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Bright light therapy for sleep problems in adults aged 60+ (Review)

Montgomery P, Dennis JA

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[Intervention Review]

Bright light therapy for sleep problems in adults aged 60+

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ABSTRACT

Background

The prevalence of sleep problems in adulthood increases with age. While not all sleep changes are pathological in later life, severe disturbances may lead to depression, cognitive impairments, deterioration of quality of life, significant stresses for carers and increased healthcare costs. The most common treatment for sleep disorders (particularly insomnia) is pharmacological. The efficacy of non-drug interventions has been suggested to be slower than pharmacological methods, but with no risk of drug-related tolerance or dependency. Bright light treatment involves participants sitting in front of a "light box" which emits very high (typically 10,000 lux) fluorescent light for periods of around two hours daily. The timing of this light treatment will depend on the irregular timing of the participant's sleep pattern.

Objectives

To assess the efficacy of bright light therapy in improving sleep quality (sleep timing in particular) amongst adults aged 60 and above.

Search methods

The following databases were searched: The Cochrane Library (Issue 1, 2002); MEDLINE (1966 - January 2002); EMBASE (1980 - January 2002); CINAHL (1982 - January 2002); PsycINFO (1887 to January 2002); National Research Register (NRR) (Issue1, 2002). Bibliographies of existing reviews in the area, as well as of all trial reports obtained, were searched. Experts in the field were consulted.

Selection criteria

Randomised controlled trials of bright light therapy for primary sleep problems where 80% or more of participants were over 60. Participants must have been screened to exclude those with dementia and/or depression.

Data collection and analysis

Abstracts of studies identified in searches of electronic databases were read and assessed to determine whether they might meet the inclusion criteria.

Main results

Reviewers found no trials on which to base conclusions for the effectiveness of this treatment.

Authors' conclusions

When the possible side-effects of standard treatment (hypnotics) are considered, there is a reasonable argument to be made for clinical use of non-pharmacological treatments. In view of the promising results of bright light therapy in other populations with problems of sleep timing, further research into their effectiveness with older adults would seem justifiable.

PLAIN LANGUAGE SUMMARY

Bright light therapy for sleep problems in adults aged 60+

Sleep problems become more common with age, affect quality of life for individuals and their families, and can increase healthcare costs. Older people are often prescribed a range of drugs for their health problems (including with sleep) many of which have side effects. This review considered the effectiveness of bright light treatment (also known as phototherapy). This aims to improve sleep by restoring the disturbed cycle of circadian rhythms found in some people with sleep problems by the administration of very high doses of fluorescent light for periods of around two hours a day. Reviewers found no trials on which to base conclusions for the effectiveness of this treatment.

BACKGROUND

Description of the condition

The prevalence of sleep problems in adulthood increases with age (Brabbins 1993; National Commission on Sleep Disorders Research [NCSDR 1993]; Bliwise 1993; Foley 1995; Ford 1989). In the general population the most common types of sleep problems reported are insomnia (both difficulties in initiating and maintaining sleep) and early morning waking with an inability to return to sleep. Older adults primarily report difficulty in maintaining sleep and, while not all sleep changes are pathological in later life (Morin 1989; Bliwise 1993), severe sleep disturbances may lead to depression and cognitive impairments (Ford 1989). Night waking produces significant stresses for carers and is a common cause for demands that institutional living arrangements be made (Pollak 1990).

Prevalence rates of insomnia in people aged 65 and over range between 12 and 40% (Morin 1999c). There are reports that the impact of chronic sleep disturbance impairs waking functions (e.g. mood, energy, performance) and life quality (Borkovec 1982; Morin 1989). There is evidence that sleep disturbances contribute significantly to healthcare costs (Stoller 1994; Simon 1997). Overall, the aetiology of sleep problems in the elderly remains uncertain. There may be a developmental perspective to sleep in this population as the question of whether older adults need less sleep or cannot get more sleep has not yet been answered (Bliwise 1993). Prevalence rates of insomnia are even higher when co-existing medical or psychiatric illness is taken into account (Ford 1989; Mellinger 1995). Lifestyle changes related to retirement, the increased incidence of health problems, and the use of medication, all place older people at increased risk of disrupted sleep (Morgan 1988).

Despite the high prevalence of sleep disorders and their negative impact, it is estimated that less than 15% of patients with chronic insomnia receive treatment (Mellinger 1995). This may be due to a lack of knowledge about sleep and its disorders amongst health professionals. It is reported that the median amount of time spent on sleep issues in medical training in the UK is five minutes (Stores 1998) and that in clinical psychology it is no better (Wiggs 1996). The relationship between sleep problems and depression in the elderly is particularly strong, but difficult to disentangle. It has been reported in a large study by Ford and Kamerow that depression can predict future sleep disturbance, and that unremitting insomnia can itself cause depression (Ford 1989). However, amongst the eight symptoms of major depressive disorder which may predict development of the full syndrome, sleep disturbance is not the most predictive. Sleep disturbances may also be comorbid with impending dementia, but that does not mean they are the cause. Alzheimer-related deterioration of suprachiasmatic nucleus neurons could cause comorbid sleep disturbance in sleep-wake cycle disorders in particular (Kripke 2002).

Description of the intervention

The most common treatment for sleep disorders is pharmacological, particularly for insomnia (Hohagen 1994; Kupfer 1997; Morin 1999b). Lack of knowledge about non-drug treatment and limited access to other forms of professional help are cited by physicians as the main reason for prescribing sleeping pills (Baillargeon 1996); however, the long-term efficacy of this approach, which usually involves the administration of hypnotics (typically benzodiazepines) is not certain. Two consensus conferences sponsored by the National Institute of Health (NIH 1983; NIH 1990) concluded that short-term use of hypnotic medications may be useful for acute and situational insomnia, but that long-term use remains controversial because of the potential risk of tolerance and dependency. The same NIH studies indicate that the drug of choice for the symptomatic treatment of insomnia is a benzodiazepine receptor agonist (e.g. temazepam, zolpidem etc). Nowell et al found that these drugs improve sleep latency (the time between going to bed and going to sleep), number of awakenings, total sleep time and total sleep quality (Nowell 1997). Post-treatment problems were not adequately investigated, as follow-up in this study only extended to one to two nights following discontinuation of the drug's administration. Other drugs, e.g. zaleplon, one of the most popular current benzodiazepine agonists, does not even significantly increase total sleep time. Ultimately, both consensus conferences clearly recommended against long term use of hypnotics.

It has been reported that older people are more likely to be affected by daytime residual effects of these types of drugs (Morgan 1988; Prinz 1990; Kripke 2002); that these drugs may increase the likelihood of patients developing sleep apnoea (Kripke 1983), as well as increasing the risk for falls and fractures (Wettstein 1992; Meyer 1998). Constipation has been correlated positively with hypnotic use (Campbell 1993). Despite this, data have suggested that persons over 60 years of age in the USA are prescribed sedative-hypnotic drugs at more than twice the rate of people 40-59 years of age (Baum 1986). Survey data suggest that older adults in France, Italy, Germany and Canada are even more likely to use hypnotics than Americans (Morin 1999c). The effects of non-drug interventions has been suggested to be slower but more durable than pharmacological methods (McClusky 1991; Milby 1993; Hauri 1997). In view of the potential risks of tolerance and dependency and the frequently high numbers of other drugs that older people may be taking, an evidence-based non-drug approach is of interest.

We intend to investigate the area of non-drug treatments for sleep problems in the older adult by undertaking four separate reviews to cover cognitive behavioural treatments (Montgomery 2003), physiological treatments (Montgomery 2002b), and hypnosis. A summary review will set out the evidence for the full range of non-drug treatments in an effort to answer the clinical question "What alternatives to medication exist for sleep problems in the older adult? "

How the intervention might work

While the quality and duration of sleep are important issues, so is the timing of the sleep phase and it is this which is the object of bright light therapy (Chesson 1999). This is a treatment based on the reports that many poor sleepers have a disrupted cycle of their circadian rhythms. This suggests that their sleep disorders maybe due to a disruption of biological rhythms. This may in turn be due to age-dependent functional changes or organic degeneration of the central nervous system, in particular the suprachiatic nucleus in the hypothalamus. A possible reduction in environmental cues has also been shown to be important. Campbell et al 1988 found that for many older persons, light stimulation was lacking (Campbell 1988). These problems may be particularly severe in higher latitudes and occur amongst other typically housebound populations. The treatment involves participants sitting in front of a "light box"

which emits very high (typically 10,000 lux) fluorescent light for periods of around two hours daily. The timing of this light treatment will depend on the irregular timing of the participant's sleep pattern. For example, to advance a patient's sleep phase, bright light would be administered early in the day.

Why it is important to do this review

Systematic reviews of which mention bright light therapy (Morin 1999c) or even focus on it entirely (Chesson 1999) highlight a lack of good-quality trials in this area.

OBJECTIVES

To assess the efficacy of bright-light therapy treatment for improving sleep quality (sleep timing in particular) amongst adults aged 60 and above.

METHODS

Criteria for considering studies for this review

Types of studies

All relevant randomised controlled trials in which participants had been randomly allocated to an intervention group and a control group. The control groups should be either waiting-list control groups or placebo.

Types of participants

In determining a cut-off point in age for this review, the age of 60 was chosen as being most clinically relevant, following consultation (DPOA 2000). Trials whose focus was explicitly on the older adult were included where 80% or more of participants were recorded as being over the age of 60. Participants must have been diagnosed with sleep problems via standardised measures (e.g. Multiple Sleep Latency Test), objective measures in sleep laboratory (e.g. polysomnography, actigraphy) or by participants' own sleep diaries or reports/diaries kept by partners or nursing staff. Participants must also have been screened to exclude those with dementia and/or depression by the use of psychometrically sound measures such as the Mini Mental State Examination (MMSE) (Folstein 1975), Beck Depression Inventory (Groth-Marnat 1990) or comparable instrument(s). This was to avoid the confounding effects of these conditions.

Sleep problems addressed in this, and related reviews will include:

Primary sleep problems:
* difficulties in initiating and maintaining sleep
* sleep efficiency
* sleep latency
* delayed or advanced sleep phase problems
* parasomnias
* impaired daytime functioning

As sleep apnoea is primarily treated as a respiratory condition, trials whose participants who had been diagnosed as having sleep apnoea were excluded. Those with secondary insomnia or sleep disturbance caused by a psychiatric or medical disorder were also excluded.

Types of interventions

"Bright light therapy" (also known as "phototherapy") as defined by trialist, involving administration of high-intensity light (typically, 10,000 lux at the point of impact) for set periods of time with the purpose of coordinating sleep onset to socially acceptable norms.

Types of outcome measures

Outcomes measures of interest to the review question include:

• Sleep onset latency (time taken to fall asleep)
• Wake after sleep onset (WASO)
• Total wake-time (TWT)
• Sleep duration (total)
• Early morning wakening (defined by the trialist)
• Sleep efficiency (ratio of time asleep / over time in bed)
• Self-report of sleep satisfaction
• Scales related to sleep, e.g.. the Pittsburgh Sleep Quality Index (PSQI [PSQI 1989]); the Sleep Impairment Index (Morin 1993a)
• Daytime functioning (as measured by attentional tasks tests, self-report using a standardised measure, e.g. the Stanford Sleepiness Scale [Hoddes 1973], the Epworth Sleepiness Scale [Johns 1991])
• Quality of life, as measured by validated scales

Outcomes to be divided, where possible, into immediate post-treatment, medium term (3-12 months), and long term (more than 12 months).

Search methods for identification of studies

Electronic searches

The following electronic databases were searched: The Cochrane Controlled Trials Register (The Cochrane Library, Issue 1, 2002), MEDLINE (1966 - January 2002); EMBASE (1980 - January 2002); CINAHL (1982 - January 2002); PsycINFO Journal Articles and Chapter/Books (1887 to 2002); National Research Register (NRR) (Issue 1, 2002);
and the sleep bibliography available at www.websciences.org/bibliosleep/ (1991 - 2002).

Terms were used to isolate controlled trials as appropriate to each database. The search terms in Appendix 1 were used to search the Cochrane Library and were modified as necessary for other databases:

Searching other resources

Reference lists of articles identified through database searches were examined to identify further relevant studies. Bibliographies of systematic and non-systematic review articles were also examined to identify relevant studies and experts in the field were consulted.

Data collection and analysis

Selection of studies

All reports of studies identified as above were inspected independently by the two reviewers. Disagreements regarding relevance were resolved by acquisition and reading of the full article and discussion between the reviewers. All selected articles were independently assessed to determine if they met inclusion criteria including limits on age, diagnosis and screening for comorbid conditions. The reviewers were not blinded to the names

of the authors, institutions or journal of publication. Provision was made for arbitration by a third reviewer although this was not required.

Should data become available, the methods in Appendix 2 will be used to perform a meta-analysis on studies meeting the inclusion criteria.

RESULTS

Description of studies

Following searches in the Cochrane Library, MEDLINE, EMBASE, CINAHL and PsychINFO, four potential references were located. Titles and abstracts were examined by both reviewers and all four papers acquired.

Included studies

No trials met the inclusion criteria for the review.

Excluded studies

Specific details of excluded studies are reported in the 'Characteristics of excluded studies' table. Clarification from trialists concerning the trial design and age of participants investigated in Rosenthal 1990 is still being sought.

Risk of bias in included studies

No trials met the inclusion criteria for the review.

Effects of interventions

No trials met the inclusion criteria for the review.

DISCUSSION

This review confirms the conclusions of other reviews of non-pharmacological treatments for sleep disorders, which identify a lack of good-quality evidence.

Campbell's 1993 study (excluded from this review) did indicate some success in treating advanced sleep phase syndrome (ASPS) (Campbell 1993). Trialists for this study, which included 16 people with a mean age of 70, reported that when objectively measured, exposure to bright light therapy in the early evening successfully advanced the sleep phase of the participants. Promising findings from other studies claiming success in entraining human circadian rhythms in younger adults may not necessarily be generalisable to an older population, although more work is needed to establish this (Rosenthal 1990).

The bulk of the research in the area of bright light therapy is currently done is for a populations excluded by this review, i.e. those with dementia, including Alzheimer (e.g. Saitlin 1992; Mishima 1994; Koyama 1999; Okawa 1989; Koyabashi 2001; Fukuda 2001) and/or depression (e.g. Sumaya 2001). Administration of bright light in these populations appears to be effective in synchronising disturbed sleep and also in reducing the frequency of behaviour disorders. Investigations into the effectiveness of bright light therapy, given the promising nature of results from such trials, seems justifiable. This is further supported by a prospective study examining 5-year mortality among hypnotic drug users and respondents with subjective insomnia identified in a longitudinal study of health, activity, and lifestyle (Nottingham Longitudinal Study of Activity and Ageing) which involved 1042 survey respondents, aged over 65 years, concluded that the mortality rate of participants was significantly greater among those taking some form of medication for sleep than for those not taking sleep medication (Rumble 1992).

AUTHORS' CONCLUSIONS

Implications for practice

Given the current absence of trial evidence in this area, bright light therapy cannot be recommended to clinicians for the treatment of sleep problems in "normal" older adults.

Implications for research

New trials should feature both objective and subjective measures of sleep, as there is a large variation in the interpretation of many sleep variables (McGhie 1962) . Follow-up data should be acquired to determine if any effects of the treatment are durable. Cost-benefit analysis as regards bright light therapy versus pharmacological treatments would be a particularly useful addition to this area of study.

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CHARACTERISTICS OF STUDIES

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Campbell 1993	This controlled trial was not randomised.
Klerman 2001	This is a study of the response of the circadian system of older adults, and is not a randomised trial.
Murphy 1996	This controlled trial assigned participants to treatment on an alternating basis.
Rosenthal 1990	No age or gender given for participants in this randomised controlled trial.

APPENDICES

Appendix 1. Cochrane Library search strategy

Cochrane Library searched Issue 1, 2002

1) SLEEP-DISORDERS*:ME
2) INSOMNIA*
3) WAKEFULNESS

4) SLEEP near DISORDER*
5) SLEEP near PROBLEM*
6) SLEEP near PATTERN*
7) SLEEP near ONSET
8) SLEEP near TIM*
9) SOMNAMBUL*

10) ((((((#1 or #2) or #3) or #4) or #5) or 6) or 7) or 8) or 9)

11) GERIATRICS*:ME
12) GERIATRIC*
13) AGED*:ME
14) ELDERLY
15) (OLD* next PERSON*)
16) (SENIOR next CITIZEN*)
17) (OLD* next PEOPLE)

18) (((((#11) or #12) or #13) or #14) or #15) or #16) or #17)

19) (#10 and #18)

Appendix 2. Methods to be used in updates of the review

Data extraction and management

Should data become available, they will be extracted independently by each reviewer, and compared using data extraction sheets and the "double entry" feature in RevMan 4.1. Where it is not possible to extract any data because they are not available or further information is needed, the first author of the trial will be contacted for clarification. Where it is possible to extract relevant data, comments on the methods, participants, interventions and outcomes will be presented in the "Included Studies" table.

Assessment of risk of bias in included studies

Assessment of methodological quality

Quality assessment will be made of all included studies, to consider the following questions:

- Was the assignment to treatment groups truly random?
- Was allocation adequately concealed?
- How complete was follow-up?
- How were the outcomes considered for people who withdrew?
- Were they included in the analysis?

• Were those assessing outcomes blind to the treatment allocation?

The Cochrane Collaboration Handbook criteria are based on the evidence of a strong relationship between the potential for bias in the results and allocation concealment and are defined as below:

A. Low risk of bias (adequate allocation concealment)
B. Moderate risk of bias (some doubt about the results)
C. High risk of bias (inadequate allocation concealment)

In the event of trials being identified which are potentially suitable for this review, we will contact all authors to acquire details both of the method of randomisation and that of allocation concealment. For the purpose of the analysis in this review, trials will only be included if they meet the criteria A or B of the Handbook.

Assessment of heterogeneity

Statistical heterogeneity will be assessed using the chi-squared test for heterogeneity along with visual inspection of the graph. A significance level of less than 0.10 will be interpreted as evidence of heterogeneity. For data where heterogeneity was found the reviewers will look for an explanation. When studies with heterogeneous results are found to be comparable, the statistical synthesis of the results will be performed using a random effects model; where they are not comparable, no meta-analysis will be undertaken.

Assessment of reporting (publication) biases

Funnel plots will be drawn to investigate any relationship between effect size and study precision (closely related to sample size). Such a relationship could be due to publication or related biases or due to systematic differences between small and large studies. If a relationship is identified clinical diversity of the studies will be further examined as a possible explanation. (See also Egger 1997) .

Data synthesis

For clarification of terms please see *The Cochrane Library* Glossary.

Incomplete data

With the exception of the outcome of 'loss to follow up', if less than 70% of people allocated to the treatments are not reported on at the end of the trial, for a particular outcome, those data will not be used as they will be considered to be too prone to bias.

Continuous (including scale) data

Rating scales: a range of instruments are available to measure sleep quality and the aspects of mental health which are associated with it (see for example Hoddes 1973; Johns 1991; PSQI 1989). Should data become available for outcome instruments, some minimum standards will be required: (i) that the psychometric properties of the instrument should have been described in a book or peer-reviewed journal; (ii) that the instrument should either have been: (a) a self report, or (b) a report completed by an independent rater, bed-partner or relative/ carer (not the therapist); and (iii) that the instrument should be either a global assessment of an area of functioning or a specific feature of sleep quality, duration or timing.

Combining mean treatment effects is straightforward when all measurements are comparable and on the same scale. The fixed effect estimate of the overall treatment effect can be computed as the weighted mean of the individual study effects, "...where the weights are equal to the individual study specific variance estimates. On other occasions it is necessary to transform the mean effect from each study to a standardised value by dividing by the sample standard deviation within each study.

Normal data: to avoid the pitfall of applying parametric tests to non-normally distributed data the following standards will be applied to any available data in future before inclusion: (i) standard deviations and means will be reported in the paper or obtained from the authors; (ii) when a scale starts from a finite number (such as 0), the standard deviation will have to be less than the mean (otherwise the mean will be considered unlikely to be an appropriate measure of the centre of the distribution). Data which do not meet the second standard will not be entered on RevMan software (which assumes a normal distribution).

General

Should relevant data become available for this review, they will be entered into RevMan in such a way that the area to the left of the 'line of no effect' indicates a favourable outcome for the relevant behavioural intervention. In outcomes where a higher number indicated a benefit to the participant when compared to a lower number (e.g., total sleep duration as measured in minutes) data will be entered as negative numbers.

WHAT'S NEW

Date	Event	Description
18 July 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 4, 2001
Review first published: Issue 2, 2002

Date	Event	Description
20 November 2002	New search has been performed	Minor update
18 December 2001	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Both reviewers contributed to the writing of the text of the protocol, the searches and the writing of the review.

DECLARATIONS OF INTEREST

None known.

NOTES

This review is part of a series of reviews examining non-pharmacological treatments for sleep problems in adults over the age of 60. Interventions considered include cognitive-behavioural treatments (CBT) and physical treatments.

INDEX TERMS

Medical Subject Headings (MeSH)

*Phototherapy; Sleep Initiation and Maintenance Disorders [therapy]; Sleep Wake Disorders [*therapy]

MeSH check words

Aged; Humans; Middle Aged