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What are the Most Effective Non-Pharmacologic Practices for the Management of Primary Insomnia in Adults?

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Abstract:

Objective: Primary insomnia is a mental health condition in which individuals struggle with falling asleep, staying asleep or early morning awakenings. As there are many treatments available that claim to help those with primary insomnia, this review looks specifically at therapy, exercise and acupuncture as management strategies.

Methods: This is a review of 15 peer-reviewed, randomized controlled trials completed in 2018 or later with one additional study completed in 2010. Also, there are four non primary insomnia based studies used to support the efficacy of alternative therapies to cognitive behavioral therapy (CBT). All the studies used in this review come from 2 educational databases (PubMed, Google Scholar). Keywords used to find these articles include primary insomnia, management, adults, CBT, therapy, exercise and acupuncture.

Discussion: Following a detailed and standardized review of each study, all three management strategies (therapy, exercise and acupuncture) were found to be effective in reducing insomnia symptoms to varying degrees.

Conclusion: Therapy, exercise and acupuncture are all effective forms of treatment in adults with primary insomnia. The most effective include CBT, moderate intensity aerobic exercise and true acupuncture at multiple acupoints with or without added auricular acupoints. This review is unable to claim one form of management is more effective than another as there is no research currently available, within the constraints of this review, that compares them. More research is needed here.

Introduction:

Sleep is an essential state of consciousness that, as humans, we require for optimal function. Even while we are somatically asleep, our brain and body remains highly active by taking part in many mechanisms needed to sustain life including neuronal communication, removing toxin buildup, forming long term memories and maintaining autonomic function [1]. On average, it is recommended that adults get seven to nine hours of sleep per day for adequate functioning [2]. Circadian rhythms are day-long cycles our bodies undergo that influence behavior, including sleep, and can be affected by many factors including food intake, stress, physical activity, social environment and temperature [3]. Disrupted circadian rhythms can lead to abnormal sleep patterns and disturbed sleep cycles.

While asleep, the body cycles through non-rapid eye movement (nREM) sleep and rapid eye movement (REM) sleep [4]. These cycles repeat, usually every 90 minutes, until the individual awakens to begin their day. nREM sleep has three stages that the individual must undergo before they can reach REM sleep. These cycles can be identified and measured by watching brain activity in an individual who is asleep using electroencephalography (EEG). Stage one of nREM is the period of falling asleep, stage two is when they are asleep and stage three is deep sleep. The individual will experience stages one, two and three in order and then must cycle back through stage two and one again before entering REM sleep. In REM sleep, the eyes are moving and the brain is highly active, similar to how it is while somatically awake, and this is when dreams occur. As the night goes on and cycles continue, the amount of time spent in deep sleep decreases and the amount of time in REM sleep increases. On average, an individual experiences four to six cycles a night [4]. Those who wake up during deep sleep or REM sleep are more likely to be tired throughout the day than when waking during stages one or two of sleep [5].

Sleep deprivation occurs when the body is not able to undergo the restorative processes that it requires and can acutely lead to disruptions in executive functioning, irritability, impaired vision and reduced reaction time, among other things [1]. Chronic sleep deprivation can increase the risk of type 2 diabetes, obesity, weakened immune system, hypertension, depression and mood disorders and dementia. On average, most people should spend one third of their life asleep [1].

Insomnia is defined as trouble falling asleep, trouble staying asleep or early morning awakening. During times of stress, many people experience short periods of insomnia lasting days to weeks [6]. According to the fifth edition of the diagnostic and statistical manual of mental disorder (DSM-V), sleep difficulty present for at least three months, not related to other causes, leading to significant distress, is a mental disorder called primary insomnia [7]. When insomnia occurs in relation to another chronic condition such as sleep apnea, cancer or mood disorders, it is called secondary insomnia [8]. One third of American adults experience symptoms of insomnia and 10% have primary insomnia as classified by the DSM V [9].

Given the prevalence of insomnia, there is a wide market of pharmaceuticals, supplements, exercise programs and breathing techniques promising to provide immediate relief of sleepless nights. In order to answer the research question of "what are the most effective non pharmacologic practices in the management of primary insomnia in adults?", this literature review will look at the efficacy of therapy, exercise and acupuncture as management strategies. It is the belief of this review that therapy, exercise and acupuncture are all effective forms of primary insomnia management but is looking to determine which aspects of each form are the most effective and, ultimately, if one intervention can be determined to be more effective than the others. For every one of the management strategies analyzed in this review, we will look at

multiple types of each. The following paragraphs and references will attempt to demonstrate the efficacy of these common practices based on the current literature. Then, a comprehensive discussion analyzing the entirety of the literature will lead to conclusions and next steps.

Methods:

An extensive literature review was conducted using PubMed and Google Scholar with the following search terms: primary insomnia, management, adults, cognitive behavioral therapy (CBT), therapy, exercise and acupuncture. Therapy, exercise and acupuncture were chosen as the primary nonpharmacologic interventions to be assessed in this review because the educational databases used showed them to be of the most researched management strategies. The inclusion criteria for the peer reviewed, randomized controlled trials in this review are 1) those completed in 2018 or later, 2) those with sample populations of adult participants (aged eighteen to seventy), 3) those with sample population with a diagnosis of DSM-V primary insomnia, 4) available in the English language, and 5) those utilizing/comparing therapy, exercise and/or acupuncture as forms of management. The exclusion criteria for this review are 1) those with sample populations who had secondary causes of insomnia (i.e. PTSD, cancer, OSA), 2) those that looked at the efficacy of pharmacological treatment, 3) those that utilized alternative non-pharmacological treatment that was not therapy, exercise or acupuncture and 4) those involving children (under eighteen) or older adults (older than seventy). Limitations of this review involve its dependence on the data and conclusions of other studies and the bias that may exist within the chosen studies. Of importance to note, there are very limited randomized controlled trials that have been conducted specifically on those with primary insomnia. The majority of the trials that have been conducted regarding insomnia are specifically secondary

insomnia in patients with a history of cancer or mental health conditions such as PTSD or depression.

Literature Review:

There are many pharmacological treatments available for the management of insomnia, the majority of which showing statistically significant effectiveness. However, this review seeks to investigate non-pharmacological approaches. It is believed that non pharmacologic interventions should be trialed and failed before moving on to pharmacologic treatment in adults with primary insomnia [10]. This is because less adverse health events and side effects occur secondary to lifestyle modifications and talk therapy than with medication administration. In a study conducted by Jarbøl et al., it was found that, when promised the same benefits with lifestyle modifications versus medications to a sample of adults aged forty to sixty, there was an overall preference for lifestyle modifications [11]. This suggests adherence if lifestyle modifications were the chosen intervention for a patient. In addition, lifestyle modifications may be able to benefit the patient in different aspects of their life. For example, exercise can be beneficial for a patient's weight management as well as maintaining bone density [12]. With the acknowledgement of non pharmacologic treatment to be a viable option for adults with primary insomnia, we will now look at three common practices - therapy, exercise, acupuncture - and their success as management strategies based on current literature.

Therapy

Therapy has been utilized as a first line alternative management strategy to pharmacologics in patients with primary insomnia for many years. The forms of therapy used in

the setting of primary insomnia that will be referenced in this review include CBT, both cognitive and behavioral therapy separately, and mind body practices. Mind body practices include lucid dream training, “three good things” exercises and yoga nidra. To note, all forms of therapy referred to in this review, except in the study involving yoga nidra, involve being delivered over the internet, telephone or via mobile devices in the form of apps. First in the analysis of therapies, we will look at dCBT, then CT and BT separately, followed by mind body practices.

To compare the efficacy of CBT delivered both in person and digitally, in 2021 Gehrman completed a study that compared insomnia symptom improvement of participants who received therapy either digitally or in person [13]. In this study, therapy was delivered as weekly sessions for six to eight weeks to a group of participants using digital CBT (dCBT) and the other face-to-face CBT with a control group not receiving any therapy. Based on the results, which were measured at both two weeks and three months, there was significant improvement in insomnia symptoms in both CBT groups and no significant improvement in the control group. The difference in improvement between the two CBT groups was negligible, suggesting that both dCBT and face-to-face CBT are both effective management strategies for primary insomnia management.

Currently, CBT is considered superior to other forms of therapy utilized for patients with primary insomnia and has even out performed pharmacologic management [14]. CBT is useful for patients with primary insomnia because it works to identify and address causes of insomnia by focusing on restructuring thoughts, feelings and behaviors regarding sleep plus providing techniques to aid in sleep promotion such as sleep restriction, stimulus control and relaxation training [15] . CBT has also been shown to work not only in the setting of primary insomnia but also in short term insomnia with no evidence of harmful side effects on patients [14].

In 2019, Espie et al. conducted a study to compare dCBT versus patient education and the ability of each to decrease insomnia symptoms in patients with primary insomnia. dCBT was provided in the form of six sessions, lasting 20 minutes each, over the course of twelve weeks for the dCBT group. The patient education group received information about sleep hygiene in the form of downloadable booklets that they had access to for twelve weeks. Insomnia symptoms were monitored at weeks four, eight and twelve. Those in the dCBT group showed a large, statistically significant improvement in insomnia symptoms, as well as personal functioning, performance and psychological well being. Those in the patient education group showed small improvements, as well as less interaction with the resources than those in the dCBT group [16].

In a similar study conducted in 2020, Madj et al. also assessed improvement of symptoms in patients with primary insomnia when provided dCBT or patient education on an app. dCBT was provided as weekly sessions lasting one hour each, completed at one's own pace. Patient education was provided weekly as a written document available on the app on how to promote good sleep. By assessing insomnia symptoms at months one, three and six, results in this study also showed decreased insomnia symptoms, improved sleep quality and the development of coping mechanisms that were statistically significant in the dCBT group [17]. Similar to the previously mentioned study completed by Espie et. al., there was slight improvement of symptoms in the patient education group but not nearly to the extent of dCBT [16,17].

Both Espie et al. and Madj et al. compare dCBT to patient education over weeks with Espie et al. looking more long term over twelve weeks and Madj et al. more short term over six weeks. In the same way that therapy is delivered digitally in each, patient education is delivered in the format of a resource available to the participant whenever they choose to access it that involves a list of tips and tricks for insomnia management. While both studies showed slight

improvement of symptoms with patient education, dCBT proved to provide statistically significant benefit to the participants in regards to their insomnia symptoms.

While Espie et al. and Madj et al. attest to the superiority of dCBT to patient education, further research completed by Cheng et al. in 2021 and Vedaa et al. in 2019 look at the lasting effects of dCBT on primary insomnia. In both of the studies completed by Cheng et al. and Vedaa et al., the participants were those that had already completed a "dCBT vs patient education" trial in the past in which they were in the dCBT group, as the goal of these studies is to attest to whether dCBT has lasting effects on primary insomnia symptoms [18]. The study by Cheng et al. in 2021 looked specifically at lasting effects of dCBT and whether they were still helpful during times of high stress. This study took place five weeks into the nationwide quarantine during the COVID19 pandemic. Through the data analysis, this study showed that those who had previously received dCBT still had improved self efficacy in managing insomnia symptoms, even during the high stress situation of the pandemic. Further, this study suggests that ongoing CBT during times of high stress could even protect from insomnia symptom development [18].

The study by Vedaa et al. in 2019 looked specifically to test the benefit of providing long term efficacy of ongoing, unguided and fully automated, dCBT for insomnia in participants that had just completed another trial for insomnia in which they were in the dCBT group, for an additional eighteen months [19]. Results were measured based on insomnia symptoms and sleep diaries. At eighteen months, results showed that, overall, participants maintained similar improvements to those they reached at the end of the initial intervention [19]. Despite Vedaa et al. looking at providing continued access versus Cheng et al. relying on recall of management strategies, both studies agree that having received dCBT in the past and being able to reflect on it

can provide continued relief of insomnia symptoms even after the intervention has been completed.

Knowing the effectiveness of dCBT, in 2019 researchers Sunnhed et al. analyzed why CBT is effective and what aspects of it are most effective as it is a combination of both cognitive and behavioral therapy [20]. In their study, they compared cognitive therapy (CT) and behavioral therapy (BT) to a "waitlist" group (WL). CT in the context of sleep is based on the theory that worry about sleep is what leads to insomnia symptoms. This group was provided guidance over the internet/telephone on how to cope with anxiety related to sleep, be selective with the attention they pay to sleep related fears, and identify and challenge these feelings through cognitive restructuring. BT in the context of sleep is based on biological theories believing that optimizing circadian rhythm and homeostatic sleep can improve insomnia symptoms. Similar to the CT group, this group was provided instructions over the internet/telephone on sleep restriction (limited time spent in bed), stimulus control (i.e. "bedroom is for sleep") and sleep hygiene (i.e. education of how to promote sleep).

Both groups received guidance over the course of ten weeks with one module per week plus telephone support from licensed therapists or graduate students soon to become therapists. The WL group was told the study has not been started yet and therefore served as the control group in this study. At the end of the ten weeks, there was no improvement in insomnia symptoms for members of the WL group, however, both the CT and BT groups showed statistically significant decreases in insomnia symptoms with CT being slightly more successful than BT, though not to a significant degree. Overall, this study showed that both the CT and BT aspects of CBT are beneficial for sleep improvement in patients receiving CBT for primary

insomnia, as well as that these two forms of therapy can be utilized separately for insomnia management as an alternative therapy to CBT [20].

Given the extensive amount of research that has been done and has proven the efficacy of CBT in patients with primary insomnia, there has also been increasingly more research completed looking to find alternative forms of therapy to CBT for those who CBT has not been effective for. The alternative forms of therapy that will be analyzed are the mind body practices previously mentioned including lucid dream training, "three good things" exercises and yoga nidra. Despite the limited amount of studies available for each of these practices in the educational databases utilized, that fit within the restraints of this review, these alternatives matter because the realm of therapies being used to assist with primary insomnia is expanding. Additional studies, not involving primary insomnia, noted within this review, are included for each of the following mind body practices in order to speak to the benefit they have shown to have outside of primary insomnia, suggesting effectiveness. These studies are incorporated only to support the inclusion of each practice into this review given the limited research of them directly with primary insomnia.

Lucid dreaming is a state of consciousness that occurs during sleep, thought to arise during the REM stage, in which the individual is essentially aware they are asleep and able to take control of their dreams [21]. In general, these types of dreams tend to occur spontaneously but recent research shows that the ability to lucid dream can be taught and practiced at the individual's own convenience. This is usually done by teaching an individual to recognize when they are in a dream based on the "out of this world" events that can occur when dreaming [21]. It is the belief of Ellis et al. that patients with insomnia tend to remember their dreams more than normal sleepers and therefore, by learning to control their dreams with lucid dreaming, those

with insomnia may have better sleep and better mood upon waking. In a study performed by these researchers in 2021, lucid dreaming training was provided to participants with primary insomnia in the form of four digital modules over the course of two weeks. Insomnia symptoms were measured at baseline and then at four weeks. Results showed a statistically significant decrease in insomnia symptoms in those that were able to learn how to lucid dream (77.1%) but not to the degree that CBT has shown benefit in other studies [22]. While this is the only study, within the restraints of this review, that has been completed that looks at both primary insomnia and lucid dreaming, further research on lucid dreaming, though not in those with primary insomnia, has shown its benefit in decreasing anxiety and depression in those struggling with posttraumatic stress disorder (PTSD), as well as increase subjective reports of both physical and mental health based on a 2020 questionnaire [23,24].

Another alternative to CBT that has been researched are “three good things” exercises. This is a form of positive psychology that involves having individuals think back through their day to write down three good things that happened during that day. It is believed that, by thinking positive thoughts before going to bed, anxieties or other factors that may contribute to their insomnia are lessened. In 2022, Sato et al. conducted a research study to compare the effects of dCBT and “three good things” exercise to a waitlist group (WL) [25]. While one group received dCBT, the “three good things” group completed daily prompts of three good things that happened that day and the WL group was informed the study had not yet taken place. Results for this study showed a statistically significant decreased insomnia symptoms in both dCBT and “three good things” groups and no change in the “waitlist” group, however those who received dCBT had an overall greater decrease in insomnia symptoms than the “three good things” group.

The results of this study suggest that both dCBT and “three good things" are effective management strategies for those with primary insomnia, however dCBT is still superior [25] .

In a similar form with a different name, positive psychology has been used in different avenues of research. In the same way that “three good things” involve writing down positive parts of the day, another study by Fuju et. al. in 2020 looked at the effects of having and utilizing a positive diary for 30 minutes a day, everyday, for four weeks [26]. To note, this study is not on those with primary insomnia but rather it involves assessing symptoms of depression in caregivers to those with dementia. At the end of the four weeks, this study showed statistically significant decreases in rates of depression based on a series of standardized questionnaires [26].

Yoga nidra is a relaxation technique, rather than an exercise, that has been analyzed for its efficacy in chronic insomnia that involves deep relaxation and stationary poses. Current research suggests yoga nidra to be already significantly effective in reducing anxiety, depression and insomnia symptoms based on a two week long trial of daily practice during the COVID 19 pandemic in healthcare workers [27]. Bear in mind, this study did not involve patients with primary insomnia but speaks to the efficacy of yoga nidra in terms of effectiveness towards relaxation and the benefits of it. Nevertheless, a study looking at the efficacy of yoga nidra as a management strategy for primary insomnia was conducted in 2021 by Datta et al [28] . In this study, yoga nidra was compared to CBT by randomly assigning participants with primary insomnia to one of two groups to either practice yoga nidra or attend CBT sessions. To note, this is the only study in which CBT was delivered in person rather than digitally. Based on the results determined by both sleep diaries and polysomnography at baseline and following the intervention, it was found that both groups experienced significantly improved insomnia symptoms. In fact, this study suggests that yoga nidra may actually be more effective than CBT

according to the polysomnography results showing yoga nidra participants had an overall higher average of time spent in bed and total sleep time than the CBT group [28]. The yoga nidra participants also had more subjective reports of improvement in insomnia symptoms than the CBT group. Overall, this study suggests that yoga nidra is an effective management strategy for primary insomnia management in adults.

Exercise

Exercise is a non pharmacological alternative for primary insomnia management in adults that has been proven to be effective. This practice has been endorsed by the medical community and healthcare providers as a way to improve sleep, even in patients without insomnia. In addition to the effects of exercise on sleep, as previously mentioned, exercise can be beneficial to many different aspects of both physical and mental health [29] . The goal of discussing the effects of exercise on primary insomnia in this review is to determine which forms of exercise are most effective. First we will look at moderate intensity aerobic exercise over a period of time, the acute effects of exercise and then low intensity exercise/stretching versus patient education.

In 2020, El-Kader and Al Jiffri investigated the effects of aerobic exercise on quality of sleep in patients with primary insomnia. In this study, participants were assigned to either a supervised moderate intensity aerobic exercise group or control group for six months in which one group completed aerobic exercise and the other maintained their normal daily routines. Insomnia symptoms were measured at baseline and at six months using polysomnography and showed an increased total sleep time and sleep efficiency with a decreased sleep onset latency in the aerobic exercise group. The control group which had no significant findings [30] . A similar study was conducted in 2023 by Baron et. al. which looked at the effects of aerobic exercise on a

specific population of middle aged women with primary insomnia [31] . In this study, similar to El Kader and Al Jiffri, there was one group assigned to moderate to vigorous aerobic exercise, which involved 75 minutes of exercise three times a week for twelve weeks, and another was the control group that did not take part in an exercise plan. In this study as well, the exercise group also showed a statistically significant decrease in insomnia symptoms compared to the control group [31] . The results of both of these studies suggest that exercise is more effective than no intervention when it comes to managing insomnia symptoms.

While both of the previous studies look at the effects of moderate intensity aerobic exercise on insomnia over a period of time, an older study completed in 2010 by Passos et al. looks at the acute effects of exercise on insomnia symptoms [32]. In this study, participants were assigned to a form of exercise to complete during the day followed by spending the night at the facility where a polysomnography could be performed, as well as staying at the facility the night before as well to get a baseline polysomnography. The groups included moderate intensity aerobic exercise (MAE), high intensity aerobic exercise (HAE), moderate intensity resistance exercise (MRE) or a control group. Based on analysis of the polysomnography between the groups, it was demonstrated that MAE was associated with the most significant acute decrease in insomnia symptoms. Both the HAE and MRE groups showed improved insomnia symptoms as well but MAE was most significant [32] .

Rather than comparing exercise to no exercise without intervention, this study by Yeung et al. in 2018 compared exercise to patient education. In this study, participants were either assigned to an exercise group that performed low intensity exercise and stretching or a group that received patient education. Participants involved adults with primary insomnia. In both groups, participants attended two, two hour training sessions on either how to complete the exercises or

learning about how to promote sleep. During the eight week course of the study, the exercise group completed their exercises at least five times a week and the control group continued their normal physical activity. Results were measured at weeks two, four, six and eight. Interestingly, the group completing the exercises showed improvement in insomnia symptoms up until week six but then data showed no significant symptoms relief by week eight [33] . This suggests that either the effects of exercise plateaued as the body adapted to the movement or that low intensity exercise and stretching are not effective forms of exercise for patients with primary insomnia to utilize as management, though may be appropriate for those experiencing bouts of insomnia.

Acupuncture

Acupuncture is a type of traditional Chinese medicine that has been incorporated into Western medicine for its ability to treat both chronic and acute medical conditions. Acupuncture involves inserting thin needles into the skin in certain areas of the body known as acupoints in an attempt to heal the patient of their symptoms. Some conditions in which acupuncture has been used include dental pain, fibromyalgia and osteoarthritis. It is believed that acupuncture allows the body to release endogenous chemicals to which work to provide relief to an individual's symptoms [34]. Acupuncture is currently being studied for its efficacy in primary insomnia, though the research available is very limited. First we will look at acupuncture versus placebos and then the benefit of adding additional acupoints to a known acupuncture regimen.

In 2020, Zhang et al. compared acupuncture to a placebo. For the placebo effect, the participants were under the impression the needle actually entered their skin, believing they received the intervention, though they did not. In both groups the same acupoints were targeted with the same intervals of time experienced between each acupuncture appointment over the

course of two weeks. At the end of the study, insomnia symptoms were reduced in both groups but those who received the actual intervention had more improved symptoms [35]. While this study suggests the efficacy of acupuncture, a study completed by Wang et al. in 2020 compared the symptomatic relief of insomnia symptoms in three groups of participants using known acupoints versus sham points. In this study, one group received acupuncture at a single acupoint, one group received acupuncture at multiple points and lastly a third received acupuncture at sham points [36]. Both the group with one acupoint being used and the group with multi acupoints being used are both using locations known to be effective acupoints and that are currently utilized by acupuncturists. The group receiving sham points are not receiving the intervention in the correct locations to bring relief. The study was done over the course of five weeks and results were measured using functional magnetic resonance imaging (fMRIs) to assess the ability of the acupuncture to regulate brain activity and influence sleep, plus subjective feelings of improved insomnia symptoms. An fMRI is a type of imaging that assesses the movement of blood flow through the brain, capable of detecting changes associated with the intervention. The results showed improvement in insomnia in all three groups but the most significant improvement was in the multi acupoint group. Both Zhang et al. and Wang et al. compared acupuncture to placebo acupuncture, both demonstrating that acupuncture is effective but only when completed the way it is taught and advertised.

To test the effects of adding additional acupoints to the already universally accepted and practiced acupoints, in 2019 Chung et al. compared acupuncture to acupuncture with added auricular acupoints to a control group [37]. The benefits of auricular acupuncture is believed to come from the theory that the ear is a map of the body [38]. The groups receiving acupuncture both did so three times a week for three weeks, however one group also received auricular acupoints

in addition to the baseline acupoints. With insomnia symptoms assessed at weeks one, four and thirteen, it was found that both acupuncture groups reported less insomnia symptoms compared to the control group, however, there was no reported difference in symptom relief for the acupuncture group to the acupuncture and auricular acupoint group. This suggests that, while acupuncture is effective, the addition of added acupoints does not provide participants with primary insomnia more relief or less relief.

Discussion:

This review of current literature serves to answer the question "What are the Most Effective Non-Pharmacologic Practices for the Management of Primary Insomnia in Adults?", looking specifically at therapy, exercise and acupuncture. The availability of studies involving therapies, specifically CBT, were most abundant. However, studies became far more scarce when looking at mind body practices, exercise and acupuncture, this review utilizing all of the studies in current literature that fit within the restraints of this review. This describes the reason for adding in additional, non primary insomnia based studies to support the efficacy of lucid dream training, three good things and yoga nidra. It is not that these topics are not being researched in the realm of insomnia, moreso that they are not being researched for primary insomnia. The majority of current literature involves secondary insomnia. Further, there are zero available studies, fitting within the constraints of this review, that make comparisons between therapy, exercise and/or acupuncture, or any mixture of the three. For this reason, it cannot be said whether one type of strategy is superior to another.

In regards to therapy, we looked at CBT, CT and BT separately followed by mind body practices. Currently, CBT is overwhelmingly accepted as the first line therapy for insomnia [14].

The compilation of studies by Espie et al. and Madj et al. serve to show that CBT is superior to patient education, meanwhile Vedaa et al. and Cheng et al. use their studies to demonstrate the lasting effects of CBT on participants who have received CBT in a prior trial [16-19]. Meanwhile, the research by Sunnhed et al. suggests that both CT and BT may be effective alternatives to CBT but does not have a CT vs CBT or BT vs CBT group [20]. Therefore, since CT and BT are not compared to CBT directly, neither can be said to be more or less effective than CBT but rather only an alternative.

The mind body practices looked at in this section included lucid dream training, "three good things" exercises and yoga nidra. While Ellis et al. expresses the benefits of lucid dream training for insomnia relief, only 77% of the sample was able to learn how to lucid dream [22]. Despite the fact that this study did not have its own comparison to CBT and rather referenced its benefit shown in other studies, of those who did learn and were able to have some relief of their symptoms, the relief was not considered significant compared to CBT [22]. However, additional research has indicated the benefit of lucid dream training in decreasing anxiety, depression and increasing subjective reports of physical and mental health [23,24].

The study by Sato et al. that compared "three good things" exercises to CBT and a control showed benefit in both "three good things" and CBT, but CBT was far superior [25]. Research by Fuju, however, indicates that the use of positive psychology, similar to that used in "three good things" exercises, can be beneficial to relieve symptoms of depression in caregivers to those with dementia [26].

Yoga nidra, the final mind body practice, proved to be quite effective based on the study by Datta et al., suggesting it may be even more effective than CBT [28]. Of all forms of therapy review, this is the only form that suggests effectiveness similar to CBT. However, this is the only

article in current literature that fits the constraints of this review involving yoga nidra and primary insomnia. Therefore, more research is needed to make the statement that yoga nidra is more effective than CBT for the management of primary insomnia in adults. Additionally, recent research has also proven yoga nidra be effective in reducing symptoms of anxiety, depression and insomnia, though not in those with primary insomnia [27].

According to this analysis, CBT is the most effective form of therapy based on each study that is compared directly to it. It is only the study by Sunnhed et al. of CT vs BT and the study by Ellis et al. of lucid dreaming that were not directly compared to CBT and therefore it cannot be said to be better or worse.

Despite the additional supportive studies included to show the additional benefits of lucid dream training, "three good things" and yoga nidra, these alternatives still cannot be said to be more effective than CBT when using a therapy approach to managing primary insomnia in adults, though they still may have some benefit. While each of these have shown to have some additional form of benefit, from anxiety reduction to depression relief, these studies do not involve primary insomnia and therefore cannot hold a stake in answering the research question of this review. Further, the extremely limited amount of research available on each of these topics speaks to the need for additional research.

In regards to exercise, we looked at moderate intensity aerobic exercise versus no exercise, effects of acute exercise and, lastly, low intensity/stretching versus patient education. Overall, exercise proved to be an effective management strategy for primary insomnia in adults. Both studies by El-Kader + Al Jiffri and Baron et al. show that moderate intensity exercise over a period of time is more beneficial than no consistent exercise in terms of insomnia relief [30,31]. Passos et al. study looking at the acute effects of exercise also suggests moderate intensity

aerobic exercise to be most beneficial, this study comparing it to other forms of exercise [32]. The study by Yeung et al. initially suggests that low intensity exercise/stretching may also provide relief, however the effects appeared to dissipate by week eight, refuting its effectiveness in primary insomnia [33]. The initial benefit, however, suggests it may be effective for those struggling with short term insomnia. Overall, these studies suggest that moderate intensity aerobic exercise is the most effective form of exercise in management of primary insomnia in adults but other forms of exercise may also be beneficial.

In regards to acupuncture, we looked at acupoints versus sham points and then the addition of auricular acupoints. Both studies by Zhang et al. and Wang et al. highlight the placebo effect of acupuncture and its inferiority to receiving the actual intervention [35,36]. Further, Wang et al. shows that maximizing the acupuncture with multiple acupoints is even more effective. The study by Chung et al. denounces the benefit of adding additional auricular acupuncture as his results showed no benefit in insomnia relief [37].

Looking at everything together, therapy, exercise and acupuncture are all effective and it cannot be said one is more effective than the other due to the lack of comparison in the research. While CBT should be considered the first line, yoga nidra may be just as or more effective. It cannot be said whether CT or BT or lucid dream training is better or worse due to the lack of evidence. The other therapies compared directly to CBT could be used as alternatives but should be considered second line. Moderate intensity aerobic exercise overwhelmingly proved most beneficial for insomnia relief and should be practiced, but both high intensity aerobic and moderate intensity resistance exercise had benefits too. While low intensity exercise/stretching did not show lasting benefit, it could be used situationally. If acupuncture is to be used, it should be performed as it is taught with true acupoints with or without auricular acupoints, as they add

no lasting benefit but also do not diminish symptom relief. Since neither therapy, exercise nor acupuncture is known to be better than the other, the decision on which non pharmacologic management is chosen to be first line should be based on patient preference.

Conclusion:

Sleep is an important part of our lives as it allows us our bodies to rest and heal, memories to form and provides time for important cellular processes to occur [1]. While insomnia is quite common in adults, one third of Americans experience insomnia at some point in their lives, approximately 10% of the population struggles with primary insomnia [9]. Primary insomnia is a DSM-V mental illness involving at least three months of sleep difficulty not due to any known causes [7]. While there are numerous pharmacologics known to assist with sleep in those with insomnia, nonpharmacologic practices are the focus of this review. Specifically, this review looks at therapy, exercise and acupuncture. Based on current literature, this review has demonstrated that CBT is the most effective form of therapy (being unable to make a statement of CT, BT and lucid dream training), moderate intensity aerobic exercise being the most effective form of exercise and true, multipoint acupuncture with or without additional auricular acupoints is the most effective form of acupuncture. To note, yoga nidra was found to be quite effective as well but more research is needed to make this claim. Since there is no current research comparing therapy, exercise and/or acupuncture, this review cannot make any claims that one management strategy is more effective than another. Next steps needed to be able to answer the question of the most effective management strategy for primary insomnia in adults requires comparing therapy, exercise and acupuncture to each other.

References

1. Brain basics: Understanding sleep. National Institute of Neurological Disorders and Stroke. July 19, 2023. Accessed March 29, 2024. https://www.ninds.nih.gov/health-information/public-education/brain-basics/brain-basics-understanding-sleep#:~:text=Your%20heartbeat%20and%20breathing%20slow,than%20in%20other%20sleep%20stages.
2. How much sleep is enough? National Heart Lung and Blood Institute. March 24, 2022. Accessed March 29, 2024. https://www.nhlbi.nih.gov/health/sleep/how-much-sleep.
3. Circadian rhythms. National Institute of General Medical Sciences. September 2023. Accessed March 29, 2024. https://www.nigms.nih.gov/education/fact-sheets/Pages/circadian-rhythms.aspx#:~:text=Circadian%20rhythms%20are%20the%20physical,and%20temperature%20also%20affect%20them.
4. How Sleep Works - Sleep Phases and Stages | NHLBI, NIH. www.nhlbi.nih.gov. Published March 24, 2022. https://www.nhlbi.nih.gov/health/sleep/stages-of-sleep#:~:text=When%20you%20sleep%2C%20you%20cycle
5. Goodbye Fatigue, Learn How to Wake Up Refreshed. Open Colleges. Published 2016. Accessed March 29, 2024. https://www.opencolleges.edu.au/blogs/articles/why-you-are-waking-up-tired-and-what-you-can-do-about-it#

6. Insomnia. Mayo Clinic. January 16, 2024. Accessed March 29, 2024. https://www.mayoclinic.org/diseases-conditions/insomnia/symptoms-causes/syc-20355167.
7. Substance Abuse and Mental Health Services Administration. Table 3.36, DSM-IV to DSM-5 Insomnia Disorder Comparison. Nih.gov. Published 2016. Accessed March 29, 2024. https://www.ncbi.nlm.nih.gov/books/NBK519704/table/ch3.t36/
8. McCrae CS, Lichstein KL. Secondary insomnia: diagnostic challenges and intervention opportunities. *Sleep Medicine Reviews*. 2001;5(1):47-61. doi:https://doi.org/10.1053/smrv.2000.0146
9. What are sleep deprivation and deficiency? National Heart Lung and Blood Institute. March 24, 2022. Accessed March 29, 2024. https://www.nhlbi.nih.gov/health/sleep-deprivation#:~:text=Sleep%20deficiency%20can%20interfere%20with,or%20worried%20in%20social%20situations.
10. Mayo Clinic Staff. Your guide to over-the-counter sleep aids. Sleep aids: Understand options sold without a prescription. Published 2019. Accessed June 6, 2024. https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/sleep-aids/art-20047860
11. Jarbøl DE, Larsen PV, Gyrd-Hansen D, et al. Determinants of preferences for lifestyle changes versus medication and beliefs in ability to maintain lifestyle changes. A population-based survey. *Prev Med Rep*. 2017;6:66-73. Published 2017 Feb 16. doi:10.1016/j.pmedr.2017.02.010
12. CDC. Benefits of Physical Activity. Centers for Disease Control and Prevention. Published June 16, 2022.

https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm#:~:text=Being%20physically%20active%20can%20improve

13. Gehrman P, Gunter P, Findley J, et al. Randomized Noninferiority Trial of Telehealth Delivery of Cognitive Behavioral Treatment of Insomnia Compared to In-Person Care. *The Journal of Clinical Psychiatry*. 2021;82(5). doi:https://doi.org/10.4088/jcp.20m13723
14. Mayo Clinic. Insomnia treatment: Cognitive Behavioral Therapy Instead of Sleeping Pills. Mayo Clinic. Published September 28, 2016. https://www.mayoclinic.org/diseases-conditions/insomnia/in-depth/insomnia-treatment/art-20046677
15. Newsom R. Cognitive behavioral therapy for insomnia (CBT-I). Sleep Foundation. Published March 27, 2024. Accessed March 29, 2024. https://www.sleepfoundation.org/insomnia/treatment/cognitive-behavioral-therapy-insomnia
16. Espie CA, Emsley R, Kyle SD, et al. Effect of Digital Cognitive Behavioral Therapy for Insomnia on Health, Psychological Well-being, and Sleep-Related Quality of Life: A Randomized Clinical Trial. *JAMA Psychiatry*. 2019;76(1):21-30. doi:10.1001/jamapsychiatry.2018.2745
17. Rajabi Majd N, Broström A, Ulander M, et al. Efficacy of a Theory-Based Cognitive Behavioral Technique App-Based Intervention for Patients With Insomnia: Randomized Controlled Trial. *J Med Internet Res*. 2020;22(4):e15841. Published 2020 Apr 1. doi:10.2196/15841

18. Cheng P, Casement MD, Kalmbach DA, Cuamatzi Castelan A, Drake CL. Self-efficacy in Insomnia Symptom Management after Digital CBT-I Mediates Insomnia Severity during the COVID-19 Pandemic. *Behav Sleep Med*. 2022;20(5):638-648. doi:10.1080/15402002.2021.1976780
19. Vedaa Ø, Hagatun S, Kallestad H, et al. Long-Term Effects of an Unguided Online Cognitive Behavioral Therapy for Chronic Insomnia. *J Clin Sleep Med*. 2019;15(1):101-110. Published 2019 Jan 15. doi:10.5664/jcsm.7580
20. Sunnhed R, Hesser H, Andersson G, et al. Comparing internet-delivered cognitive therapy and behavior therapy with telephone support for insomnia disorder: a randomized controlled trial. *Sleep*. 2020;43(2):zsz245. doi:10.1093/sleep/zsz245
21. Voss U, Holzmann R, Tuin I, Hobson JA. Lucid dreaming: a state of consciousness with features of both waking and non-lucid dreaming. Sleep. 2009;32(9):1191-1200. doi:10.1093/sleep/32.9.1191
22. Ellis JG, De Koninck J, Bastien CH. Managing Insomnia Using Lucid Dreaming Training: A Pilot Study. Behavioral sleep medicine. 2021;19(2):273-283. doi:10.1080/15402002.2020.1739688
23. Erlacher D, Schredl M, Stumbrys T. Self-perceived effects of lucid dreaming on mental and physical health. International Journal of Dream Research. 2020;13(2):309-313. doi:https://doi.org/10.11588/ijodr.2020.2.75952
24. Holzinger B, Saletu B, Klösch G. Cognitions in Sleep: Lucid Dreaming as an Intervention for Nightmares in Patients With Posttraumatic Stress Disorder. Front Psychol. 2020;11:1826. Published 2020 Aug 21. doi:10.3389/fpsyg.2020.01826

25. Sato D, Sekizawa Y, Sutoh C, et al. Effectiveness of Unguided Internet-Based Cognitive Behavioral Therapy and the Three Good Things Exercise for Insomnia: 3-Arm Randomized Controlled Trial. *J Med Internet Res*. 2022;24(2):e28747. Published 2022 Feb 9. doi:10.2196/28747
26. Fuju T, Yamagami T, Yamaguchi H, Yamazaki T. A randomized controlled trial of the "positive diary" intervention for family caregivers of people with dementia. Perspect Psychiatr Care. 2022;58(4):1949-1958. doi:10.1111/ppc.13013
27. Gunjiganvi M, Rai S, Awale R, Mishra P, Gupta D, Gurjar M. Efficacy of Yoga Nidra on Depression, Anxiety, and Insomnia in Frontline COVID-19 Healthcare Workers: A Pilot Randomized Controlled Trial. Int J Yoga Therap. 2023;33(2023):Article 3. doi:10.17761/2023-D-22-00011
28. Datta K, Tripathi M, Verma M, Masiwal D, Mallick HN. Yoga nidra practice shows improvement in sleep in patients with chronic insomnia: A randomized controlled trial. Natl Med J India. 2021 May-Jun;34(3):143-150. doi: 10.25259/NMJI_63_19. PMID: 34825538.
29. Better Health Channel. Exercise and Mental Health. Better Health Channel. Published December 20, 2021. Accessed March 29, 2024. https://www.betterhealth.vic.gov.au/health/healthyliving/exercise-and-mental-health
30. Abd El-Kader SM, Al-Jiffri OH. Aerobic exercise affects sleep, psychological wellbeing and immune system parameters among subjects with chronic primary insomnia. *Afr Health Sci*. 2020;20(4):1761-1769. doi:10.4314/ahs.v20i4.29
31. Baron P, Hermand É, Bourlois V, et al. Effect of Aerobic Exercise Training on Sleep and Core Temperature in Middle-Aged Women with Chronic Insomnia: A Randomized

Controlled Trial. *Int J Environ Res Public Health*. 2023;20(8):5452. Published 2023 Apr 10. doi:10.3390/ijerph20085452

32. Passos GS, Poyares D, Santana MG, Garbuio SA, Tufik S, Mello MT. Effect of acute physical exercise on patients with chronic primary insomnia. *J Clin Sleep Med*. 2010;6(3):270-275.
33. Yeung W-F, Lai AY-K, Ho FY-Y, et al. Effects of Zero-time Exercise on inactive adults with insomnia disorder: a pilot randomized controlled trial. Sleep Medicine. 2018;52:118-127. doi:10.1016/j.sleep.2018.07.025
34. Mayo Clinic. Acupuncture . Mayo Clinic. Published April 30, 2022. Accessed March 29, 2024. https://www.mayoclinic.org/tests-procedures/acupuncture/about/pac-20392763
35. Zhang L, Tang Y, Hui R, et al. The effects of active acupuncture and placebo acupuncture on insomnia patients: a randomized controlled trial. Psychology, health & medicine. 2020;25(10):1201-1215. doi:10.1080/13548506.2020.1738015
36. Wang YK, Li T, Ha LJ, et al. Effectiveness and cerebral responses of multi-points acupuncture for primary insomnia: a preliminary randomized clinical trial and fMRI study. *BMC Complement Med Ther*. 2020;20(1):254. Published 2020 Aug 17. doi:10.1186/s12906-020-02969-6
37. Chung KF, Yeung WF, Yu BYM, et al. Acupuncture with or without Combined Auricular Acupuncture for Insomnia: a Randomised, Waitlist-Controlled Trial. *Acupuncture in Medicine*. 2018;36(1):2-13. doi:https://doi.org/10.1136/acupmed-2017-011371
38. Auricular Acupuncture . National Cancer Institute . Published 2011. Accessed March 29, 2024.

https://www.cancer.gov/publications/dictionaries/cancer-terms/def/auricular-acupuncture#