CRD summary
The authors concluded that spinal manipulation in children can be associated with serious adverse events, but the incidence of such events cannot be determined from observational studies. This was generally a well-conducted review and the authors’ conclusions are likely to be reliable.

Authors' objectives
To examine data on adverse events associated with paediatric spinal manipulation.

Searching
MEDLINE, PubMed, EMBASE, CINAHL, AltHealthWatch, MANTIS and ICL were searched from inception to June 2004. Details of the search strategy were reported as being available on request. No language restrictions were applied. In addition, reference lists were screened and authors of relevant studies and experts in the field were contacted for information about further studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs), controlled trials, case reports, case series, case-control studies, surveys or surveillance studies were eligible for inclusion.

Specific interventions included in the review
Studies of spinal manipulation were eligible for inclusion. Inclusion criteria were not limited by the comparison intervention. Where reported, a variety of types of spinal manipulation were used: strong rotation; flexion, extension, axial loading; rapid manual rotations of the head with flexion and extension; assisted passive motion of cervical spine; high velocity, low-amplitude; and Gonstead technique. Where reported, chiropractors (including students) mainly performed the manipulations; other practitioners included physiotherapists and medical doctors.

Participants included in the review
Studies that included children aged 18 years or younger were eligible for inclusion. Where reported, children were undergoing spinal manipulation for a variety of conditions, such as congenital torticollis, spinal cord astrocytoma, osteogenesis imperfects, head and neck and back pain, nocturnal enuresis and chronic otitis media.

Outcomes assessed in the review
Studies that reported adverse events were eligible for inclusion. The review assessed adverse events associated with the delivery of spinal manipulation and those associated with delayed or missed diagnoses. Adverse events were classified as severe (hospitalisation, permanent disability, mortality), moderate (transient disability with the seeking of medical aid but no hospitalisation), minor (self-limiting, requiring no additional medical care) and delayed diagnosis or treatment (moderate to severe adverse events as defined previously, as a result of delayed diagnosis or treatment of a medical condition).

How were decisions on the relevance of primary studies made?
Two reviewers independently screened titles and abstracts, while three reviewers independently selected the studies.

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

Data extraction
Two reviewers independently extracted the data and resolved any discrepancies through recourse to a third author if required.
Methods of synthesis
How were the studies combined?
The studies were grouped by study design and type of adverse events (direct or indirect) and combined in a narrative.

How were differences between studies investigated?
Differences could be observed through the tables of studies and results.

Results of the review
Two RCTs (n=191) and 11 case series/reports (n=34) were included.

Fourteen patients with direct adverse events were found. Of these, nine cases were classified as serious and ten occurred within 24 hours of spinal manipulation. Cases included subarachnoid haemorrhage, paraplegia and dislocations of cervical vertebrae.

Twenty patients with delayed diagnoses or treatment were also identified. Seven involved delayed treatment for cancer, two involved delayed treatment for meningitis, and one involved delayed treatment for embryonal rhabdomyosarcoma (the three latter cases resulted in death). Other cases involved delayed diagnosis of cervical adenitis, encopresis, otitis media, Crohn's disease, diabetes mellitus, partial complex seizures, hypertension with unilateral renal disease, anaemia, severe rheumatoid arthritis and slipped femoral epiphysis (one case each).

One RCT (171 children who all received spinal manipulation) reported two adverse events. Both were of moderate severity (one child with severe headaches and one with acute lumbar pain; both resolved). Another RCT (20 children, of which 9 received treatment) reported two minor adverse events (one midback soreness and one irritability; both resolved).

Authors’ conclusions
Spinal manipulation in children can be associated with serious adverse events, but the incidence of such events cannot be determined from observational studies.

CRD commentary
The review addressed a clear question that was defined in terms of the participants, intervention and outcomes; the inclusion criteria for study design were appropriately broad. Several relevant sources were searched and attempts were made to minimise publication and language bias. Methods were used to minimise reviewer error and bias in the study selection and data extraction processes. It was appropriate to classify adverse events according to severity and combine the studies in a narrative with accompanying tables. Validity was not assessed, but the limitations of evidence from observational studies were discussed. This was generally a well-conducted review and the authors’ conclusions are likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that, until the incidence of serious adverse events associated with spinal manipulation is known, clinicians should ask parents and children about the use of complementary medicine and warn them that serious adverse events or delayed treatment, although rare, can occur.

Research: The authors stated the need for prospective population-based studies to identify the incidence of serious adverse events associated with spinal manipulation.

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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.