Authors' objectives
To provide practical direction for the treatment of insomnia by investigating the following: the effectiveness of psychological treatments compared with each other and with a placebo, to determine the most effective treatments for the various symptoms of insomnia over short- and long-term periods, to assess the patient and treatment variables that have most influence on outcome, and to determine how effect sizes are related to systematic differences in study methodology.

Searching
PsycLIT and MEDLINE were searched from 1973 to 1993 for articles published in the English language using the keyword 'insomnia', and the reference lists of relevant review articles and books were examined. Unpublished studies were identified from listings of dissertations and theses over the same period, and by communication with prominent researchers.

Study selection
Study designs of evaluations included in the review
No study design criteria are specified. Treatment groups were included if they fulfilled the following criteria: the use of a psychological treatment or a combination of psychological treatments for insomnia; they involved at least 5 insomniacs whose health and background were described or assumed to be normal.

Specific interventions included in the review
Treatment included the following: relaxation approaches incorporating progressive muscle relaxation, meditation, desensitisation, imagery, hypnosis and autogenic training; stimulus control, paradoxical intervention, sleep restriction therapy, and combination treatment consisting mainly of composites of stimulus control and relaxation. Treatments that required equipment, which was considered impractical for general wide-scale use, were excluded.

Participants included in the review
The characteristics of the participants were as follows: mean age 41.65 years (standard deviation, SD = 12.65; range: 17-79 years), proportion of females 61.54%, proportion of solicited volunteers 84.52%, mean duration of chronic insomnia 11.14 years (SD = 4.01), mean sleep onset latency (SOL) 61.41 minutes (SD = 31.38), mean total sleep time (TST) 5.65 hours (SD = 1.12) and number of nocturnal awakenings per night 1.63 (SD = 1.94). Excluded from the review were specialised participants (e.g. prisoners or alcoholics) and insomniacs clinically-diagnosed with other sleep disorders, psychological disturbances or serious medical illness.

Outcomes assessed in the review
The outcomes assessed were SOL, TST, number of nocturnal awakenings and subjective evaluation of sleep quality. These variables were measured using sleep diary data since there was an insufficient number of groups using objective physiological or observer measures of sleep patterns. Short-term (within 3 months of treatment) and long-term (averaging 8 months after treatment) outcomes were included.

How were decisions on the relevance of primary studies made?
Inter-rater agreement for the inclusion of treatment groups was assessed using a random sample of 123 PsycLIT studies; 100% agreement was achieved.

Assessment of study quality
The individual studies were coded on 17 treatment, patient and design characteristics. Design factors considered were the number of groups, the method of allocation to treatment group, the presence of a control group, and the presence of a control group matching SOL. A second researcher independently coded a random sample of 44 treatment groups. The
inter-coder agreement was 100% for 7 of the variables assessed.

**Data extraction**
The following data were extracted and coded: age, sex, duration of insomnia, severity of insomnia, occupation, source, hypnotic drug use, mode of treatment, therapist experience, home practice used, amount of treatment, form, year of presentation, study design, use of objective validation, assessment of expectance and comprehensiveness of result reporting. A second researcher independently coded a random sample of 44 treatment groups. The inter-coder agreement was 94.8% overall.

**Methods of synthesis**
How were the studies combined?
The average effect sizes were calculated, with weighting by sample size. Effect size variance was corrected for artifactual variance. Assuming a normal distribution of effect sizes, 95% confidence intervals (CIs) were calculated for each effect size using the corrected estimation of variance. Where possible, effect sizes were calculated for each outcome, for each treatment group, by dividing the difference between the treatment groups (pre- or post-)and the change in the control group, by the pooled standard deviation. Where there was no control group, pre-treatment measures were used as the no-treatment comparison group. If a treatment group produced 2 or more effect sizes for one outcome they were combined by calculating the average. The maximum number of effect sizes a single treatment group could contribute to the overall analysis was limited to 8.

How were differences between studies investigated?
Stepwise and hierarchical regressions were used to identify the potential moderating variables that were significant predictors of effect size, and to determine whether treatment methods predicted effect size after controlling for differences in patient characteristics, treatment setting and methodological features.

**Results of the review**
A total of 139 treatment groups from 66 studies were assessed (n=1,538 and n=369 for experimental and no-treatment participants, respectively). The numbers of studies and the number of participants used to analyse the various outcomes are unclear.

Progressive muscular relaxation-based approaches were assessed from 40 groups. Other relaxation approaches, including meditation, desensitisation, imagery relaxation, hypnosis and autogenic training, were assessed from 16 groups.

Stimulus control approaches were assessed from 25 groups.

Paradoxical intention approaches were assessed from 14 groups.

Sleep restriction approaches were assessed from 4 groups.

Combination treatments were assessed from 23 groups.

Placebo effect sizes were assessed from 17 groups.

Results are given for all 4 outcomes and for all treatments investigated. Only summary results are quoted below.

SOL: overall weighted mean effect 0.87 (95% CI: 0.58, 1.16); the weighted mean effect ranged from 0.46 (placebo) to 1.16 (stimulus control).

Follow-up weighted mean effect: 1.01 (95% CI: 1.01, 1.01); the weighted mean effect ranged from 0.43 (placebo) to 2.04 (other relaxation).

TST: overall weighted mean effect 0.49 (95% CI: 0.49, 0.49); the weighted mean effect ranged from 0.1 (paradoxical
intention and placebo) to 0.78 (combination).

Follow-up weighted mean effect: 0.54 (95% CI: 0.54, 0.54).

Number of nocturnal awakenings: overall weighted mean effect 0.63 (95% CI: 0.63, 0.63); the weighted mean effect ranged from 0.37 (other relaxation) to 1.00 (paradoxical intention).

Follow-up weighted mean effect: 0.78 (95% CI: -0.08, 1.64).

Sleep quality ratings: overall weighted mean effect 0.94 (95% CI: 0.28, 1.60); weighted mean effect ranged from 0.21 (placebo) to 1.30 (stimulus control).

Follow-up weighted mean effect: 1.30 (95% CI: 1.30, 1.30).

The following factors were found to be significant predictors of effect size: source of participant, i.e. clinically-referred compared to solicited volunteer, non-hypnotic drug user compared to hypnotic user, year of study and presence of home practice. These 4 variables accounted for 28.5% of the variance. After controlling for differences in patient characteristics, treatment settings and methodological features, the significant predictors of the effect size were the source of participants, non-use of drugs and placebo treatment. None of the design variables considered were found to influence effect size estimates.

Authors' conclusions
Psychological interventions produce reliable and durable benefits in the treatment of insomnia. It appears that active treatments are superior to placebo therapies but they do not differ greatly among themselves. Treatment gains for sleep latency period were greater for clinically-referred patients and for insomniacs who were not regular users of sleep medications. Empirical research is needed to evaluate treatment efficacy on alternative indices of insomnia, and to identify the conditions for optimum outcome.

CRD commentary
The methodology of this review accounts for some sources of potential bias but it should have considered additional sources and clarified some methodological aspect. The inclusion of published and unpublished material in the literature search should have revealed most relevant studies, but by limiting the search to English language articles, some may have been omitted. Inclusion criteria for studies are not specified and only selective data were analysed, i.e. that from specific treatment groups and not from entire studies. Some potential sources of bias were accounted for by including both unpublished and published studies, by assessing inter-rater agreement for inclusion of the primary studies, and by coding the extracted variables. The analysis included an investigation into the effect of study methodology on the effect size, but the criteria used to assess study methodology appeared minimal. The summary effect sizes were calculated using data from both with and without control groups and may have resulted in an over-estimate of effect. Several of the 95% CIs are given as point estimates rather than a range and the reason for this is not stated. Attrition rates are quoted as being greater than 50% from post-treatment to follow-up and, as the authors state, reporting bias may have affected the assessment of follow-up treatment effect size. It is unclear whether the analysis was performed on an intention to treat basis for the short- or long-term follow-up outcomes. There are no details of the included trials, no details of the number of participants on which the results are based, and although the studies were coded on 17 variables, no details of the scores are given for the individual studies. Hence, no judgement can be made on the strength of the evidence offered.

Implications of the review for practice and research
Empirical research is needed to evaluate the most cost-effective treatment for insomnia based on objectively validated indices of insomnia, and to identify the conditions for optimum outcome.

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