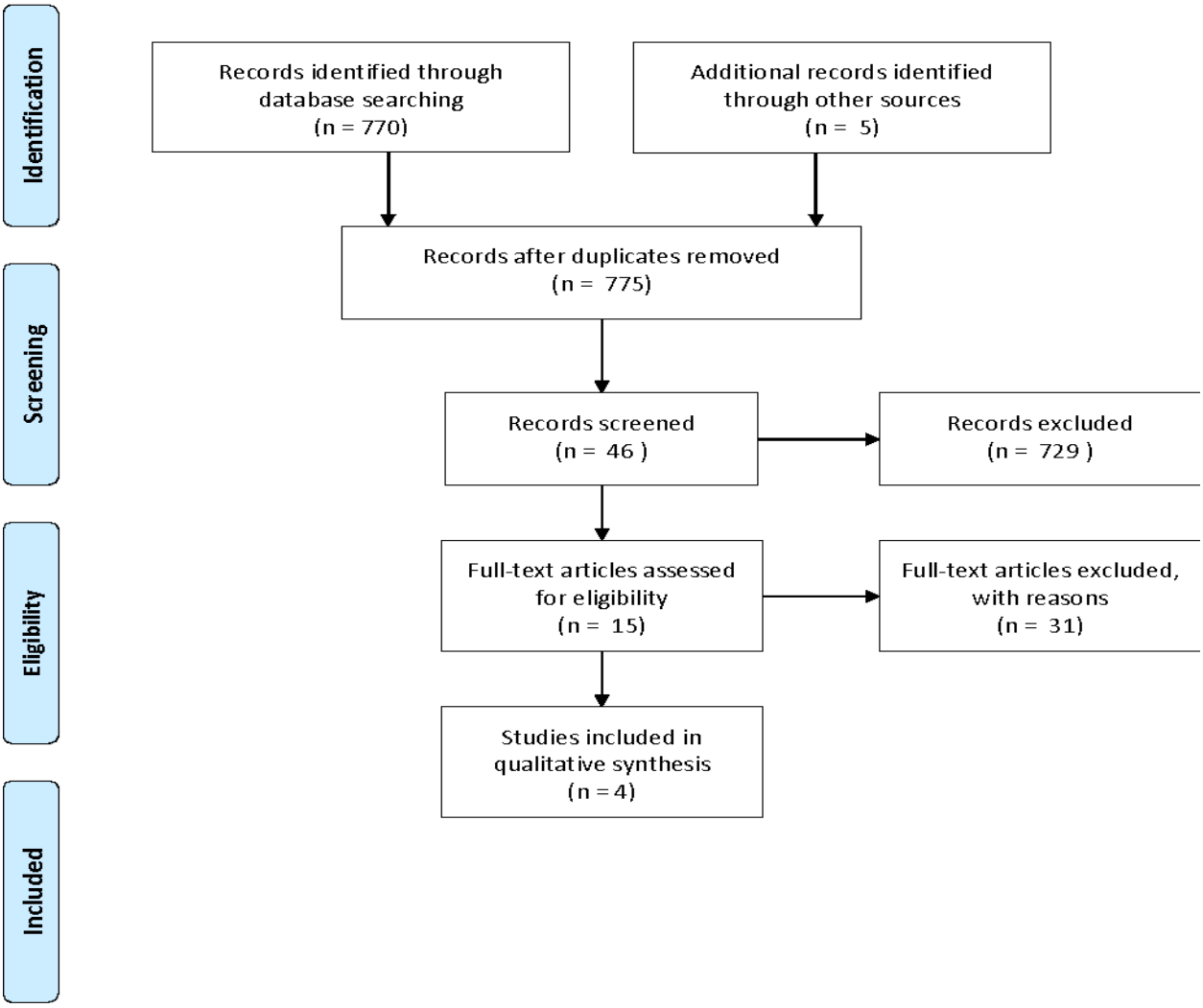
Human Protections Administrator or Veterinarian (If required):

[redacted]

Chief, DCI:

[redacted]

Appendix E. PRISMA Flow Diagram (Moher, Liberati, Tetzlaff, & Altman, 2009)



Appendix F. Data Collection and Analysis Plan

	Variable Name	Variable Description and Type of Measure	Data Source	Possible Range of Values	Level of Measurement	Time Frame for Collection	Statistical Test	Decision Rule
POPULATION	Independent Variable: Nonpharmacological treatment for sleep – CBT-based sleep applications	Description: BH Clinic patients survey - "Do you use a sleep app?" Patients who use a CBT-based sleep app will be compared to patients who do not use a sleep app. Type: outcome measures	Survey BH clinic patients (voluntary)	YES or NO 0 = Sleep app use 1 = No sleep app use LENGTH OF TIME 0 = Less than 4 weeks 1 = More than 4 weeks USE FREQUENCY 0 = More than 5 days/wk 1 = Less than 5 days/wk	Nominal and Ordinal	September 2020 to March 2021	Fisher's Exact test	AASM recommend CBT-I for insomnia Pulantara et al. (2018) and Horsch et al. (2017) found statistically significant positive results with CBT-based mobile apps Lee and Jung (2018) DeStressify app used at least 5 days/week - 4-week use
	Dependent Variable: Insomnia Severity Index Score	Outcome measure: Insomnia Severity Index Questionnaire	Behavioral Health Data Portal	0 to 28	Interval	September 2020 to March 2021	Fisher's Exact test	Pulantara et al. (2018), Horsch et al. (2017), and Koffel et al. (2018) utilized ISI. Pulantara (2018) and Horsch (2017) defined treatment response as decrease in ISI score by 8 points.

Appendix G. DNP Project Completion Verification Form

Appendix G: Daniel K. Inouye Graduate School of Nursing
DNP Project Completion Verification Form

DOCTOR OF NURSING PRACTICE PROJECT
Completion Verification Form

The DNP Project titled:

There's an App for That: Mobile Applications to Improve Sleep

was completed at: Joint Base Lewis McChord, Tacoma, WA

by the following student(s):

(type student name)	*(signature)*	*(date)*
Yosef Fufa, MAJ	[redacted]	05/04/2021
Megan Buehler-Brazas, CPT		05/04/2021

The DNP Practice Project Team verifies that the following components of the DNP project, accomplished by the above students, is of sufficient rigor and demonstrates doctoral level scholarship to meet the requirements for USUHS GSN graduation:

- Presentation of DNP project to the leadership/stakeholders at the Phase II Site,
- Abstract/Impact Statement (*Appendix F*), and
- DNP Project written report.

Verified by:

	(type name)	*(signature)*	*(date)*
Senior Mentor:	LCDR Tarah Lewis	[redacted]	
Team Mentor:			
Team Mentor:			
Phase II Site Director:	LTC Tommy Thompson	[redacted]	

For RNA Students only - add the following additional signature for final verification of project completion:

RNA Project Director *(type name)*	*(Signature)*	*(Date)*

Form Version: 26 Aug 2017/30 Mar2020

Appendix H. Insomnia Severity Index

For each question, please *CIRCLE* the number that best describes your answer.

Please rate the *CURRENT (i.e. LAST 2 WEEKS) SEVERITY* of your insomnia problem(s).

Insomnia problem	**None**	**Mild**	**Moderate**	**Severe**	**Very severe**
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problem waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem?

Not at all Worried	A Little	Somewhat	Much	Very Much Worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:

0-7 = No clinically significant insomnia

8-14 = Subthreshold insomnia

15-21 = Clinical insomnia (moderate severity)

22-28 = Clinical insomnia (severe)

Department of Veterans Affairs (2020). Insomnia Severity Index. Retrieved from https://www.myhealth.va.gov/mhv-portal-web/insomnia-severity-index

Appendix I. Pre-Implementation Survey

Name:_____

Have you used a CBT-I (cognitive behavioral therapy for insomnia) based sleep application?

YES NO

App name (if applicable):_____

When did you start using the app (if applicable)?_____

Over the past month, how many days per week have you used the app?

0 1 2 3 4 5 6 7

Appendix J. Post-Implementation Survey

Name:_____

Have you used a CBT-I (cognitive behavioral therapy for insomnia) based sleep application in the past month?

YES NO

App Name (if applicable):_____

Over the past month, how many days per week have you used the app?

0 1 2 3 4 5 6 7

Since using the app (if applicable), have you noticed a change in:

Time spent asleep?

Increased No change Decreased

Nightly awakenings?

Increased No change Decreased

Daytime tiredness?

Increased No change Decreased

Overall sleep quality?

Improved No changed Worsened