Effectiveness and cost-effectiveness of paediatric bariatric surgery: a systematic review
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CRD summary
This review concluded that evidence from small retrospective studies suggested that bariatric surgery in older children reduced weight significantly and improved co-existing health problems and quality of life, but postoperative complications, compliance and follow-up might be more of a problem for adolescents than for adults. These authors' conclusions reflect the evidence presented and acknowledge its limitations.

Authors' objectives
To evaluate the effectiveness and cost-effectiveness of surgery for obese children and adolescents.

Searching
PubMed, Web of Science, EMBASE, and The Cochrane Library were searched to September 2010, for articles with an abstract in English. Full-text articles in Danish, English, French or Norwegian were eligible. Search terms were reported. Reference lists of retrieved articles and reviews were searched.

Study selection
Studies evaluating paediatric bariatric surgery, and including participants aged 19 years or younger, were eligible for inclusion. Studies had to report at least one postoperative weight loss measure and at least one year of postoperative follow-up.

The included studies were conducted in Europe, Israel, Saudi Arabia, USA, Australia, Canada, Trinidad and Tobago, Ecuador, or Brazil. The interventions included the laparoscopic adjustable gastric band, Roux-en-Y gastric bypass (laparoscopic or open surgery), and other surgical interventions (details were reported). The outcomes were reduction in body mass index (BMI), mortality, improvement in comorbidities, and postoperative complications. The age of participants ranged from six to 19 years. Their mean baseline BMI, in kg per m², ranged from 38 to 54 for laparoscopic adjustable gastric band, from 48 to 67 for Roux-en-Y gastric bypass, and from 44 to 62 for other surgical interventions.

The authors did not state how many reviewers selected studies for inclusion.

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

Data extraction
The change in body mass index (BMI), mortality, comorbidities and complications, from before surgery to postoperative follow-up, were extracted for each study. The authors did not state how many reviewers extracted the data.

Methods of synthesis
The data were grouped by type of surgery and combined in a narrative, with additional information in tables.

Results of the review
Thirty-four studies were included, with 831 participants (range one to 78). There was one randomised controlled trial (RCT), one retrospective cohort, one longitudinal study, two prospective longitudinal trials, eight cohort studies, 10 retrospective chart reviews, and 11 case series.

Laparoscopic adjustable gastric band: Where reported, in 13 studies (one RCT), the mean follow-up ranged from 16 months to 39.5 months. Reductions in the mean BMI ranged from 8.5 to 43kg/m² at postoperative follow-up, across 12 studies. One study (one patient) reported a weight gain of 2.2kg/m². The one RCT reported a greater decrease in mean BMI with the gastric band (12.7kg/m²), after two years, compared with a lifestyle intervention (1.3kg/m²). Nine studies reported an average excess weight loss at 12 months after surgery, ranging from 34% to 60%. The resolution of specific comorbidities was reported in 11 to 100% of cases (seven studies). Seven studies reported no surgery-related deaths.
Most studies reported a range of complications, including band slippage, band removal due to psychological intolerance, vomiting, band readjustment, and weight gain.

**Roux-en-Y Gastric bypass**: Where reported, in eight studies, follow-up ranged from 12 to 48 months. All eight studies reported reductions in the mean BMI ranging from 9 to 25kg/m² at postoperative follow-up. No surgery-related deaths were reported. Most studies reported some postoperative complications, including dehydration, peristomal ulcer, intestinal leakage, wound infection, anastomotic stricture, nutritional deficiencies, acute gallstone pancreatitis, iron deficiency anaemia, and bowel obstruction.

**Other surgical interventions**: Where reported, in 14 studies, the mean follow-up ranged from 12 to 132 months. All fourteen studies reported reductions in the mean BMI ranging from 9 to 24kg/m² at postoperative follow-up. Improvements were reported in physical health (four studies) and mental health (one study). Three surgery-related deaths, due to protein energy malnutrition, pulmonary oedema and acute necrotising pancreatitis, were reported in one study. Surgical complications were reported in nine studies and included pulmonary embolism, nutritional deficiencies, infection and ulcers, dumping syndrome, and mechanical problems. Two studies reported weight gain in a few participants.

**Cost information**
Three articles assessed the cost-effectiveness of the laparoscopic adjustable gastric band in adolescents, based on the Assessing Cost-effectiveness in Obesity project. Using cost data from 28 patients, extrapolated to the Australian adolescent population, the estimated net cost savings per disability-adjusted life-year were 44,400 Australian dollars, compared with other treatments and preventive measures. Gastric banding was deemed cost-effective, but there were concerns about its acceptability, feasibility, sustainability and equity.

**Authors’ conclusions**
The evidence, from underpowered retrospective studies, suggested that bariatric surgery for older children reduced weight significantly and improved comorbidities and quality of life, but postoperative complications, compliance and follow-up might be more of a problem for adolescents than for adults.

**CRD commentary**
The review question was clear, with defined inclusion and exclusion criteria. Several relevant sources were searched. The restriction to four languages and the exclusion of grey literature may mean that some relevant studies were missed. It was unclear whether appropriate methods to reduce reviewer error and bias were used throughout the review. Study quality was not assessed, but the authors noted that most of the evidence was from retrospective or observational studies, which are open to multiple biases, and the samples were too small to detect an effect. A narrative synthesis was appropriate, given the differences between the studies, in their interventions, follow-up, outcomes and participants.

There remains a possibility of bias if only one reviewer conducted the key processes of the review, but the authors' conclusions reflect the evidence presented and acknowledge its limitations.

**Implications of the review for practice and research**
**Practice**: The authors stated that until there was an improvement in the quality of the available evidence, child and adolescent bariatric surgery should be used with caution. Reversible techniques were advised. Public health experts should convince governments of the importance of health promotion to prevent obesity.

**Research**: The authors stated that further long-term prospective studies and controlled clinical trials were needed. Clear care criteria should be determined for clinicians and teams performing bariatric procedures in adolescents. Future studies should include long-term monitoring, and measures of obesity, other than BMI, should be investigated. Further research questions were raised.

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