CRD summary
This review concluded that virtual reality exposure therapy (VRET) was highly effective in treating phobias when compared with active or inactive controls, and was slightly but significantly more effective than in vivo exposure. The results should be treated with caution due to the lack of reported methodological details.

Authors' objectives
To assess the effect sizes associated with virtual reality exposure therapy (VRET) when compared to in vivo exposure or control conditions for the treatment of anxiety disorders.

Searching
PsycINFO and MEDLINE were searched from inception to February 2007. Cochrane Central Register of Controlled Trials was searched for the first quarter of 2007. Search terms for all databases were reported. Citation maps and 'cited by' search tools were used to identify additional studies and these were cross-referenced with citations from relevant reviews. Only English language papers were considered for inclusion.

Study selection
Included studies were randomly assigned or matched comparisons of VRET with an active or inactive control group in a between-group study design. Although anxiety disorders were clearly the focus of the review, these were not specified or defined in the inclusion criteria. Included studies used VRET versus no treatment or wait list, or VRET versus in vivo exposure, attention control, bibliotherapy or a relaxation control group. The VRET intervention was delivered in varying numbers of session (range 1 to 12). The participants were described as having a specific phobia, social phobia, panic disorder or post traumatic stress disorder (PTSD). Outcome measures were not specified but included domain-specific subjective distress, general subjective distress, cognitive factors, behavioural factors and psychophysiological factors, all of which were measured using a variety of psychometric scales.

The authors stated neither how papers were selected for the review nor how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The outcome data was grouped according to specified categories: domain-specific subjective distress, general subjective distress, cognitive, behavioural and psychophysiological. Each category covered a number of outcome scales. Between-group effect sizes were calculated for each study using Hedges g. Where studies reported multiple outcomes, these were categorised as above and then combined within each domain. Multiple outcomes were combined (reference for method in original paper). Where possible, effect sizes were calculated directly. Otherwise these were estimated using conversion equations for significance tests. All effect sizes were adjusted for small sample sizes and then interpreted using the Cohen convention of 0.2 = small, 0.5 = medium and 0.8 = large. Authors were contacted for missing data where possible. The authors did not report how many reviewers extracted the data.

Methods of synthesis
Meta-analysis was carried out using both a fixed- and random-effects model to calculate overall mean effect sizes for comparisons of interest, and additionally for each outcome category. Hedge's g and Cohen's d were both calculated. Meta-regression was used to explore the relationships between number of sessions and effect size, sample size and effect size, and publication year and effect size. Publication bias was assessed by calculating the fail-safe N, or number of studies showing no evidence of benefit that would have to be located in addition to those already included to change the results significantly.
Results of the review
Thirteen studies (n=397) were included in this review: 11 used random assignment (n=343) and two (n=54) used matching to allocate the groups; nine studies addressed a specific phobia.

VRET versus control: random-effects analysis produced a mean overall effect size of Hedge's g = 1.08 (95% CI: 0.80, 1.35) and of Cohen's d = 1.11 (95% CI: 0.82 - 1.39), indicating a large effect size in favour of VRET compared with control conditions.

When analysed by outcome categories, all comparisons indicated either a medium or large effect size for VRET over control conditions: general subjective distress Hedge's g = 0.5 (95% CI: 0.006, 0.95) based on four studies; cognitive measures Hedge's g = 1.30 (95% CI: 0.70, 1.91) based on five studies; behavioural measures Hedge's g = 1.27 (95% CI: 0.66, 1.88) based on two studies; and psychophysiological measures Hedge's g = 0.68 (95% CI: 0.03, 1.34) based on two studies.

VRET versus in vivo exposure: VRET was more effective than in vivo exposure according to random-effects measures of both Hedge's g 0.34 (95% CI: 0.05, 0.63) and Cohen's d 0.35 (95% CI: 0.02, 0.65), indicating there was a small effect in favour of VRET.

Meta-regression found: a non-significant trend towards a dose-response relationship between number of sessions and effect sizes (p=0.06); no significant relationship between sample size and effect size (p=0.10); and no significant relationship between publication year and effect size (p=0.70).

Calculation of the fail-safe N indicated that it would require more than 231 additional studies with an effect size of 0 to reduce any of the primary findings to non-significant levels.

Authors' conclusions
VRET was highly effective in treating phobias when compared with active or inactive controls and was slightly but significantly more effective than in vivo exposure.

CRD commentary
This review addressed a broad clinical question with appropriate inclusion criteria. The database search could have been broadened to include EMBASE (a standard reference source). The included papers were restricted to English language only, so language bias was possible. The searches did not appear to have been designed to detect any grey literature, so there was potential for publication bias. No validity assessment appeared to have been carried out within this review, which makes it difficult to judge the reliability of the included primary studies. The authors did not report on the methodological processes used (such as how study selection/data extraction was carried out, how many reviewers performed each task, any checking carried out), so reviewer error or bias could not be ruled out.

It was unclear why one study was excluded on the basis of being the only study comparing VRET with imaginal exposure; as a consequence this review may not represent the fullest picture of the available evidence. The analysis was carried out without grouping studies according to the target anxiety condition or control condition. This may have been appropriate, but was difficult to assess as neither clinical nor statistical heterogeneity was considered. The analysis of VRET versus control was performed using overall effect sizes from each study averaged across outcome domains and then used to calculate a pooled effect size; this made it difficult to interpret the main results.

This review appears to draw reasonable conclusions based on the included evidence, but methodological shortcomings mean the results should be treated with caution.

Implications of the review for practice and research
Practice: the authors state that a broader application of VRET in clinical practice is justified by this meta-analysis.

Research: the authors state that future research should incorporate behavioural avoidance tests to assess the impact of treatment on anxiety provoking situations and generalisation to the real world.
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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.