CRD summary
This review assessed stroke rehabilitation using virtual reality interventions. The authors concluded that, although the findings were generally positive, the evidence base was too weak for the value of the interventions to be definitively assessed. These conclusions accurately reflect the results of the review, despite some shortcomings in the methodology and reporting.

Authors' objectives
To assess the usefulness of virtual reality in stroke rehabilitation.

Searching
MEDLINE, EMBASE, AMED, CINAHL, PsycINFO and ProQuest were searched from inception or 1980 to September 2004; the search terms were reported. Only studies reported in English were eligible for inclusion in the review.

Study selection
Studies that used any form of virtual reality as a rehabilitation intervention for patients with stroke were eligible for inclusion. Studies of patients with a variety of stroke foci and symptomatology were included in the review. The included studies used a wide range of virtual reality interventions which focused on skills such as memory, spatial awareness, motor control and balance. The majority of studies used a desktop personal computer to deliver the intervention, but head-mounted displays, glasses and alternative monitors were also used, as were a variety of user interfaces. Where reported, the number of virtual reality sessions ranged from 1 to 20, and lasted between 13 and 150 minutes. Studies were required to report levels of impairment or activity levels as outcomes. The outcomes reported were predominantly related to motor function; other outcomes included range and speed of movement of upper limb or gait, and measures of strength. The outcomes were mostly assessed using computer-based measures and kinematic data derived from motion tracking devices. Inclusion criteria were not stated for the study design; the included studies were randomised controlled trials (RCTs), controlled clinical trials (CCTs), uncontrolled trials and case reports.

The authors stated that studies were selected for the review by screening abstracts, with full papers assessed where necessary, but did not state how many reviewers performed the selection.

Assessment of study quality
Studies were assessed for validity using the American Academy for Cerebral Palsy and Developmental Medicine adaptation of Sackett's validity scoring, which assigns studies to levels of evidence and then grades them as 'strong', 'moderate' or 'weak' within the level assigned.

Two reviewers independently assessed the studies for validity. Any disagreements were resolved by consensus.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The studies were combined in a narrative, with studies grouped by their assessed level of evidence.

Results of the review
Eleven studies were included in the review, of which three were RCTs, one was a CCT, one an uncontrolled study and six were case reports.
The three RCTs were classified as weak level I evidence. The remaining studies were classified as level III, IV or V and were regarded as weak.

The three RCTs all reported statistically significant improvements following virtual reality training. One found that active involvement in virtual environments improved memory training performance significantly more than passive observation or control conditions (p-value not reported); a second found significantly greater improvements in gait velocity in a group given virtual rather than 'real' training sessions (p< 0.01) as well as improvement on other measures of ambulation; the third found improvements in symmetric posture during sit-stand transitions.

The non-randomised studies reported a range of improvements in outcome measures; details were reported in the paper.

**Authors' conclusions**
The findings of the review were generally positive, but the evidence base was too limited by design and power to allow a definitive evaluation of its value.

**CRD commentary**
The review question and the inclusion criteria were clear if broadly defined. The authors searched a number of relevant databases, but the restriction to published studies reported in English might have increased the possibility that some relevant studies were not included in the review. The authors reported using methods designed to minimise bias and error in the assessment of study validity, but not in the selection of studies or the extraction of data. The authors undertook a validity assessment, but this was primarily based on assignment to 'levels of evidence' which may not be informative. The decision to employ a narrative synthesis was appropriate. The authors' cautious conclusions appear to reflect the evidence presented in the review, although the poor reporting of review methodology should be borne in mind.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.

Research: The authors stated that further rigorously designed controlled studies are required.

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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.