A systematic review of the routine monitoring of growth in children of primary school age to identify growth-related conditions

CRD summary
This review evaluated the clinical effectiveness of growth monitoring of children and determined the diagnostic performance of growth-monitoring strategies for the identification of growth-related conditions. The authors concluded that growth monitoring may potentially have utility and cost-effectiveness implications for increased detection of stature-related disorders, but emphasised the need for further research. The conclusions are likely to be reliable.

Authors' objectives
The review addressed a range of objectives around growth monitoring in children, including determining the clinical effectiveness of growth monitoring in terms of the age of diagnosis and management/outcome of children, and determining the diagnostic performance of growth monitoring strategies for the identification of growth-related conditions.

Searching
Twenty-four electronic databases and resources including MEDLINE, EMBASE, BIOSIS Previews, Science Citation Index and Google were searched for published and unpublished studies from inception to July 2005. Search terms were reported. Handsearching of journals, scanning of reference lists of included papers and contacting experts in the field were used as means of identifying any further relevant studies. Studies set in developing countries were excluded; no other limits were applied.

Study selection
Growth monitoring studies were included in the review if they were conducted with children aged four to 11 years in Western Europe, North America or Australia/New Zealand (excluding aboriginal populations) and reported any single or serial height measure, height/weight ratio, body mass index (BMI) or alternative obesity indices as part of a population-level assessment. Studies had to target the following conditions: growth hormone deficiency (GHD), juvenile hyperthyroidism (JH) or Turner's syndrome (TS). Also eligible were studies that targeted other syndromes associated with short stature, psychosocial growth failure caused by emotional, physical, sexual abuse and neglect, clinical conditions associated with tall stature and obesity. Studies that monitored trends to determine prevalence of obesity were excluded. For the clinical effectiveness question, randomised controlled (RCTs) or non-randomised controlled studies (CCTs) that compared screened versus unscreened populations or different screening strategies were eligible for inclusion. For the diagnostic performance question, diagnostic cohort or case-control studies were eligible for inclusion in the review.

Studies selected for review that evaluated measures of obesity included: the use of body mass index (BMI) with different thresholds and classifications; evaluated BMI and skinfold thickness; BMI and skinfold thickness in addition to weight; weight for height or relative weight; and BMI and ideal body weight. Most included studies used densitometrically defined body fat as the reference standard. Studies included only children reported to be too tall or too short according to a designated threshold and did not include children of normal height. Intervention delivery agents and measuring tools/thresholds varied between studies.

The studies were screened for inclusion independently by two reviewers; any disagreements were resolved by consensus or referral to a third reviewer.

Assessment of study quality
The quality of RCTs was assessed using a 10-item checklist developed by the Scottish Intercollegiate Guidelines Network (including items on randomisation, concealment of allocation and blinding). The quality of diagnostic accuracy studies was evaluated using a modified version of the QUADAS tool (which included items that addressed, spectrum bias, verification bias and accounting of withdrawals).
Validity assessment was carried out by one reviewer and checked by a second; disagreements were resolved by consensus of through referral to a third reviewer.

**Data extraction**

For obesity, diagnostic accuracy studies, sensitivity and specificity with 95% confidence intervals (CIs) were calculated from 2x2 data for each study. CIs were calculated using the Wilson score confidence interval method. For growth monitoring studies, detection rates for the numbers of new cases were extracted and 95% CIs calculated.

Data were extracted by one reviewer and checked by a second; disagreements were resolved by consensus or through referral to a third reviewer.

**Methods of synthesis**

Diagnostic accuracy studies were combined in a narrative synthesis and in tables grouped by index test and age groups/ranges, with an emphasis on studies of populations considered representative of the UK population.

**Results of the review**

No controlled trials of the impact of growth monitoring or studies of the diagnostic performance of different methods for stature-related growth monitoring were found. Examination of 12 studies (n ranged from 1,592 to 114,881; 45% to 100% were eligible for inclusion) presenting the diagnostic yield of growth monitoring indicated that one-off screening might identify between 1:545 and 1:1793 new cases of potentially treatable growth conditions.

Eleven studies (n=13,388; sample size ranged from 138 to 3,948) evaluated the diagnostic performance of measures used to detect obesity. None of these met all 12 QUADAS criteria. All studies avoided verification bias, but the generally poor quality of reporting meant that many criteria could not be said to be met. Included studies focused predominantly on the performance of BMI against measures of body fat. Sensitivity ranged from 0.17 to 1 and specificity ranged from 0.82 to 1. These studies were heterogeneous in terms of their thresholds and reported sensitivity and specificity measures, but overall BMI often appeared a poor predictor of obesity when compared with densitometrically defined measures of fat mass.

Studies on attitudes towards routine growth monitoring programmes and human resource requirements were reported in the review.

**Cost information**

An economic model conducted alongside the review indicated that growth monitoring was associated with health improvements with an incremental cost-per QALY (Quality Adjusted Life Year) of £9,500.

**Authors’ conclusions**

Data were inadequate to answer questions on harms and benefits of growth monitoring to detect growth disorders and findings were unclear for obesity. This review indicated the potential utility and cost-effectiveness of growth monitoring in terms of increased detection of stature-related disorders and pointed strongly to the need for further research.

**CRD commentary**

This was a well-conducted review of the literature. The review questions were clearly defined in terms of the study characteristics of interest. The authors searched a wide range of sources without language or publication restrictions, thus minimising the possibility of any relevant studies being missed. Validity of included studies was assessed using appropriate tools and the results of this assessment were incorporated into the synthesis. The use of a narrative synthesis was appropriate given the clear heterogeneity between included studies. Throughout the various review processes, the authors reported procedures intended to minimise the potential for bias and error. Given these strengths and the observed limitations of the primary studies, the authors’ conclusions are likely to be reliable.

**Implications of the review for practice and research**
**Research:** The authors made extensive and detailed recommendations for future research to establish the clinical and cost-effectiveness of stature-related growth monitoring. They suggested that clinical effectiveness would ideally be evaluated in a cluster randomised trial that compared growth monitoring strategies with no growth monitoring in a general population. Before a similar trial could be undertaken for obesity monitoring, the authors suggested the need for research to identify effective weight reduction strategies and primary prevention strategies.

**Practice:** The authors stated that a range of uncertainties needed to be addressed before moving away from the current population-based approach to obesity monitoring.

**Funding**
The review was funded by the NIHR Health Technology Assessment Programme; project number 04/09/02

**Bibliographic details**

**Linked records**
- Childhood obesity: should primary school children be routinely screened? A systematic review and discussion of the evidence
- Growth monitoring for short stature: update of a systematic review and economic model

**Original Paper URL**
http://www.hta.ac.uk/execsumm/summ1122.htm

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Anthropometry; Child; Child Development /physiology; Child, Preschool; Cost-Benefit Analysis; Great Britain; Growth /physiology: Growth Disorders /diagnosis; Guidelines as Topic; Obesity /diagnosis /prevention & control

**AccessionNumber**
12007008390

**Date bibliographic record published**
10/03/2008

**Date abstract record published**
12/08/2009

**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.