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Perceived Effectiveness of Diverse Sleep Treatments in Older Adults

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Abstract

Objectives—To describe the different methods older adults use to treat sleep problems and the perceived effectiveness of these methods.

Design—Cross-sectional study of treatment patterns for sleep disorders using a mailed questionnaire that gathered information concerning sleep history, demographics, and treatment choices.

Setting/Participants—Study participants were drawn from a community-based sample of adults aged >65 years, of which 242 responded (67% response rate).

Measurements—Standardized questionnaires to assess sleep parameters (Pittsburgh Sleep Quality Index), demographic information, and sleep treatment options.

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Results—Study participants engaged in a variety of treatment regimens to improve their sleep, with the average number of treatments attempted being 4.7 $\pm$ 2.9. The most commonly used interventions were watching TV or listening to the radio (66.4%) or reading (56.2%). The most commonly used pharmacotherapy was pain medication (40.1%). Prescription sleeping pills had the greatest self-reported effectiveness. Approximately half of all study participants who used alcohol or over-the-counter sleeping aids had not discussed their sleep problems with their doctor.

Conclusion—Older adults frequently choose treatments for their sleep problems that can potentially worsen their sleep symptoms. Many patients have not spoken to their health care provider about their treatment choices. These findings highlight the importance of discussing sleep habits and self-treatment choices as well as treating sleep disorders in older adults.

Keywords

sleep; treatment; effectiveness; alcohol; benzodiazepines

INTRODUCTION

Sleep disorders are common in the elderly, with up to 57% of older adults complaining of difficulties.^{1, 2} These sleep disorders may be associated with an increased risk of driving accidents,³⁻⁵ cardiovascular mortality,⁶ falls,⁷ depression,⁸ and cognitive deficits.⁹ Despite the significant sequelae of sleep disorders, many older adults do not seek treatment of their sleep disorders from their health care providers and instead engage in a number of self-treatment activities.^{10, 11} This may be particularly relevant for older adults because regular users of sleep aids tend to be older than non-regular users.¹²

Potential self-treatments include both conventional pharmacological aids (e.g., sedative hypnotics); alternative therapeutics (e.g., melatonin, herbal therapies); and non-pharmacological activities (e.g., exercise, reading).¹³⁻¹⁵ While some treatments are advantageous, some treatment choices may be particularly detrimental, such as alcohol use. Furthermore, in geriatric care, it is critical to understand patients' treatment choices because of the potentially serious consequences of polypharmacy. Few studies have examined both non-pharmacologic and pharmacological treatment for sleep problems in older adults, with most research focusing primarily on sedative-hypnotic agents.

The purpose of this study was to explore, in a population-based sample, the different types of treatment strategies that were being used by older adults for their sleep complaints, considering both pharmacological and non-pharmacological approaches. Understanding common pharmacological and non-pharmacological strategies among older adults with sleep complaints is an important aspect of providing effective care for their sleep disturbances and may help to identify counter-productive or potentially harmful treatments.

METHODS

Participants

Our study consisted of adults over 65 living in the greater Philadelphia metropolitan area. The list of potential study participants was randomly drawn from the Penn Partners in Healthy Living Program, an elder outreach program of 120,000 older adults that solicited membership via advertisement, mailings, and recruitment from diverse clinics affiliated with the University of Pennsylvania Health System. Participants in this program received quarterly newsletters with information on age-related topics, health-related coupons and discounts. They had also expressed willingness to be contacted for research studies.

Instruments

The overall study design was a cross-sectional survey consisting of a mailed questionnaire, the first part of which consisted of the Pittsburgh Sleep Quality Index (PSQI),¹⁶ a widely used 19-item questionnaire that gathers information on sleep habits, daytime effects of sleep disorders, and etiology of nocturnal sleep disruption. Global scores provide an assessment of overall sleep quality and range from 0 to 21, with scores greater than 5 indicative of poor sleep quality. We also asked study participants to complete a questionnaire regarding self-treatment for sleeping problems. This consisted of 21 items (Tables 1 and 2), and was modified from the longer Self Treatment for Fatigue questionnaire used by Corless et al.¹⁷ The items chosen for the questionnaire were based on pilot data collection from study participants attending geriatric clinics affiliated with the Hospital of the University of Pennsylvania. Only study participants with complaints of “trouble sleeping in the past month” were asked to complete the self-treatment questionnaire.

Study participant names were initially identified from the Penn Partners in Healthy Living Program. The study participants whose addresses were verified received a packet, which contained a letter explaining the study, the study questionnaire, a stamped envelope, and \$1 in compensation if they chose to participate. Study participants who did not wish to participate, as indicated by their mailing back the compensation, would not receive any further mailings (i.e., no repeat attempts would be made to contact them). The research study protocol was approved by the Institutional Review Board of the University of Pennsylvania.

Statistical Analysis

Descriptive statistics were calculated to determine the number of medications used, establish activity/treatment participation, number of treatments, type of treatment, and perceived effectiveness of each treatment. To determine the relative effectiveness of a given method compared to other methods, we used z-score normalization: the perceived effectiveness of each method was standardized using a z-score to remove the effect of range of scores and account for the average perceived effectiveness across all other methods. This allowed for the determination of a pooled standard deviation that could be compared with each individual treatment's standard deviation. The individual methods were compared using a t-test statistic against the null hypothesis of zero difference, which, in the case of z-score normalization, represented the difference from the average pooled perceived effectiveness of all methods. To avoid inflating the experiment-wide error rate due to the multiple comparisons involved (21 different treatment methods were compared to the average effectiveness), a Bonferroni adjustment was applied to the p-value for these t-test comparisons; the significance level of the p-value was adjusted to 0.0024 (0.05/21). We also examined the dataset for significant differences in activity participation based on the demographic factors of gender or race. Such analyses involved comparing responses (Yes/No) with a given factor (Male/Female or Caucasian/African American, etc.) using a chi-square statistic, or a Fisher exact test in cases where cell counts were below five.

The analyses were conducted using the statistical software SAS v9.1 (SAS Institute, Cary, North Carolina).

RESULTS

Of 2,000 randomly selected names in the Penn Partners in Healthy Living database, 686 addresses were verified and were sent the questionnaires. There were 460 responses to this mailing, which yielded a 67% response rate. Of these 460, 251 study participants reported difficulty with sleep and thus were eligible for the current study; they completed the

additional questionnaire on sleep treatment. Nine questionnaires were filled out inaccurately and could not be analyzed, leaving a total of 242 completed questionnaires for the subsequent analysis.

The sample characteristics were 66.0% female; mean age 74.3 $\pm$ 6.6 years; 76.2% of study participants identified themselves as Caucasian, 21.7% as African-American, and 2.1% as "Other." Study participants self-rated their health: 7.7% excellent; 23.4% very good; 44.9% good; 21.4% fair; and 2.6% poor. Education levels were reported as 7.2% junior high or less; 42.0% high school; 32.1% 2-4 years of college; 18.6% graduate school.

Table 1 lists the different treatment strategies employed by the respondents and their relative frequency. As noted, respondents were asked to complete the self-treatment questionnaire if they had trouble sleeping in the past month; of this group, 95.5% (95% C.I.: 92.0% - 97.7%) reported having used one of the listed treatment options for sleep. A free text field was also included for treatment options not listed in the 21 categories. The most common responses in the free text field were prayer (3 study participants, 1.2%) and sleep apnea treatment (2 study participants, 0.8%).

Study participants were also asked if they had discussed their sleep problem with a health care provider (Table 1). These responses were compared to determine whether those who used a specific treatment option were more or less likely to speak with their health care provider about their sleep (Table 1). While there was a trend for study participants who used pain medications, melatonin, vitamins/herbal products and exercise to speak with their health care provider about sleep, only those who used prescription sleep medications had a statistically significant difference after adjustment for multiple comparisons. Approximately half of all study participants using alcohol or OTC sleep aids had not spoken with their health care provider about their sleep complaints.

Figure 1 demonstrates the number of treatments used by study participants. An average of 4.8 (SD 2.9, range 0-13) treatments was used per study participant. There was a statistically significant correlation between the number of treatments attempted and the PSQI sleep quality score ($r=0.37$, $p<0.0001$), suggesting that study participants who had worse sleep quality had tried more sleep treatments. We did not ask if study participants used these treatments concurrently, or if there were particular patterns of combining treatments

Study participants were asked to rate the perceived effectiveness of each treatment option (Table 2). Prescription sleeping pills were felt to be the most effective treatment option (2.5) and ear plugs (1.0) the least effective. When compared to the null value of 0 (no effectiveness) using a one-sample t-test comparison, all treatment options were found to be significant to the Bonferroni adjusted p-value criteria of 0.0024 except for acupuncture ($p=0.19$); ear plugs ($p=0.23$); and cigarettes ($p=0.08$). Comparing z-score normalized values revealed that only prescription medications had a perceived effectiveness significantly larger than the pooled average effectiveness of the other methods (also using the Bonferroni adjusted p-value criteria of 0.0024) (Table 2).

Demographic influences on treatment preferences were then considered. When comparing Caucasians and African-Americans, the following treatment differences were noted: 1) Caucasians were more likely to change their room to deal with their sleep symptoms than African-Americans (20.5 vs. 2.4, $p=0.01$); 2) Caucasians were more likely to change the temperature of their room than African-Americans (50.9 vs. 29.3, $p=0.03$); and 3) African-Americans were more likely than Caucasians to speak with someone on the telephone (21.4 vs. 5.2, $p=0.01$). The races did not differ in terms of pharmacotherapy or other treatment methods. Gender differences were also examined: Women were more likely to 1) eat a snack to help with their sleep symptoms (39.7 vs. 24.3, $p=0.03$); 2) ingest other liquids (non-

alcohol) (37.6 vs. 21.9, $p=0.02$); and 3) read (64.6 vs. 43.0, $p=0.002$). No statistically significant differences existed in the overall number of treatments attempted by race or gender.

DISCUSSION

This study examined a broad array of pharmacological and non-pharmacological treatment options used by older adults for sleep difficulties. The findings are notable for the observation that older adults used several different strategies for their sleep complaints, with the average number of treatments attempted being 4.8 ± 2.9 . The most commonly used interventions were watching TV/listening to the radio (66.4%) or reading (56.2%). Pain medications were the most frequently used pharmacotherapy (40.1%), highlighting the impact of pain as an etiological factor for sleep disruption in the elderly. Of particular concern, nearly half of all study participants who used alcohol or OTC sleeping aids had not discussed their sleep problems with their health care provider.

Sleep problems are a common health issue in older adults with multiple sequelae. Of general practice patients older than 65, 23% complained that their sleep problems were severe enough to impair daytime functioning.¹⁸ Due to the frequency of complaints, however, sleep problems are often viewed as having minimal clinical significance; for example, studies indicate that <5% of older patients with sleep disorders undergo a sleep study and evaluations.¹⁹ Clearly, however, many older adults are troubled by their inability to sleep, and consequently engage in a variety of behaviors to ameliorate their problem.^{20,21} In one study of older rural women, a population with limited access to health care, 69% self-treated their sleep problems using some combination of alcohol and/or OTC medications regularly.²⁰ Clarifying patients' treatment patterns is important because patients often have different perceptions of treatment effectiveness from their physician: one study notes that older adults may have a higher perceived benefit and lower perceived risk than their physician regarding benzodiazepines.²¹

There are several relevant observations from the current study findings. Clearly, older adults are engaging in a number of activities to help alleviate their sleep problems, with the extreme being the study participants who endorsed up to 13 different treatment strategies from the list of 21 provided. Based on the observation that the most common activities used were watching the TV or listening to the radio and reading, it seems plausible that elderly patients are attempting methods of distraction to help them fall asleep. The results also reveal interesting social patterns. Caucasian older adults were more likely to resort to environmental changes to address their sleep complaints than African-Americans, while African-Americans were more likely to use social interaction. These results may indicate an increased reliance on social support system among African Americans. Different race/culture perceptions of sleep may also influence treatment choices, and further research is needed in this area. We did not observe prominent differences in pharmacotherapy choices by race or gender.

The study results also highlight the importance of the relationship between chronic pain and sleep. This is understandable, as chronically painful conditions are frequently associated with sleep disruption. In addition, sleep deprivation may decrease pain tolerance and exacerbate painful conditions.^{22,23} While this cycle may prompt patients to use pain medications to reduce their pain and improve their sleep, it is also possible that patients know that pain medications can also cause drowsiness and fatigue, and may therefore use them for that effect.

Several findings also suggest potential areas for health care providers to address in terms of sleep treatment. For example, watching TV or listening to the radio was cited by many as a common strategy to improve sleep; however, these external stimuli can often disrupt sleep; thus, minimizing these activities is often suggested as a part of sleep hygiene therapy.² Older adults, in particular, can have reduced auditory arousal thresholds, making them more likely to wake even at lower decibel noises.²⁴ Napping the following day was a treatment strategy used by nearly 40% of study respondents; however, this cycle of insomnia followed by daytime napping can ultimately worsen insomnia, and most sleep hygiene interventions call for cessation of daytime naps in patients with insomnia. Additional sleep hygiene interventions that can improve sleep are adhering to a regular bedtime and waketime, avoiding caffeinated beverages after lunch, and minimizing stressful activities around bedtime; these are reviewed in more detail in a recent Journal of the American Geriatrics Society review of sleep disorders in older adults by Bloom and colleagues.²

Of particular concern was the use of alcohol as a sleep aid. These individuals are potentially at risk of alcohol dependence or adverse sequelae from alcohol, including worsening of insomnia. The existence of this category is consistent with International Classification of Sleep Disorders-2 criteria for alcohol-dependent insomnia, and alcohol use in older adults as a sleep aid has been noted by others.^{20, 25} Furthermore, we noted that this group discussed their sleep problems with a physician in only half of all cases, suggesting that increased efforts by health care providers to inquire about sleep and self-treatment practices may help identify older adults who use this counter-productive self-treatment.

In general, the perceived effectiveness data suggests that most therapies had low to moderate levels of perceived effectiveness: all treatments were effective compared to the null hypothesis of “not effective at all” except for acupuncture, ear plug use, and cigarette use. When compared to a pooled average effectiveness across all treatments, only prescription sleep medications showed a statistically significant difference in effectiveness. Understanding why some patients respond to sleep treatments, while others remain refractory to a broad range of therapeutic options, is an interesting area that merits further research.

The study has several potential limitations. The study used the general term “sleep problems” or “trouble sleeping,” which is not necessarily equivalent to insomnia. We chose this term because the word “insomnia” can be perceived as referring to a disease, and while many older adults may have significant difficulties with sleep, they may not necessarily consider these sleep problems to be insomnia per se. We limited our survey to 21 common treatment options; thus, it is possible that other treatment strategies are used by older adults that we did not capture. For example, we did not have a specific category for cognitive-behavioral therapy for insomnia. However, study participants had the option of entering “Other” activities in a free-text field, but none indicated cognitive-behavioral therapy; thus, it is most likely that cognitive-behavioral therapy was entered into the relaxation therapy category. The OTC sleep medication treatment category and the pain medication category may have frequent overlap; for example, many pain medications are marketed in a “PM” form. Study participants were drawn from a database of older adults who have come to the University of Pennsylvania for their health care (outpatients or inpatients). Thus, these study participants represent a predominantly urban population and may have different demographic characteristics than other groups. Social pressures may have resulted in a response bias. Patients may have underreported negatively viewed activities or treatments such as alcohol, smoking, or even medications. While this may suggest that our data is not completely representative of our elderly population, it does imply that even more patients may be treating themselves than we are aware. There may also be other potential biases in the respondents that may affect the results. For example, potential study participants with

more severe sleep complaints may be more likely to respond to the mailed survey, and these study participants may be more likely to engage in activities or treatments to improve their sleep. Individuals with a higher level of comorbid illness, especially those with vision or musculoskeletal impairments, and those with lower levels of literacy may be less likely to complete the survey, thus our findings may not necessarily be applicable to those groups; it is difficult to estimate what effect these conditions may have on sleep treatment choices.

Another important limitation is that our study did not specifically identify what type of sleep problem a study participant may have; clearly this could play a role in influencing their treatment choices. In particular, we could not assess for sleep apnea in older adults because our study did not include overnight polysomnography. Sleep apnea can be more difficult to diagnose by history or exam in older adults relative to younger subjects since older adults with sleep apnea may not necessarily be overweight or report snoring, thus polysomnography is required for diagnosis.^{25, 26} Sleep apnea may affect up to 20% of older adults, a higher prevalence rate than observed in younger populations possibly due to alterations in upper airway anatomy with aging, amongst other changes.^{26, 27} It can be associated with excessive daytime sleepiness, and unrefreshing sleep.^{25, 26} Some, but not all, studies suggest an association with insomnia as well.^{28, 29} It is thus likely that some of our patients with sleep complaints have co-existing sleep apnea, and that they are attempting to use various sleep treatments to inappropriately address symptoms from their sleep apnea. The use of daytime naps, for example, may be a result of daytime sleepiness from sleep apnea. Furthermore, sleep apnea therapy can be challenging, especially in older adults with functional impairments. There was no specific category on our survey for sleep apnea therapies, such as continuous positive airway pressure therapy, but this could have been entered into the “Other” field, which two study participants did. These two study participants noted improved sleep with sleep apnea treatment.

In conclusion, older adults with sleep complaints have often attempted several treatments, with some subjects having used treatments in 13 of 21 possible treatment areas. While the most commonly used interventions were non-pharmacologic, such as watching TV/listening to the radio or reading, several of these non-pharmacologic approaches can be counter-productive. Of the pharmacologic interventions, pain medications were the most frequently used. A small subset of patients also relied on alcohol as a sleep aid. Many patients using alcohol or OTC sleep aids had not discussed this treatment with their health care provider; this is an important unmet need that could be readily addressed during office visits and could potentially minimize the risk of polypharmacy and adverse drug interactions. Ultimately, it is important to discuss and treat an older adult’s sleep concerns. If they are not addressed, older patients may elect to self-treat and in some cases, may make self-treatment choices that can exacerbate their problems or are potentially harmful through drug-interactions or other side effects. Future work is needed to explore what factors govern the patient-physician interaction in terms of managing patients’ sleep disorders to understand barriers to communication and effective treatment.

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Figure 1.
Bar graph showing the number of treatments used by study participants

Table 1

Percentage of study participants who participated in each activity to treat their sleep complaints and had discussed their sleep complaints with their health care provider. P-values indicate if there is an association between using this activity and discussing sleep complaints with a health care provider (calculated using a chi-square statistic unless otherwise noted).

Activity	Participated in this activity (Percent)	Discussed their sleep complaints with their health care provider (Percent)	p-value
Sleep Hygiene			
"Listened to radio, music or watched TV"	66.4	47.0	0.9
"Read a book, newspaper, magazine"	56.2	46.2	0.9
"Took a nap the next day"	44.0	48.6	0.7
"Did not nap the next day"	35.0	45.2	0.9
"Had a snack"	34.1	52.5	0.2
"Drank other liquids (tea, coffee, milk, etc.)"	32.6	49.0	0.8
"Drank a beer, wine or other alcohol"	13.0	50.0	0.8
"Spoke to someone on the telephone"	8.2	61.5	0.3
"Smoked a cigarette"	4.2	25.0	0.6 [^]
Environment			
"Adjusted temperature of the room, adjusted blankets or clothing"	47.0	48.7	0.8
"Went to a different room to sleep"	15.6	50.0	0.7
"Wear ear plugs"	1.4	66.7	0.6 [^]
Medications			
"Took a pain medicine"	40.1	55.1	0.03
"Took an over-the-counter sleeping pill (Nyquil, Tylenol PM, etc.)"	30.6	48.2	0.7
"Took a prescription sleeping pill (Valium, Ativan, Sonata, etc.)"	22.1	77.5	<0.0001*
Alternative Therapies			
"Did relaxation exercise, hypnosis, meditated"	15.3	40.0	0.5
"Took a vitamins or herb"	11.0	68.2	0.04
"Took melatonin"	10.6	71.4	0.01
"Went for acupuncture treatment"	1.9	75.0	0.3
Other			
"Had a hot bath or massage"	29.6	53.3	0.3
"Went for a walk or exercised (jogging, swimming, etc.)"	18.6	64.3	0.03

[^] Calculated using a Fisher's exact test comparison due to cell counts less than five. Asterisk indicates that the p-value is below the Bonferroni multiple comparisons correction threshold of 0.0024.

Table 2

Self-report of effectiveness of each activity based on a 0-4 scale, with 0 indicating “not effective at all” and 4 indicating “completely effective”. T-tests were performed on the z-score to identify statistically significant differences from the pooled mean. Asterisk indicates that the p-value is below the Bonferroni multiple comparisons correction threshold of 0.0024.

Activity	Mean Perceived Effectiveness (SD)	Range	Z-score	p-value
Prescription sleeping medicine	2.5 (1.2)	0 - 4	0.54 (1.06)	0.001*
Change room	2.1 (1.2)	0 - 4	0.23 (1.03)	0.3
Read	2.0 (1.2)	0 - 4	0.10 (1.03)	0.3
Radio or TV	2.0 (1.1)	0 - 4	0.12 (0.95)	0.2
Change room temperature	2.0 (1.1)	0 - 4	0.11 (0.87)	0.3
Over-the-counter sleeping medicine	1.9 (1.3)	0 - 4	0.08 (1.07)	0.6
Took a nap the next day	1.9 (1.1)	0 - 4	0.05 (0.90)	0.7
Took medicine for pain	1.9 (1.1)	0 - 4	0.03 (0.94)	0.8
Bath/massage	1.8 (1.3)	0 - 4	-0.03 (1.06)	0.8
Alcohol	1.8 (1.0)	0 - 4	-0.05 (0.83)	0.8
Spoke to someone	1.8 (1.2)	0 - 4	-0.09 (1.03)	0.8
Exercise	1.7 (1.3)	0 - 4	-0.14 (1.09)	0.5
Snack	1.7 (1.1)	0 - 4	-0.15 (0.95)	0.3
Drank other liquids	1.6 (1.0)	0 - 4	-0.22 (0.84)	0.06
Relaxation exercises	1.5 (1.2)	0 - 4	-0.35 (1.04)	0.06
Cigarette	1.3 (1.6)	0 - 4	-0.48 (1.37)	0.4
Melatonin	1.3 (1.3)	0 - 4	-0.46 (1.10)	0.09
Vitamins	1.3 (1.3)	0 - 4	-0.50 (1.09)	0.1
Acupuncture	1.3 (1.5)	0 - 3	-0.51 (1.28)	0.5
Refrained from taking a nap the next day	1.2 (1.2)	0 - 4	-0.57 (1.07)	0.02
Ear plugs	1.0 (1.0)	0 - 2	-0.72 (0.85)	0.3