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A Rapid Review of Economic Literature Related to The Promotion of Physical Activity, Play and Sport for Pre-school and School Age Children in Family, Pre-school, School and Community Settings

PDG Report

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Introduction

The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop guidance on a public health programme aimed at "promoting physical activity, play and sport for pre-school and school age children in family, pre-school, school and community settings". Reviews of effectiveness literature have been carried out by the NICE Public Health Collaborating Centre in four core areas, namely:

- The Under-Eights;
- Adolescent Girls;
- Active Travel;
- Families and Community

This report presents findings from a rapid review of the economic evidence relating to the promotion of physical activity, play and sport in these four core areas.

Methods

Relevant literature for this review was obtained from four principal sources:

- Review of effectiveness literature search results;
- A dedicated search of health economic literature databases;
- Internet searches;
- Review of papers extracted from personal libraries.

The search strategy identified a total of 101,479 titles. Studies were excluded from the review if they provided no economic evidence that was directly linked to any of the core areas identified in the effectiveness reviews. The titles, and where appropriate/available abstracts, were scanned for relevance and 67 papers were ultimately assessed against the inclusion criteria. Of these, 2 papers were identified as being full economic evaluations. Their quality was assessed and data were extracted and tabulated into evidence tables. A further 37 studies were not economic

evaluations but were retained as they could potentially inform the economic modelling.

Results

The literature contained very limited economic evidence. Two studies met the criteria for quality appraisal.

The first (Goldfield et al., 2001) considered the results of a randomised controlled trial and compared the cost-effectiveness of two protocols for the delivery of a family-based behavioural treatment programme for obese children (between the ages of 8 and 12 years) and their obese parents, in a US setting. The quality of this study was graded as '-'. The authors suggested that family-based behavioural treatment for childhood obesity is more cost-effective when provided in group format, compared to the combination of group plus individualised treatment.

The second study (Wang et al., 2003) considered the results of a cluster randomised controlled trial and examined the cost-effectiveness and cost-benefit of Planet Health, a school-based intervention to reduce obesity in middle-school aged children (between the ages of 11 and 14 years), also in a US setting. The quality of this study was graded as '+'. The authors suggested that this programme is cost-effective in base-case and all other scenarios projected in the sensitivity analyses, and yielded net benefits to society in base-case and in most other scenarios considered in the sensitivity analysis.

The 37 studies retained with a view to informing the economic modelling work contained a mixture of resource use, costs or outcomes data, of variable quality. Just 3 of these studies were rated as 'Good' in terms of their generalisability to the NICE terms of reference for this guidance, with 14 rated as 'Moderate' and 20 rated as 'Limited'.

Discussion

Overall, there was very limited economic evidence with respect to the promotion of physical activity, play and sport in the four core areas identified. These findings are

not unusual in reviews of economic literature, not only on specific public health interventions but also on broader public health programmes.

Of the two quality appraised studies, Goldfield et al 2001 contained a number of inconsistencies, and we therefore had some reservations about the quality of this paper. It was undertaken from an uncertain viewpoint, and key costs and consequences were not included. A true incremental cost-effectiveness analysis was not reported and no allowance was made for uncertainty. Furthermore no attempt was made to generalise the results to other settings outside of a white US population. Crucially for these guidelines, no real implications of promoting physical activity can be identified, as this intervention was combined with other behavioural interventions.

Although we had reservations about certain aspects of the second study (Wang et al., 2003), it did contain information that could be relevant to this guidance. A societal perspective was taken and most of the relevant costs and consequences were considered. A full sensitivity analysis was conducted and the authors generalised their results to different age groups and settings. Both the cost-effectiveness and cost-benefit analyses were conducted according to standard practice, and the results generated allowed comparisons to be made with other related studies. Of the issues that remain, effectiveness data was extrapolated from girls only to cover the whole population (both sexes), which affects the reliability of the final results. Furthermore, the impact of physical activity is again not obvious, and would be difficult to decompose.

Evidence Statement

There is limited economic evidence from one randomised controlled trial (Goldfield et al.) and one cluster randomised controlled trial (+), both from the USA, with respect to the promotion of physical activity, play and sport.

One randomised controlled trial (Goldfield et al.) examined the cost-effectiveness of a family-based behavioural treatment programme and reported that family-based treatment was more cost-effective when provided in group format, compared to the combination of group plus individualised treatment. However the study had limited quality and applicability.

One cluster randomised controlled trial (+) examined the cost-effectiveness and cost-benefit of a school-based intervention to reduce obesity in middle school aged children (between the ages of 11 and 14 years), using a curriculum-based approach, including sessions on decreasing television viewing, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity. This US study reported that the intervention was cost-effective in base-case and all other scenarios projected in the sensitivity analyses, and yielded net benefits to society in base-case and in most other scenarios considered in the sensitivity analysis. This study was considered to be of moderate quality and applicable with adaptation to the UK.

Section 1: Introduction

The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop guidance on a public health programme aimed at "promoting physical activity, play and sport for pre-school and school age children in family, pre-school, school and community settings". The guidance will provide recommendations for good practice based on the best available evidence of effectiveness, including cost-effectiveness. It is aimed at professionals with public health as part of their remit working within the NHS, education, local authorities and the wider public, private, voluntary and community sectors. It will also be relevant to parents, grandparents, other carers, professional carers and children.

1.1 THE NEED FOR GUIDANCE

Participation in physical activity is fundamental for healthy growth and development. It can reduce the risk of chronic conditions (for example, obesity) and improve children's health and wellbeing. Current guidelines recommend that children should do a minimum of 60 minutes of at least moderate intensity physical activity each day (Department of Health, 2004). The best way to encourage children to be physically active may differ according to age and gender.

Up to a third of children aged 7 years and under are not active enough on a daily basis to meet the recommended levels of physical activity (Department of Health, 2003). Improving younger children's motor skills and general ability to partake in physical activity (their physical literacy) may help increase their activity levels throughout childhood and into adulthood, by making physical activity more enjoyable.

Girls are less likely than boys to achieve the recommended physical activity levels. While this is true throughout childhood, it is particularly the case for 11 to 15 year-old girls (only 52% of them are physically active for at least 60 minutes, 7 days a week, compared with 70% of boys). The average time that girls spend participating in physical activity declines steadily with age, from 13 hours per week among 2 year olds, to 9.6 hours per week among 15 year olds (Department of Health, 2003).

The number of children who walk to school has fallen significantly during the last decade. In 1992/93, 61% of 5–10 year olds and 44% of 11–16 year olds walked to school. In 2002/03, these figures fell to 52% and 40% respectively. In the same year,

only a small number of children cycled to school (a negligible number of 5–10 year olds and 2% of 11–16 year olds) (Department for Transport, 2005).

The 2005/06 'School sport survey' found that 80% of pupils in the schools surveyed participated in at least 2 hours of 'high quality' physical education (PE) and school sport in a typical week, compared with 62% in 2003/04 (Department for Education and Skills, 2006). (Sixty one per cent of them achieved this through curriculum-based activities – up from 44% in 2003/04).

Physical inactivity in England is estimated to cost £8.2 billion a year and this is predicted to rise. It includes the direct costs of treating major lifestyle-related diseases and the indirect costs of sickness absence (Department of Health, 2004). Physical inactivity is also estimated to cause 54,000 premature deaths a year (Department for Culture Media and Sport, 2002).

1.2 THE SCOPE OF THE REVIEWS

1.2.1 Areas that will be covered

NICE guidance will cover policies, strategies, campaigns, interventions and other approaches that help pre-school and school-age children in England to:

- improve their motor skills and general ability to partake in physical activity (physical literacy)
- incorporate physical activity into daily life
- increase formal and informal recreational activity.

The guidance will be based on the findings from reviews on four core areas of interest:

- The Under-Eights;
- Adolescent Girls;
- Active Travel;
- Families and Community.

1.2.2 Areas that will not be covered

The guidance will not cover interventions dealt with in previous NICE guidance (or guidance in development) aimed at pre-school and school-age children.

1.2.3 Population Groups that will be Covered

Children and young people up to the age of 18 years.

1.2.4 Population Groups that will not be Covered

Children and young people who have a medical condition requiring clinical assessment or monitoring immediately prior to and/or during, physical activity.

1.2.5 Outcomes

The primary outcome will be changes in physical activity or improvements in physical literacy (as measured by a change in motor skills or the ability to undertake physical activity). Measurements of physical activity will include:

- changes in the proportion of children achieving a pre-determined level of physical activity
- number of minutes, frequency and intensity of physical activity
- numbers participating or using physical activity facilities.

The following secondary outcomes will be assessed where a study reports a primary outcome:

- affective, for example, intention and motivation to be physically active
- health, including: body mass index, coronary heart disease risk factors, bone density, and exercise-related injury
- psychological, including: reductions in fear and anxiety, and mental and emotional wellbeing (for example, self-esteem)
- educational, for example, improvements in examination results
- change in sedentary behaviours.

1.2.6 The Review Team

Reviews of effectiveness literature are being carried out by a team from the Physical Activity Collaborating Centre (PACC), based on search protocols developed in liaison with NICE's Information Collaborating Centre at Cardiff. PACC is an alliance between the British Heart Foundation Health Promotion Research Group (University of Oxford) and the British Heart Foundation National Centre for Physical Activity and Health (Loughborough University). The economic literature has been reviewed by a team from the Health Economics Research Centre (HERC), University of Oxford.

Section 2: Methodology

2.1 LITERATURE SEARCH

A search was carried out to identify quantitative economic literature on public health programmes aimed at promoting physical activity, play and sport for pre-school and school age children in family, pre-school, school and community settings.

2.1.1 Search Strategy

Relevant literature for this review was obtained from four principal sources:

- Review of effectiveness literature search results;
- A dedicated search of health economic literature databases;
- Internet searches;
- Review of papers extracted from personal libraries.

Review of effectiveness literature results

A review of the effectiveness evidence collected by the NICE Public Health Collaborating Centre was carried out, and any economic papers identified were passed onto the health economics team.

Economic literature databases

A number of more specialised databases were also searched to find economic literature that had not been identified through the search of the effectiveness review results. These included:

- NHS Economic Evaluation Database (NHS EED)
- Health Economic Evaluation Database (HEED)
- EconLIT

NHS EED and HEED store details of health economic and health literature, while EconLIT is a database of economic literature.

Internet searches

Rather than using general search engines, potentially relevant organisational websites were searched via the internet (e.g. www.sportengland.org, www.dft.gov.uk). Websites were searched where possible and browsed when it was not possible to search. Reports and studies of potential relevance were retrieved.

Review of papers extracted from personal libraries

Further papers were identified by members of the health economics team from personal collections.

2.1.2 Selection of Studies for Inclusion

Studies were reviewed if they provided economic evidence that was directly linked to any of the core areas considered in the effectiveness reviews. It became apparent whilst undertaking this selection process that the number of studies containing a suitable combination of cost and benefit data were limited. We therefore broadened this criterion to also include studies which were likely to solely provide either cost or outcomes evidence which could be used to inform the economic modelling. Furthermore, the primary outcome to be considered in the original scope for this review was 'changes in physical activity or improvements in physical literacy' (see section 1.2.5). Given the data limitations mentioned above, we broadened this scope to include any outcomes pertaining to physical activity in children.

Selection procedure

The main challenge related to searching for economic evidence in this field is that the search terms need to be as broad as possible to capture all relevant studies. Hence the range of publications that could be useful is large. This results in a large number of documents which, on further inspection, are not relevant. Our search strategies resulted in 101,479 titles. The majority of these came from the review of the effectiveness evidence. Prior to acquiring papers for assessment, preliminary screening of the titles of retrieved items was undertaken to discard irrelevant material. Abstracts were obtained for the remaining 67 papers and these were then scrutinised against the in-out criteria. Abstracts not meeting the inclusion criteria were eliminated.

Once the abstracts had been assessed, paper copies of the selected studies were acquired for further review. Those that met the inclusion criteria and were full economic evaluations went forward to be appraised on the strength of their evidence. Studies which were not economic evaluations, but which met the inclusion criteria and were likely to provide useful outcome, resource use or cost data to inform the economic modelling were retained. Those that failed to meet the inclusion criteria were excluded.

The inclusion criteria were:

- English language studies from 1990 onwards;
- Studies based on economically developed country settings;
- Studies which considered the promotion of physical activity, play and sport for children in the core study areas identified.
- Studies which were economic evaluations, or contained cost, resource use or outcomes data, which could be used to inform the economic modelling.

Table 2.1 identifies search results by source. Figures in brackets represent those studies which were not economic evaluations (and whose quality was therefore not appraised), but which were retained as they could potentially inform the economic modelling.

A list of the abstracts assessed against the in-out criteria is given in Appendix A.1, along with an explanation as to why papers were initially selected, and how they matched up to the inclusion criteria.

Table 2.1: Search results by source

	Data sources			Total
	Effectiveness reviews and economics literature searches	Internet searches	Personal libraries	
Number of hits	101,455	1	23	**101,479**
Full papers retrieved for more detailed evaluation of evidence	43	1	23	**67**
Papers with quality appraisal (papers with potential to inform modelling)	2 (13)	0 (1)	0 (23)	**2 (37)**

2.2 STUDY TYPE AND QUALITY APPRAISAL

Published studies that met the inclusion criteria were rated by two independent reviewers to determine the strength of the evidence, with each being assessed for methodological rigour and quality against the Drummond checklist (NICE, 2006b). Each study was graded using a code '++', '+' or '-', based on the extent to which the potential sources of bias had been minimised (see Table 2.2). Any differences between the two reviewers were resolved by discussion. Health economic appraisal forms for the included papers can be found in Appendix B.

Table 2.2: Grading the evidence

Grading the evidence	
++	All of most of the quality criteria have been fulfilled. Where they have been fulfilled the conclusions of the study are thought to be very unlikely to alter.
+	Some of the criteria have been fulfilled. Where they have been fulfilled the conclusions of the study are thought to be unlikely to alter.
-	Few or no criteria have been fulfilled. The conclusions of the study are thought to be likely or very likely to alter.

Study quality

Two studies met the criteria for quality appraisal. The first (Goldfield et al., 2001) considered the results of a randomised controlled trial (RCT) and compared the cost-effectiveness of two protocols for the delivery of a family-based behavioural treatment programme for obese children and their obese parents, in a US setting. The quality of this study was graded as '-'. The second study (Wang et al., 2003) considered the results of a cluster randomised controlled trial (CRCT) and examined the cost-effectiveness and cost-benefit of Planet Health, a school-based intervention to reduce obesity in middle-school aged children, also in a US setting. The quality of this study was graded as '+'.

2.3 ASSESSING APPLICABILITY

Each study was assessed on its external validity: that is, whether or not it was directly applicable to the target populations and settings in the scope. This

assessment took into account whether the study was conducted in the UK, and any barriers identified by studies or the review team to implementing each intervention in the UK.

2.4 SYNTHESIS

It was not appropriate to use meta-analysis to synthesise the outcome data as interventions, methods and outcomes were heterogeneous. The following review is therefore restricted to a narrative overview of those studies that met the inclusion criteria, along with a summary (in Appendix A.2) of those studies not meeting the criteria, but which may be useful in informing the economic modelling.

2.5 CURRENCY CONVERSION

As details of the price year used were not available for one of the two studies being considered (Goldfield et al., 2001), and the results of the second study (Wang et al., 2003) were likely to have limited applicability in the UK, we report all costs and benefits as they appear in the original study.

Section 3: Summary of Findings

Broadly speaking, the two included studies considered the cost-effectiveness (both) and cost-benefit (Wang et al., 2003) of two different interventions, designed to modify the behaviour of obese children (both) and their parents (Goldfield et al., 2001).

3.1 GOLDFIELD ET AL 2001

The intervention considered by Goldfield et al 2001 was a family based behavioural treatment programme. American obese children (between the ages of 8 and 12 years) and their parents were randomised between two treatment groups – standard treatment, incorporating a mixture of group and individualised treatment, and group treatment only – and the costs and effects associated with each group were compared.

The mixed treatment group consisted of 15-20 minute individual sessions with a therapist alongside 40 minutes of group therapy. Group treatment received group sessions but did not receive individual attention – group treatment sessions were instead extended by 20 minutes. Both programmes ran for 13 weeks with weekly, bi-weekly and monthly meetings. Both received advice from therapists on the traffic light diet, physical activity, self-monitoring, stimulus control, and reinforcement.

The viewpoint of a public health care provider was implied and effectiveness was measured in terms of both reduction in standardised body mass index (Z-BMI) and percentage overweight. Costs were identified and collected in a number of different categories including orientation and screening costs (spending on materials, advertising and staffing) and treatment costs (materials, staffing and travel expenses). A summary of the cost and effectiveness data is provided in Table 3.1. Effectiveness results are expressed as mean values across both treatment groups as outcomes were judged to be equivalent for both interventions, due to group treatment being common to both options.

The results for the two treatment groups were ultimately expressed in terms of the change in effects divided by the total cost of treatment at twelve month follow up, effectively giving a measure of improvement per dollar spent (see Table 3.2).

Table 3.1: Goldfield et al - Summary of data

	Level Of Presentation Of Data	Group Treatment	Mixed Treatment
Total Cost of Treatment ($ at 12 months)	Family	491.48	1390.72
Change in Percentage Overweight (Baseline to 12 months) [1]	Children	-8.04	
	Parents	-5.31	
	Overweight Parents	-5.70	
Change in Z-BMI (Baseline to 12 months) [1]	Children	-0.64	
	Parents	-0.29	
	Overweight Parents	-0.31	

Source: Adapted from Goldfield et al 2001
[1] Data only available as mean values across both treatment groups

The authors suggest that these results indicate that family-based behavioural treatment for childhood obesity is more cost-effective when provided in group format, compared to the combination of group plus individualised treatment.

Table 3.2: Goldfield et al - 'Cost-effectiveness' ratios

Treatment Group	Change in Z-BMI / Total Cost	Change in Percentage Overweight / Total Cost
Group Treatment	-0.001 Z-BMI Units per Dollar Spent	-0.014 Percentage Overweight Units per Dollar Spent
Mixed Treatment	-0.0004 Z-BMI Units per Dollar Spent	-0.005 Percentage Overweight Units per Dollar Spent

Source: Adapted from Goldfield et al 2001

3.2 WANG ET AL 2003

The intervention considered by Wang et al 2003 was called Planet Health. This was an American school based programme designed to reduce obesity in youth of middle-school age (between the ages of 11 and 14 years). Intervention material was given in four subject areas (language arts, maths, science, social studies) and physical education (PE). Sessions focused on decreasing television viewing, decreasing consumption of high-fat foods, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity.

Randomisation occurred at the school level. Control groups received their usual curriculum and PE, and both groups were followed up for approximately 18 months. A societal perspective was taken and costs and outcomes data were collected according to this. A decision model was developed to estimate effectiveness and cost-effectiveness beyond the dates of follow up.

The costs captured by the study included intervention costs (Table 3.3) (teacher training workshops, materials, staffing), lifetime medical costs averted (both direct health care and medication costs), and productivity loss averted (in terms of both impaired ability to work and lost economic productivity because of death). Effectiveness was measured in terms of cases of adulthood overweight prevented and quality-adjusted life years (QALYs) saved (using the *Healthy People 2000* years of healthy life (YHL) measure).

The results for the treatment and control groups were expressed in terms of Incremental Cost-Effectiveness Ratios (ICER's) giving the cost in dollars per Quality Adjusted Life Year (QALY) gained. A cost-benefit analysis was also reported, comparing the costs associated with treatment (or control) with the benefits, valued in monetary terms. The base-case analysis results are presented in Table 3.4. One-way and multivariate sensitivity analyses across 10 parameters were also conducted for both the cost-effectiveness and cost-benefit analyses (Table 3.5).

The authors suggest that, although no universally accepted standard exists, health related programmes with cost-utility ratios less than $30,000 per QALY saved are generally considered cost-effective. Using this figure as a threshold for their cost-effectiveness analysis, they judge that the Planet Health school-based obesity prevention programme is cost-effective in base-case and all other scenarios projected in the sensitivity analyses. When the cost-benefit of Planet Health was considered, they found that it was expected to yield net benefits to society in base-case and in most other scenarios considered in sensitivity analyses.

Table 3.3: Wang et al – Planet Health intervention costs

Item	Quantity	Unit cost	Total cost in 1996 dollars
Training Workshop:			
- Trainer	1 day each year for each of the five schools	Annual salary $38,000	1462
- Assistant Trainer	1 day each year for each of the five schools	Annual salary $29,000	1115
Teacher Reimbursement:			
- Subject Teachers	3 hours of training for 101 teachers in each of the two years	$25 per hour	15150
- PE Teachers	5 hours of training for nine teachers in 1st year, and 3 hours in second year	$25 per hour	1800
- Food	110 teachers each year	$10 each	2200
Teacher Wellness Activities:			
- Trainer	6 one-hour sessions for each of the five schools	$30 per hour	900
Fitness Funds	5 schools	$500 per school per year	5000
Planet Health Book	1 copy for each of 110 teachers	$55 per book	6050
Total			33677

Source: Adapted from Wang et al 2003

3.3 STUDIES RETAINED TO INFORM THE ECONOMIC MODELLING

There were 37 studies retained with a view to informing future economic modelling work. These contained either resource use, cost or outcomes data, or a combination of all three. The number of papers in each category is shown in Table 3.6. Full references are available in Appendix A.3.

Table 3.4: Wang et al – Cost-effectiveness and cost-benefit results

	Cost-effectiveness analysis	Cost-benefit analysis
Intervention costs	$33,677	$33,677
Cases of adult overweight prevented	5.805	5.805
QALY's saved	4.13	-
Medical care costs averted	$15,887	$15,887
Costs of lost productivity averted	-	$25,104
Cost-effectiveness ratio	**$4,305 per QALY saved**	**-**
Net benefit	**-**	**$7,313**

Source: Adapted from Wang et al 2003

A wide selection of outcomes data are available. However, few studies have considered the resource use implications of the schemes and programmes they analyse, and even fewer have attempted to attach any costs to this limited resource use data.

A commentary on these studies is available in Appendix A.2. The data on resource use, costs and outcomes described in each study is broadly summarised, and the overall generalisability of each study to the NICE terms of reference for this guidance is briefly discussed. Studies are then rated on this generalisability, from 'Limited' (unlikely to inform future modelling work), to 'Moderate' (may, to some degree, inform future modelling work), to 'Good' (highly likely to be able to inform future modelling work). Of the 37 studies considered, 20 were rated as 'Limited', 14 as 'Moderate' and 3 as 'Good'.

Table 3.5: Wang et al – Sensitivity analyses results

Analysis	Cost-effectiveness ratio ($ per QALY saved)		Net benefit ($)	
	95% CI	Mean	95% CI	Mean
Univariate analysis				
- An overweight girl at age 14 years who remains overweight aged 21 to 29 years (64.4% to 86.2%)	3381 to 5525	4351	1968 to 12544	7271
- A nonoverweight girl at age 14 years who becomes overweight by age 21 to 29 years (7.5% to 12.1%)	4088 to 4532	4306	6197 to 8428	7313
- An overweight woman at age 21 to 29 years who becomes overweight by age 40 years (84.9% to 97.5%)	3602 to 5152	4325	3449 to 11175	7313
- A non-overweight woman at age 21 to 29 years who becomes overweight by age 40 years (33.5% to 45.1%)	3654 to 5078	4322	3754 to 10869	7313
- Years of healthy life scores per nonoverweight woman aged 40 to 65 years (0.827 to 0.842)	4064 to 4623	4325	N/A	N/A
- Years of healthy life scores per overweight woman aged 40 to 65 years (0.743 to 0.764)	3971 to 4748	4330	N/A	N/A
- Annual workdays lost per nonoverweight woman (3.4 to 6.0)	N/A	N/A	3019 to 11605	7313
- Annual workdays lost per overweight woman (5.5 to 9.8)	N/A	N/A	482 to 14511	7453
- Annual discount rate (0 to 0.05)	1737 to 7420	4065	(3995) to 49881	13819
- Medical care costs averted per case of overweight prevented ($1476 to $3527)	3477 to 5718	4525	1469 to 10730	6403
Multivariate analysis	1612 to 9010	4397	(8579) to 53392	13029

Source: Adapted from Wang et al 2003

Table 3.6: Studies which could inform economic modelling work

Study	Costs	Resource Use	Outcomes
Burke 1992	✓	✓	✓
Cawley 2005			✓
Fardy 1996			✓
Hillman 1993		✓	✓
Langbein 2002		✓	
Lister-Sharp 1999	✓	✓	✓
Litman 2003	✓	✓	✓
McDonald 2004	✓	✓	✓
McKay 2007			✓
Metcalf 2004			✓
Ott 2006	✓	✓	✓
Preston 1995			✓
Summerbell 2007			✓
Bayne-Smith 2004			✓
Fairclough 2005			✓
Fairclough 2006			✓
Frenn 2003			✓
Frenn 2005			✓
Gortmaker 1999			✓
Haerens 2006			✓
Jamner 2004			✓
Manios 1998			✓
Manios 2002			✓
Neumark-Sztainer 2003			✓
Pate 2005			✓
Patrick 2006			✓
Perry 1994			✓
Prochaska 2004			✓
Reilly 2006			✓
Robbins 2006			✓
Sallis 2003			✓
Schofield 2005			✓
Simon 2004			✓
Stratton 2005	✓		✓
Warren 2003			✓
Young 2006			✓
Biddle 2004			✓
Total	**6**	**7**	**36**

Section 4: Discussion

Overall, there was very limited economic evidence with respect to the promotion of physical activity, play and sport in the four core areas identified. Two economic evaluations were appraised on the strength of their evidence: both were from the USA, and both considered interventions to modify the behaviour of obese children (and in one study, the behaviour of their obese parents).

These findings are not unusual in reviews of economic literature, not only on specific public health interventions but also on broader public health programmes. Indeed, two previous NICE reviews on 'Physical Activity' and 'Physical Activity and Environment' highlighted a general lack of economic evidence of sufficient quality to reliably inform the economic modelling work undertaken (NICE, 2006a, 2008). A further study suggested that the limited overall public health evidence base and the difficulties faced when adapting existing methodologies were the most challenging issues to be overcome when applying the principles of cost-effectiveness analysis to the public health context (Chalkidou et al., 2007).

This section will firstly review the reliability of the two studies which met the criteria for quality appraisal, before considering the limitations of this review and offering some concluding remarks.

4.1 GOLDFIELD ET AL 2001

Goldfield et al 2001 considered a family based behavioural treatment programme, with obese children and their parents being randomised between two treatment groups – standard treatment, incorporating a mixture of group and individualised treatment, and group treatment only. The quality of this study was rated as '-', indicating serious concerns over the quality of the evidence and its applicability to this guidance.

The viewpoint of this study was not stated, although it was occasionally implied that the perspective of a public health care provider had been taken. It was therefore difficult to accurately assess whether all important and relevant costs and consequences had been included for each alternative. Some important and relevant costs were omitted from the analysis e.g. the out-of-pocket costs to the participants,

for example the cost of changing diet, the reduced cost of medical care as a result of the treatment, and the cost to the participant's family. In terms of consequences not included, the change in physical activity as a result of the treatment was not reported. To compound these issues, the sources and dates of cost data were not reported, nor the price year.

A second failing was that the study did not report a true incremental analysis, as is standard practice. The change in effects (in terms of the change in Z-BMI or the percentage overweight) was divided by the total cost of treatment at twelve month follow up, to give a measure of improvement per dollar spent. This makes it difficult to compare the cost-effectiveness of this intervention with other studies in this field. No allowance was made for uncertainty in the estimates of costs and consequences either – no sensitivity analysis was reported.

Furthermore the authors made no attempt to generalise the results to other settings and patient groups (results that were based on only a small number of families, n=24), given that the study sample consisted solely of white US subjects.

There are also limitations in terms of the applicability of their results to the research aims of this guideline. The study considers the family as a whole unit, rather than children alone, and it is not straightforward to decompose the effects of treatment solely on children. In addition, no real implications of promoting physical activity can be identified, as this intervention is combined with other behavioural interventions.

4.2 WANG ET AL 2003

Wang et al 2003 considered a programme called Planet Health. This was an American school based programme designed to reduce obesity in youth of middle-school age (between the ages of 11 and 14 years). The quality of this study was graded as '+'. Although we had reservations about certain aspects of the study, it did contain information that could be relevant to this guidance.

This study took a societal perspective and considered most of the relevant costs and consequences. Of the costs not included, the authors show that their inclusion would have led them to draw even more favourable conclusions. A full sensitivity analysis was conducted on all variables of interest and results were reported within 95% confidence intervals. This allowed the authors to generalise their results to different

age groups and settings. Both the cost-effectiveness and cost-benefit analyses were conducted according to standard practice, and the results generated allow comparisons to be made with other related studies.

However a number of issues remain. Effectiveness data was extrapolated from girls only to cover the whole population (both sexes), which may affect the reliability of the final results. The sample population was again US based which limits the applicability of the results. Furthermore, the impact of physical activity is again not obvious, and would be difficult to decompose.

4.3 LIMITATIONS OF THE REVIEW

This review has a number of limitations of note. The first is that research into economics and public health, and in particular research into economics and the promotion of physical activity, play and sport for children is still in its infancy. There is currently a lack of appropriate data in this specific field (Sallis et al., 1998), and much of the data that is available is both of poor quality and US-based. Given that a significant proportion of the evidence in this report and associated appendices are from non-UK studies undertaken in a limited range of settings, its applicability to the UK should be carefully considered.

A second potential limitation of this review is publication bias. Other types of interventions may exist but have not been submitted or accepted for publication, or only those with positive results have been published. There is also likely to be considerable 'grey' literature available, and it is possible that this was not captured fully in the original literature searches.

A third limitation is that many of the available studies are constrained in their design - it is often difficult to establish which component of the intervention in question relates to physical activity, and therefore what contribution this makes to any changes in physical activity. Furthermore, as increased physical activity was not the main aim of many of the interventions studied, it was not clear in many cases what proportion of the cost might be attributed to the health benefits arising from a subsequent increase in physical activity levels (NICE, 2008).

4.4 CONCLUSIONS

There is limited economic evidence from one randomised controlled trial (Goldfield et al.) and one cluster randomised controlled trial (+), both from the USA, with respect to the promotion of physical activity, play and sport. There are a further 37 studies containing a mixture of resource use, costs or outcomes data, of variable quality, which have the potential to inform future economic modelling work.

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APPENDIX A

A.1 Abstract Appraisal

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
1	Albright	2005	E					X	No	No	No	Yes	Impact of physical activity on behaviour and health	Outside terms of reference - considers women, not children	No
2	Andreff	2001	E					X	No	No	No	No	Correlation between economic underdevelopment and sport	Outside terms of reference - based on developing country	No
3	Ball	2004	E					X	No	No	No	Yes	How feasible are healthy eating and physical activity for young women?	Outside terms of reference - considers women, not children	No
4	Ball	2007	E					X	No	No	No	Uncertain	Personal, social and environmental determinants of educational inequalities in walking	Outside terms of reference - considers women, not children	No
5	Barron	2004	E	X	X		X		No	Uncertain	Uncertain	Uncertain	Willingness To Pay study - use in a group of children with arthritis, with respect to certain hypothetical drugs	Unlikely to contain relevant data	No
6	Bell	2006	E		X				No	No	No	Uncertain	Does timing and sequencing of transitions to adulthood make a difference? (Looks in particular at physical activity)	Outside terms of reference - considers women, not children	No
7	Burke	1992	E			X			No	Uncertain	Uncertain	Uncertain	Summary of health and cost data concerning cycling and walking	Likely to contain relevant data	**Yes**
8	Cawley	2005	E	X	X				No	No	No	Uncertain	Considers the factors which influence how much P.E. children do and how this affects student activity and weight	Likely to contain relevant data	**Yes**
9	Cheung	1995	E			X			No	Yes	Uncertain	Uncertain	Subsidising student travel - effect on travel activity	Unable to obtain	No
10	Delaney	2004	E			X			No	No	Uncertain	Uncertain	Effectiveness of the safe routes to school programme	Unlikely to contain relevant data	No
11	Duncan	2002	E						No	No	No	Yes	Impact of socio-economic status on physical activity of adolescents	Unlikely to contain relevant data	No
12	Dwyer	2003	E	X					No	No	Uncertain	Uncertain	Designing a programme to promote physical activity in children	Unlikely to contain relevant data	No
13	Edwards	?	E					X	No	No	No	Uncertain	Developing a 'tool' to measure the social impact of recreation programmes on communities	Unable to obtain - plus unclear study population	No

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
14	Fardy	1996	E		X				No	No	No	Yes	Evaluating the impact of an exercise programme / education / behaviour modification on health knowledge / behaviour / fitness	Likely to contain relevant data	**Yes**
15	Fuller	2000	E		X				Cost-effectiveness	Yes	Yes	Yes	Cost-effectiveness of screening for Sudden Cardiac Death	Unlikely to contain relevant data	No
16	Gliebe	2005	E			X	X		No	No	No	No	Modelling household decision making with respect to travel plans	Unlikely to be able to isolate effects on children	No
17	Goldfield	2001	E	X	X		X		Cost effectiveness	Uncertain	Yes	Yes	Measures to tackle childhood obesity in a family setting	**Economic evaluation - considered for quality appraisal**	**Yes**
18	Hatziandreu	1995	E	X	X				Cost-effectiveness	Yes	Yes	Yes	Cost-effectiveness of three programmes to increase cycle helmet usage in children	Unlikely to contain relevant data	No
19	Hillman	1993	E			X			No	No	Yes	Yes	Outlines the contribution made to congestion by educational escort trips	Likely to contain relevant data	**Yes**
20	Kelleher	1999	E		X				No	No	Uncertain	Uncertain	Feasibility of a lifestyle cardiovascular health promotion programme for 8-15 year olds	Unlikely to contain relevant data	No
21	Kinkade	?	E	X	X				No	No	Uncertain	Uncertain	Contribution of recreation and sport participation to the QOL of children with disabilities	Unlikely to contain relevant data	No
22	Kirk	1997	E	X	X		X		No	Yes	No	No	Economic impact on families of children's participation in sport	Unlikely to contain relevant data	No
23	Kuh	1992	E	X	X				No	No	Uncertain	Yes	Childhood predictors of physical activity at 36 years	Unlikely to contain relevant data	No
24	Langbein	2002	E	X	X				No	No	Uncertain	No	How does participation in sports programmes impact on participants / non-participants?	May contain relevant data	**Uncertain**
25	Lee	2006	E			X	X		No	No	Uncertain	No	Analysis of family travel behaviour and general activity planning	Unlikely to be able to isolate effects on children	No
26	Lister-Sharp	1999	E	X	X		X		No	Uncertain	Uncertain	Yes	Review of effectiveness of school-based health promotion interventions	Likely to contain relevant data	**Yes**
27	Litman	2003	E					X	No	Uncertain	Uncertain	Uncertain	Analysis of the economic value of walking and 'walkability'	Likely to contain relevant data	**Yes**

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
28	Matsudo	2002	E	X	X				No	No	No	Uncertain	Promotion of physical activity in a developing country	Outside terms of reference - based on developing country	No
29	McDonald	2004	E	X	X				No	Uncertain	Uncertain	Uncertain	Subsidising student travel costs to increase P.E. participation after school	May contain relevant data	**Uncertain**
30	McKay	2007	E		X				No	No	No	Yes	Influence of economic and social context on inactivity / obesity	Likely to contain relevant data	**Yes**
31	McMillan	2007	E			X			No	No	No	No	Review of factors which affect children's travel behaviour	No useful data	No
32	Metcalf	2004	E			X			No	No	No	Uncertain	Impact on children of being driven to school - physical activity cost	Likely to contain relevant data	**Yes**
33	Osula	2005	E			X			No	Uncertain	No	No	How to calculate public transport subsidies	Outside terms of reference - based on developing country	No
34	Ott	2006	E					X	Cost-benefit	Yes	Yes	Yes	RCT to compare subsidised versus self-financed recreation	Economic evaluation	**Yes**
35	Pratt	2004	E					X	No	Uncertain	No	No	Considers economic interventions to promote physical activity, within the framework of a particular model	Outside terms of reference – doesn't consider children	**No**
36	Preston	1995	E			X			Review of various economic evaluations	No	No	Yes	Summary of cost-effective ways to make walking safer for children and adolescents	Likely to contain relevant data	**Yes**
37	Saiyed	2004	E			X			No	Uncertain	Uncertain	Uncertain	Summary of how safe and active routes to school programme has been implemented / its effects	Unable to obtain	No
38	Singh	2006	E		X				No	No	No	Yes	Developing an obesity prevention programme for adolescents	Unlikely to contain relevant data	No
39	Summerbell	2007	E	X	X				No	No	No	Yes	Assesses the effectiveness of various interventions to prevent obesity in childhood	May contain relevant data	**Uncertain**
40	Vickerman	1975	E					X	No	Uncertain	Uncertain	Uncertain	The economics of leisure and education	Outside terms of reference - dates from 1975	No
41	Wang	2003	E	X	X				Cost effectiveness and Cost benefit	Yes	Yes	Yes	Economic analysis of school based obesity programme	**Economic evaluation - considered for quality appraisal**	**Yes**

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
42	Willis	2000	E	X	X				No	Uncertain	Uncertain	Uncertain	Looks at the development of a particular sports association / impact this had on development	Outside terms of reference - based on developing country	No
43	Xaio Lin	1996	E		X		X		No	No	Uncertain	Yes	Parental influences on participation of children in sport	Unlikely to contain relevant data	No
44	Bayne-Smith	2004	P		X				No	No	No	Uncertain	Assesses the effects of a school-based intervention programme on cardiovascular disease risk factors in urban girls.	May contain relevant data	**Yes**
45	Fairclough	2005	P		X				No	No	No	Uncertain	Considers the effects of an intervention to increase levels of moderate-to-vigorous intensity physical activity during girls' physical education lessons.	May contain relevant data	**Yes**
46	Fairclough	2006	P		X				No	No	No	Uncertain	Effects of a physical education intervention to improve student activity levels	May contain relevant data	**Yes**
47	Frenn	2003	P		X				No	No	No	Uncertain	Addressing health disparities in middle school students' nutrition and exercise.	May contain relevant data	**Yes**
48	Frenn	2005	P		X				No	No	No	Uncertain	Examines the effectiveness of an intervention to increase physical activity and reduce dietary fat among low-income, culturally diverse, seventh-grade students.	May contain relevant data	**Yes**
49	Gortmaker	1999	P		X				No	No	No	Uncertain	Evaluates the impact of a school-based health behaviour intervention (Planet Health) on obesity amongst boys and girls in grades 6 to 8.	May contain relevant data	**Yes**
50	Haerens	2006	P		X				No	No	No	Uncertain	Evaluation of a 2-year physical activity and healthy eating intervention in middle school children	May contain relevant data	**Yes**
51	Jamner	2004	P		X				No	No	No	Uncertain	Evaluates the effects of a school-based intervention designed to increase physical activity among sedentary adolescent females.	May contain relevant data	**Yes**
52	Manios	1998	P	X					No	No	No	Uncertain	Effect of a school-based health intervention programme on increasing physical activity	May contain relevant data	**Yes**

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
53	Manios	2002	P	X					No	No	No	Uncertain	Effect of a school-based health and nutrition education programme on chronic disease risk factors	May contain relevant data	**Yes**
54	Neumark-Sztainer	2003	P		X				No	No	No	Uncertain	Tests the feasibility of a school-based programme for obesity prevention among adolescent girls.	May contain relevant data	**Yes**
55	Pate	2005	P		X		X		No	No	No	Uncertain	Examines the effects of a comprehensive school-based intervention on physical activity among high-school girls.	May contain relevant data	**Yes**
56	Patrick	2006	P		X				No	No	No	Uncertain	Randomized Controlled Trial of a Primary Care and Home-Based Intervention for Physical Activity and Nutrition Behaviours in adolescents	May contain relevant data	**Yes**
57	Perry	1994	P		X				No	No	No	Uncertain	Community-wide cardiovascular disease prevention in young people	May contain relevant data	**Yes**
58	Prochaska	2004	P		X				No	No	No	Uncertain	Compares interventions targeting physical activity and nutrition (PAN) concurrently versus physical activity (PA) alone in adolescents.	May contain relevant data	**Yes**
59	Reilly	2006	P	X					No	No	No	Yes	Cluster RCT to assess whether physical activity reduces BMI in young children	Likely to contain relevant data	**Yes**
60	Robbins	2006	P		X				No	No	No	Uncertain	Study to determine the efficacy of “Girls on the Move,” a computerized individually tailored physical activity (PA) programme plus nurse counselling intervention, in increasing PA.	May contain relevant data	**Yes**
61	Sallis	2003	P		X				No	No	No	Uncertain	Evaluates the effects of environmental, policy, and social marketing interventions on physical activity and fat intake of middle school students on campus.	May contain relevant data	**Yes**
62	Schofield	2005	P		X				No	No	No	Uncertain	Considers the effectiveness an intervention to increase the health-related physical activity of low-active adolescent girls.	May contain relevant data	**Yes**

	First author	Year	Source	Core Area					Is study an economic evaluation?	Type of data			Subject of paper	Comments	Inclusion decision
				Under Eights	Adolescent Girls	Active Travel	Families and Community	Ambiguous		Costs	Resource use	Outcomes			
63	Simon	2004	P		X		X		No	No	No	Uncertain	Considers the impact of a physical activity intervention on the activity patterns of adolescents.	May contain relevant data	**Yes**
64	Stratton	2005	P	X	X				No	Yes	No	Yes	The effect of playground markings on children's physical activity	Likely to contain relevant data	**Yes**
65	Warren	2003	P	X					No	No	No	Uncertain	Describes the development, implementation and evaluation of a school- and family-based intervention to prevent obesity in children aged 5–7 years.	May contain relevant data	**Yes**
66	Young	2006	P		X				No	No	No	Uncertain	Evaluates the effects of a life skills–oriented physical activity intervention for increasing overall physical activity in high school–aged girls.	May contain relevant data	**Yes**
67	Biddle	2004	I	X	X	X	X		No	No	No	Uncertain	Review of evidence of the effects of health-based physical activity on children and adolescents	May contain relevant data	**Yes**
Count =				**21**	**41**	**12**	**10**	**9**						**Yes =**	**36**
									6	**7**	**6**	**19**	**= Yes**	**Uncertain =**	**3**
									61	**49**	**44**	**8**	**= No**		
									0	**11**	**17**	**40**	**= Uncertain**		

Source code: E = Effectiveness Review Searches & Dedicated Economic Review; P = Personal Libraries; I = Internet Searches

A.2 A Review Of Material With The Potential To Inform The Economic Modelling

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Burke 1992	Review; Predominantly USA	- Active Travel	C / R / O	Summary: Considers the benefits of cycling and walking to health. Analyses current levels of use, barriers to increased use, and the health economic costs and benefits of the promotion of these activities. Study population: Children and adults, of various ages and ethnic backgrounds Costs: Very limited consideration of the monetary benefits of an increase in cycling and walking, at the individual, corporate, and national level. Resource Use: Data available on bicycle usage and walking activity, although this is difficult to decompose into subgroups. Outcomes: Data available on the impact of cycling and walking on the burning of calories, cholesterol, aging, and other disease specific markers. Generalisability: **Limited** – very little data is available to inform the economic modelling work, particular in terms of costs and resource use. Some outcomes data may prove to be useful, although it may not be applicable in a UK setting.
Cawley 2005	Economic modelling; USA	- Under Eights - Adolescent Girls	O	Summary: Models estimated using national- and state-level datasets to study the extent to which state requirements increase the time that students spend active in PE. Study population: High School students (grades 9-12). Mixed sex. Outcomes: Three outcome measures for physical activity employed: the number of days per week in which the student exercises for 20 minutes or more; the number of days per week in which the student engages in strength building activity, and the number of days per week in which the student engages in light activity for 30 minutes or more. BMI and an indicator for overweight are also measured. Generalisability: **Moderate** – some potentially useful outcome data – should consider how reliable this is in a UK setting.
Fardy 1996	RCT: USA	- Adolescent Girls	O	Summary: Evaluates the impact of a school-based programme on health knowledge, behaviour, disease risk factors and cardiovascular fitness. The intervention (PATH – Physical Activity and Teenage Health) Study population: 346 racially diverse 9th and 10th grade students (average age = 16) from a single school. Mixed sex. Outcomes: Data available on BMI, percentage body fat, physical activity (self-reported), dietary habits and cardiovascular fitness. Generalisability: **Limited** – very limited data available on physical activity, which is unlikely to be directly applicable to a UK setting.
Hillman 1993	Review; UK	- Active Travel	R / O	Summary: Considers the costs imposed by the congestion resulting from the transportation of children to and from school. Study population: Unclear, although likely to be children of all ages. Assumed to be mixed sex, although not explicitly stated. Costs: A very limited attempt is made to quantify the costs in question – any cost figures generated are likely to be of little use in the economic modelling work. Resource Use: A small amount of data is available concerning the resource use impact (% of vehicle mileage accounted for) of 'educational escort trips'. Outcomes: Outcomes associated with reducing these costs are discussed in broad terms, but no data is available to inform any economic modelling work. Generalisability: **Limited** – there may be a very small amount of UK cost and resource use data which is potentially useful for economic modelling. However, details of the methodology employed are sparse, and some of the data is obtained from pre-1990 sources, so one could question the validity of this data for the research question being considered.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Langbein 2002	Cross-sectional data analysis; USA	- Under Eights - Adolescent Girls	R	Summary: Examines the behavioural impact of school sports programmes on participants and non-participants, considering issues such as delinquency. Study population: High School students (grades 9-12). Mixed sex. Resource Use: Very limited evidence on participation of students in sports clubs. Generalisability: **Limited** – unlikely to be generalisable to a UK setting.
Lister-Sharp 1999	Review; Primarily UK and USA, although other economically developed countries also included	- Under Eights - Adolescent Girls - Families and Community	C / R / O	Summary: Review of the effectiveness of various school-based health promotion interventions, including health promoting schools themselves. Study population: Children and adolescents, in various settings. Mixed sex. Costs: Some data available on the costs associated with health promoting schools, plus a limited selection of health promoting interventions. Resource Use: Very limited data available for health promoting schools and some other health promoting interventions. Outcomes: Report highlights a number of sources providing data on the effectiveness of health promoting interventions in terms of their impact on physical activity. Generalisability: **Moderate** – some potentially useful data is either included or signposted elsewhere – much of this is provided in a UK setting and could possibly inform some of the modelling work.
Litman 2003	Review; Various countries, although appears to predominantly consider US data	- Ambiguous	C / R / O	Summary: Evaluates the value of walking and walkability. Both health and monetary costs and benefits are considered. Study population: Unspecified. Costs: Considers consumer cost savings and public cost savings resulting from better walking conditions. Also looks at the greater efficiency of land use associated with the promotion of non-motorised versus motorised transport (although this isn't explicitly quantified). Resource Use: Considers the amount of time spent in different modes of transport. Outcomes: Identifies some health benefits associated with the increased physical activity resulting from better walking conditions. Generalisability: **Limited** – although a wide range of issues are considered, few are explicitly quantified, and there is unlikely to be a great deal of data here with the potential to inform any economic modelling work. A number of links to further sources of data are available though.
McDonald 2004	Data analysis; Predominantly USA	- Under Eights - Adolescent Girls	C / R / O	Summary: Reviews the performance of a free bus pass programme for students, in terms of its impact on costs and resource use. Data were collected across two school years, for a different group of students in each case, using surveys interviews and focus groups. Study population: Low-income middle school and high school students in San Francisco, from 17 schools. Mixed sex. Costs: Data available on the cost of the programme and some of the costs imposed on the students. Resource Use: Data available on student travel patterns and usage of various modes of transport. Outcomes: Data available on the impact on academic performance, although this is not linked explicitly to health outcomes, and no link is made to the effect on physical activity (a link is however made to after school activity participation). Generalisability: **Moderate** – some cost and resource use data is available which could be useful in an economic modelling context. However, the data is in part specific to this intervention and setting, and is not decomposed by age or sex.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
McKay 2007	Data analysis; USA	- Adolescent Girls	O	Summary: Considers whether various economic and social contexts affect the probability of adolescents being overweight. Study population: 37,930 adolescents from almost all US states between the ages of 10 and 17. Mixed sex. Outcomes: Data available for all on physical activity and age-adjusted BMI, which were then combined with data on social contexts (social trust, mutual aid) and economic indicators (state level poverty) Generalisability: **Limited** – dataset is entirely US based, and no specific intervention is considered so physical activity is therefore only measured at a single point in time.
Metcalf 2004	Data analysis; UK	- Active Travel	O	Summary: Analyses the physical activity cost of the school run across 53 urban primary schools. Study population: 275 first year primary school children. Mixed sex. Outcomes: Data available on physical activity (measured by accelerometers) in both children who walked to school and children who travelled by car. Data collection covered both the journey to and from school, and also physical activity during the rest of the week. Generalisability: **Good** – data on the difference in physical activity available in paper and is directly applicable to the UK.
Ott 2006	RCT; Canada	- Ambiguous	C / R / O	Summary: Considers the costs and effects of providing subsidised recreation for children. Control group used who didn't receive subsidised education. Study population: Children between the ages of 4 and 17. Mixed sex. Costs: Collected for both groups. Include – cost of recreation programmes / cost of health and social services. Resource Use: Collected for both groups. Includes – data on children's attendance in recreation activities / use of health and social services. Outcomes: Effects primarily measured in terms of a 'child competence score', which indicated the prevalence of psychiatric disorders amongst the children. Secondary effects included non-monetary family benefits and decreased health and social services expenditure. Generalisability: **Limited** – cost and resource use data sparse / impact of physical activity unclear.
Preston 1995	Review; Mainly UK, also some European countries	- Active Travel	O	Summary: Review of cost-effective ways to make walking safer for children and adolescents. Study population: Unclear, although likely to be children of all ages. Mixed sex. Outcomes: Very limited narrative overview of a small selection of cost-effectiveness studies. Generalisability: **Limited** – some narrative evidence but very little information that could be incorporated into an economic model.
Summerbell 2007	Review; Various countries, including Europe and North America	- Under Eights - Adolescent Girls	O	Summary: Considers the effectiveness of various interventions designed to prevent obesity in childhood. 22 studies in total included, both short-term and long-term, based in various locations (school, community, family). Almost all of the studies considered physical activity to some degree. A number of studies focused on less developed countries and can therefore be discounted for the purposes of this review. Summaries of several other studies can be found elsewhere in this appendix. Study population: Participants were under 18. Mixed sex. Outcomes: Outcome data including MVPA, BMI and dietary habits are available for some or all of the interventions and studies considered. Generalisability: **Limited** – although a wide range of interventions are considered, little data is provided. A number of links to further sources of data are available and further investigation could yield data to inform the economic modelling work.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Bayne-Smith 2004	RCT: USA	- Adolescent Girls	O	Summary: Considers the effectiveness of a school-based intervention programme on cardiovascular disease risk factors called PATH (Physical Activity and Teenage Health). Intervention and control groups compared. Intervention was taught as a personal wellness course integrating vigorous exercise, health and nutrition education, and behaviour modification. Study population: 442 urban multi-ethnic girls, aged 14-19, from 3 New York city high schools. Outcomes: Data available on BMI, percentage body fat, blood pressure, cholesterol, cardiovascular fitness and physical activity. Generalisability: **Limited** – limited data on physical activity is available but only in a US setting, and results are specific to the racial mix of students considered.
Fairclough 2005	RCT; UK	- Adolescent Girls	O	Summary: Examines the effectiveness of an intervention to increase levels of MVPA during girls' PE lessons. Control and intervention groups were compared. Both followed the same 6 lesson gymnastics programme, but the teacher for the intervention group was instructed to explicitly consider the additional objective of increasing MVPA during their lessons. Study population: 33 girls across two Year 7 classes (ages 11-12) in one English school. After eliminating those girls with incomplete data sets, 14 remained in the control group, and 12 in the intervention group. Outcomes: The principal outcome measured was the physical activity (heart rate) of the students. They also completed psychological questionnaires after each lesson. Generalisability: **Moderate** – some potentially useful data is identified in a UK setting which could possibly inform some of the modelling work.
Fairclough 2006	RCT; UK	- Adolescent Girls	O	Summary: This is a slightly more detailed version of Fairclough 2005, with more in depth data analysis of the same outcomes data. Generalisability: **Moderate** – some potentially useful data is identified in a UK setting which could possibly inform some of the modelling work.
Frenn 2003	RCT; USA	- Adolescent Girls	O	Summary: Considers the effectiveness of an intervention to improve low fat diet and MVPA. Intervention was Internet and video based and also involved the provision of healthy snacks and gym labs. Those receiving the intervention were compared with those remaining on the normal curriculum. Study population: The initial racially diverse sample contained 341 students between the ages of 12-15 in two Midwest urban schools. Mixed sex. Outcomes: Data available on percentage of fat in diet and duration of MVPA (both before and after intervention). Generalisability: **Limited** – data on physical activity is difficult to decompose, available only in a US setting, and results are specific to the racial mix of students considered.
Frenn 2005	RCT: USA	- Adolescent Girls	O	Summary: This is an extended study of the intervention previously considered by Frenn 2003, with the number of intervention sessions doubled from 4 to 8. The intervention is designed to increase physical activity and reduce dietary fat. Study population: 178 racially diverse 7th grade students from one Midwest urban public middle school. Mixed sex. Outcomes: Data available on physical activity and percentage dietary fat. Generalisability: **Limited** – data on physical activity is difficult to decompose, available only in a US setting, and results are specific to the racial mix of students considered.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Gortmaker 1999	RCT: USA	- Adolescent Girls	O	Summary: Considers the effectiveness of an intervention called Planet Health (described in main body of report). Schools either assigned to intervention, or kept as controls. Study population: 1,295 ethnically diverse grade 6 and 7 students from 10 different schools. Mixed sex. Outcomes: Principle outcome measure was reduction in obesity (BMI). Data also available on television viewing habits, MVPA and diet, obtained through a survey. Generalisability: **Limited** – very limited data available on physical activity, since this was not the primary outcome measure. Unlikely to be especially relevant in a UK setting, even if this data can be effectively decomposed.
Haerens 2006	RCT: Belgium	- Adolescent Girls	O	Summary: Evaluates the effects of a physical activity and healthy eating intervention. This combined changes in the school environment with interactive computer-tailored feedback. Parental involvement was also considered. Two slightly different intervention groups (one of which considered the impact of parental involvement) were compared to a control group. Study population: 2,991 students in seventh and eighth grades (average age = 13 years) in 15 different schools. Mixed sex. Outcomes: MVPA (both self-reported, and measured with an accelerometer) and fat intake. Generalisability: **Good** – some useful data on physical activity is available, decomposed into subgroups. A large sample is considered, which is likely to be of a similar ethnic breakdown to any potential UK sample.
Jamner 2004	RCT: USA	- Adolescent Girls	O	Summary: Evaluates the effects of a school-based intervention ('Project FAB') to increase MVPA in sedentary adolescent females. The intervention was a special PE class available only to study members. Those receiving the intervention were compared to a control group. Randomisation was at the school level. Study population: 58 ethnically diverse tenth or eleventh grade adolescent females from 2 Californian high schools Outcomes: Data available at baseline and four month follow up on cardiovascular fitness, BMI, physical activity (self-reported) and various psychosocial measures. Generalisability: **Limited** – some data is available on physical activity, but only in a US setting, and results are specific to the racial mix of students considered.
Manios 1998	RCT; Greece	- Under Eights	O	Summary: Considers the effects of a health education intervention programme directed at both children and their parents, which combined both health promotion and moderate intensity physical training. Intervention and control groups are compared over the course of 6 years, and this study presents the results after the third year of the intervention. Study population: 5,681 children registered in first grade in 1992. Mixed sex. Outcomes: Data available on MVPA (observed by parents), the general fitness of participants, and BMI. Generalisability: **Moderate** – some informative physical activity data is available, which could potentially be applied to a UK setting. However, the age of participants is not clear, nor are results decomposed by age or other relevant variables.
Manios 2002	RCT; Greece	- Under Eights	O	Summary: This is an updated version of Manios 1998, presenting the results at the end of the 6 year programme. Study population: As Manios 1998. The average age of participants is also identified as being 5.5-6.5 years. Outcomes: As Manios 1998. Generalisability: **Moderate** – as before, some informative data is available. However results are not presented in a manner which will enable easy integration into the economic modelling work.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Neumark-Sztainer 2003	RCT: USA	- Adolescent Girls	O	Summary: Tests the feasibility of a school-based programme ('New Moves') for obesity prevention in adolescent girls. Intervention had 3 components – targeted physical activity, and offered social support and nutritional guidance. Intervention and control groups compared. Study population: 201 racially diverse adolescent girls (average age = 15) from 6 Minnesotan high schools. Outcomes: Data available at baseline, post-intervention and 8 month follow up on physical activity, eating habits and BMI. Generalisability: **Limited** – data on physical activity is limited and may not be directly applicable to the UK.
Pate 2005	RCT; USA	- Adolescent Girls - Families and Community	O	Summary: Examines the effects of a school-based intervention on physical activity amongst high school girls. Intervention (LEAP) was designed to modify both the programme of teaching and the school environment to increase support for physical activity among girls. Study population: 2,744 eighth and ninth grade girls across 24 schools. Mixed race. Outcomes: Primary outcome measure was the percentage of girls in each school who reported participating in MVPA. Also considered prevalence of overweight and at-risk for overweight. Generalisability: **Good** – although data was collected in a US setting, it appears to be applicable to the UK – most importantly, information is available on the key outcome variable for this guidance.
Patrick 2006	RCT; USA	- Adolescent Girls	O	Summary: Evaluates a health care intervention designed to improve eating and physical activity behaviour in adolescents – PACE+ (Patient-centred Assessment and Counselling for Exercise + Nutrition). Intervention and control group compared. Intervention was multi-modal and designed to be initiated in primary care. Study population: 878 adolescents aged 11-15 years from 6 private clinics in California. Mixed sex. Outcomes: Both self-reported and externally assessed physical activity, diet and BMI. Generalisability: **Moderate** – some potentially useful data is identified which could possibly inform some of the modelling work, although data was collected in a US setting.
Perry 1994	Cohort study; USA	- Adolescent Girls	O	Summary: Two cohorts of adolescents examined – one group received a 5 year long intervention in the form of an educational programme designed to encourage healthy eating and exercise, and reduce smoking and blood pressure. Study population: Adolescents in grade / high schools. Mixed sex. Outcomes: Amongst the outcomes considered were the prevalence of smoking and problem drinking, physical activity, and healthy eating behaviour. Results available by sex. Generalisability: **Moderate** – data potentially relevant in a UK setting – study published in 1994, but data were collected across the 1980's so this should be taken into account - evidence is available on outcome measures of interest for this guidance though.
Prochaska 2004	RCT: USA	- Adolescent Girls	O	Summary: Reports the results of an RCT of a single health behaviour intervention versus a multiple health behaviour intervention. Specifically, the former targets physical activity and nutrition behaviour concurrently, the latter targets physical activity alone. These two interventions were compared to a control group. The multiple health behaviour intervention was a modified version of PACE+ (see Patrick 2006). Study population: 138 racially diverse adolescents from grades 6-8 (mean age = 12) of a middle school in California were recruited. Mixed sex. Outcomes: Data available at baseline and 3 month follow up on MVPA (measured via accelerometers), diet and BMI. Generalisability: **Limited** – limited data on physical activity is available but only in a US setting, and results are specific to the racial mix of students considered. Furthermore, the data that could be useful for modelling purposes is likely to be difficult to decompose.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Reilly 2006	RCT: UK	- Under Eights	O	Summary: Considers the effectiveness of a physical activity intervention to reduce BMI. The intervention combines a nursery-based physical activity programme and home-based health education. Intervention and control groups are compared, with randomisation occurring at the nursery level. Study population: 545 children (average age = 4) at 36 nurseries in Scotland. Mixed sex. Outcomes: BMI and MVPA (measured via accelerometer). Generalisability: **Moderate** – although data on physical activity is limited, it can be directly applied to a general UK setting.
Robbins 2006	RCT; USA	- Adolescent Girls	O	Summary: Aims to determine the efficacy of a computerised individually tailored physical activity intervention ('Girls On The Move') in increasing physical activity. Control and intervention groups compared. Intervention lasted 12 weeks and participants received regular tailored feedback on their progress towards meeting individual physical activity goals. Those in control groups received no more individual support than usual. Study population: 77 racially diverse sedentary adolescent girls from 2 middle schools (11-14 years old) Outcomes: Data collected on physical activity frequency, intensity and duration, (self-reported); BMI; and other self-reported psychological data. Generalisability: **Limited** – some useful data available, but in a US setting, for two schools containing pupils from mainly low socio-economic backgrounds, and from diverse racial backgrounds. Given these constraints, the applicability of the results to a UK setting could be questioned.
Sallis 2003	RCT: USA	- Adolescent Girls	O	Summary: Evaluates the effects of a combined environmental and policy intervention on the eating habits and physical activity of students. The programme was composed of separate physical activity and nutrition interventions, and participating schools were compared to control schools. Study population: Students from 24 Californian schools. Racially diverse. Mixed sex. Outcomes: Primary outcome measures were observed in a school setting and included dietary intake and MVPA. Secondary outcome measures included self-reported MVPA and dietary habits. BMI data also available. Generalisability: **Limited** – limited data available on physical activity, which is unlikely to be especially relevant in a UK setting.
Schofield 2005	RCT; Australia	- Adolescent Girls	O	Summary: Considers an intervention called 'Girls Stepping Out Programme' (GSOP) – two intervention groups compared. The first group used a pedometer as a basis for increasing physical activity, the second used a time-based approach. Goals were set for each group, and reviewed weekly for 12 weeks, and results were compared. A control group was also considered. Study population: 415 year 11 and 12 girls (15-18 years old) of European descent from 3 Central Queensland high schools, although this study is based on the least active of these students (n=85). Outcomes: Data available from the start, middle and end of the intervention period on BMI, cardiorespiratory fitness, physical activity (measured either by pedometer or self-reported questionnaire) Generalisability: **Moderate** – although data was collected in an Australian setting, it appears to be applicable to a certain degree to the UK and information is available on the key outcome variable for this guidance.
Simon 2004	RCT: France	- Adolescent Girls - Families and Community	O	Summary: Evaluates the impact of a multilevel physical activity intervention on activity patterns among adolescents. Intervention was designed to reduce weight gain and cardiovascular risk and improve patterns of physical activity. Intervention participants were compared to a control group following the normal curriculum. Study population: 954 adolescents (average age = 12) from 8 French schools. Mixed sex. Outcomes: Data available at baseline and 6-month follow up on the primary outcome measures of BMI and percentage body fat. Secondary outcome measures included various cardiovascular risk factors, physical activity, and a number of psychosocial indicators. Generalisability: **Moderate** – some data is available on physical activity that could potentially inform the economic modelling – the setting is French, but the study population is likely to be generalisable to a UK setting.

Study	Type of Study; Country	Core Area	Type of Data [1]	Description
Stratton 2005	Controlled trial; UK	- Under Eights - Adolescent Girls	C / O	Summary: Considers the effect of multicolour playground markings on children's physical activity levels. Study population: 99 children from 8 schools. Children were of mixed ages – some from early primary schools, some from late primary schools. Mixed sex. Costs: Limited data available on the cost of painting the playgrounds. Outcomes: Data available on BMI and MVPA during recess (measured using telemeters). Generalisability: **Limited** – the available data is directly applicable to the UK, but results are specific to the intervention considered and may not be more widely applicable to other interventions and scenarios.
Warren 2003	RCT; UK	- Under Eights	O	Summary: Describes the development, implementation and evaluation of a school- and family-based intervention ('Be Smart') to prevent obesity in children. Three different intervention groups were compared to a control group. The intervention generally aimed to increase healthy behaviour in children and their parents, but different versions of the intervention were compared: 'Eat Smart' (focus on food and healthy behaviour); 'Play Smart' (focus on physical activity and healthy behaviour); and 'Eat Smart Play Smart' (combination of the two). Study population: 213 children aged 5-7 years from 3 primary schools in Oxford. Outcomes: Outcomes assessed included: BMI, nutrition knowledge, physical activity and diet. Generalisability: **Limited** – a small amount of potentially useful data is identified in a UK setting which could possibly inform some of the modelling work.
Young 2006	RCT; USA	- Adolescent Girls	O	Summary: Evaluates the effects of a life-skills oriented physical activity intervention for increasing physical activity in adolescent girls. The intervention was delivered in a school setting – material advising the benefits of a physically active lifestyle was provided to the students, alongside sessions on developing certain social skills. Study population: 221 ninth grade girls, predominantly African-American. Outcomes: Main outcome measures – daily physical activity and sedentary activities, cardio-respiratory fitness, and certain cardiovascular disease factors. Generalisability: **Moderate** – some concerns over the validity of the sample when compared to likely UK subjects – good evidence available on outcome measures of interest though.
Biddle 2004	Review; Various countries in Europe, North America and Oceania	- Under Eights - Adolescent Girls - Active Travel - Families and Community	O	Summary: Reviews the interrelationships between physical activity and health in young people, in particular the links between physical activity and various health markers, the prevalence of physical activity and sedentary behaviour, and the determinants of physical activity and how this behaviour can be changed. This latter issue is explicitly addressed through a review of interventions promoting physical activity, a number of which have been identified in this appendix already. Study population: Children and adolescents, in various settings. Mixed sex. Outcomes: Summary data available for physical activity and sedentary behaviour, amongst other variables. Generalisability: **Moderate** – the data available is likely to be directly applicable to a UK setting. However, the data is predominantly summary data, and more thorough investigation of those sources which appear to be useful for modelling purposes is likely to be necessary.

RCT = Randomised Controlled Trial; MVPA = Moderate and Vigorous Physical Activity; BMI = Body Mass Index

[1] C = Costs; R = Resource Use; O = Outcomes

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APPENDIX B

Health Economic Appraisal Forms

		Goldfield, 2001	Wang, 2003
	Evaluation criterion	**Comments**	
1	**Was a well-defined question posed in answerable form?**	The aim of the study was to compare the cost-effectiveness (CEA) of two protocols for the delivery of family-based behavioral treatment programme for obese children and their obese parents: standard treatment incorporating a mixture of group and individualized treatment vs group treatment only.	The aim was to assess the cost-effectiveness (CEA) and cost-benefit (CBA) of Planet Health, a school based intervention to reduce obesity in youth of middle-school aged children.
1.1	Did the study examine both costs and effects of the service(s) or programme(s)?	The study measured costs in terms of direct costs, which included orientation/screening for recruitment costs (advertising, materials and salary), and treatment costs (materials (treatment manuals, handouts and habit books), staffing and travel expenses incurred during treatment). Effects were measured in terms of reduction in standardised body mass index (Z-BMI) and percentage overweight	The study measured costs in terms of intervention costs, costs averted by intervention, medical care costs and productivity costs associated with adult overweight. Health outcomes were measured as cases of adult overweight prevented and QALY's saved.
1.2	Did the study involve a comparison of alternatives?	Yes, it compared group and individualized treatment vs group treatment	Yes it compared intervention and control situations
1.3	Was a viewpoint for the analysis stated and was the study placed in any particular decision-making context?	The viewpoint was not stated, although the analysis performed suggested that the perspective of a public health care provider was taken. US community setting	Yes – societal perspective - USA
2	**Was a comprehensive description of the competing alternatives given (that is, can you tell who? did what? to whom? where? and how often?)?**	Mixed treatment group consisted of 15 – 20 min individual sessions with a therapist and 40 min of group therapy. Group treatment received group sessions and did not receive individual attention. Participants in this condition received an additional 20 min of group treatment. The common components of the treatment were: A 13 session programme that included: eight weekly meetings, four bi-weekly meetings and one monthly meeting. Included advise from therapists on: traffic light diet, physical activity, self-monitoring, stimulus control and reinforcement	The intervention – an obesity prevention programme (Planet Health), where intervention material was given in 4 subject areas (language arts, maths, science and social studies) and PE. Sessions were on reducing TV viewing, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity. Control group received usual curriculum and PE. 10 middle schools randomised to intervention or control, and followed up from fall 1995 to spring 1997.
2.1	Were any important alternatives omitted?	None appear to have been omitted. Choice of comparator was justified on the grounds that it involved less staff.	No
2.2	Was (Should) a do-nothing alternative (be) considered?	A do-nothing comparator was not considered	Yes – use of control group
3	**Was the effectiveness of the programmes or services established?**	Yes through use of RCT	Schools were randomised
3.1	Was this done through a randomised, controlled clinical trial? If so, did the trial protocol reflect what would happen in regular practice?	Families were recruited and randomized, RCT carried out in community setting on ITT basis. Demographics of families were reported. Trial protocol appeared to reflect what would happen in regular practice.	Yes RCT- schools were randomised. Trial protocol appeared to reflect what would happen in regular practice.

		Goldfield, 2001	Wang, 2003
3.2	Was effectiveness established through an overview of clinical studies?	No	Generally speaking, there was no overview of clinical studies to establish effectiveness. However, medical costs averted per case of adulthood overweight prevented were derived from the relevant literature.
3.3	Were observational data or assumptions used to establish effectiveness? If so, what are the potential biases in results?	Effectiveness (reduction in BMI) was established using data derived from the RCT, which was then compared to standardised values derived from literature covering the US population only.	To estimate effectiveness beyond the dates of follow up of planet health study a decision model was developed. This was based on effectiveness data from Planet health data combined with a study published by Whitaker et al 1997 and data from the National Health and Nutrition Epidemiological follow- up study.
4	**Were all the important and relevant costs and consequences for each alternative identified?**	All relevant direct costs appeared to be included, quantities and costs were reported separately. Costs included: total treatment cost, cost of screening and recruitment, programme overheads. Costs not included: cost of data collection, costs of participants to take part in trial (cost of changing diet etc), reduced cost of medical care, cost to family. Consequences included: change in BMI. Consequences not included: change in physical activity.	Quantities and costs were reported separately for some resources categories only (intervention costs). Did not include direct and indirect costs of being overweight in adolescent or younger age groups, impact measured from age of 40-65 (however their inclusion would have made intervention even more C-E). Costs included: intervention costs, medical costs averted, productivity loss averted. Costs not included: medical costs associated with obesity during adolescence, lower income associated with overweight status. Consequences included: reduction in the prevalence of obesity, cases of adult overweight prevented, QALYs saved. Consequences not included: change in physical activity.
4.1	Was the range wide enough for the research question at hand?	If we assume the analysis is approached from a public health care provider perspective, then the range of costs and consequences included is reasonable, although not comprehensive.	Yes – costs (intervention, medical and productivity), consequences – QALY's
4.2	Did it cover all relevant viewpoints? (Possible viewpoints include the community or social viewpoint, and those of patients and third-party payers.)	No – although the viewpoint is not explicitly stated, the implied viewpoint that of a public health care provider, no wider than this.	Different viewpoints were not explicitly considered, but given that the overall viewpoint taken was societal, other narrower viewpoints were automatically encompassed within this perspective.
4.3	Were capital costs, as well as operating costs, included?	No	The capital outlay of the scheme was explicitly included.
5	**Were costs and consequences measured accurately in appropriate physical units (for example, hours of nursing time, number of physician visits, lost work-days, gained life-years)?**	Costs and quantities and consequences were reported separately, measured in appropriate units.	Yes
5.1	Were any of the identified items omitted from measurement? If so, does this mean that they carried no weight in the subsequent analysis?	Did not value the costs to the families, nor reduced cost of medical care.	No - although indirect costs not included in incremental analysis, but authors did show that when they were included the intervention became cost saving.

		Goldfield, 2001	Wang, 2003
5.2	Were there any special circumstances (for example, joint use of resources) that made measurement difficult? Were these circumstances handled appropriately?	N/A	N/A
6	**Were costs and consequences valued credibly?**	Costs - No	Yes
6.1	Were the sources of all values clearly identified? (Possible sources include market values, patient or client preferences and views, policy-makers' views and health professionals' judgements.)	Source and dates of cost data were not reported nor price year	All sources of values were described.
6.2	Were market values employed for changes involving resources gained or depleted?	N/A	Market value of productivity loss used
6.3	Where market values were absent (for example, volunteer labour), or did not reflect actual values (for example, clinic space donated at reduced rate), were adjustments made to approximate market values?	As the source of cost data was unclear, it is difficult to tell how the authors dealt with this problem, if and when it arose.	N/A
6.4	Was the valuation of consequences appropriate for the question posed (that is, has the appropriate type or types of analysis – cost-effectiveness, cost-benefit, cost-utility – been selected)?	Yes - The appropriate type of analysis was used given the data available (CEA).	Yes – use of CUA and CBA both encompass societal viewpoint
7	**Were costs and consequences adjusted for differential timing?**	No – due to short time frame of analysis – less than 1 year	Yes both costs and benefits discounted @ 3%
7.1	Were costs and consequences which occur in the future 'discounted' to their present values?	No	Yes both costs and benefits discounted @ 3% over 25 yr period from 40-65. However would question whether this is correct approach to take as it is not clear whether the DR was only applied so that costs and outcomes present valued to age of 40 rather than back to start of adolescence?
7.2	Was any justification given for the discount rate used?	N/A	Yes – reference was made to the US panel recommendations on CEA
8	**Was an incremental analysis of costs and consequences of alternatives performed?**	Costs and consequences are compared but not as formal ICER	Yes (but productivity costs excluded from this analysis)
8.1	Were the additional (incremental) costs generated by one alternative over another compared to the additional effects, benefits or utilities generated?	Not true incremental analysis – divided the change in effects (ZBMI or % overweight) by the total cost of treatment at 12 month follow up – gave a measure of improvement per dollar spent.	Yes – provided an ICER of $4305 per QALY gained. Also reported CBA – cost saving of $7313
9	**Was allowance made for uncertainty in the estimates of costs and consequences?**	No – no sensitivity analysis reported	Yes – sensitivity analysis was reported - univariate and monte carlo simulation.
9.1	If data on costs or consequences were stochastic, were appropriate statistical analyses performed?	The data was not stochastic. No sensitivity analysis reported	Data were deterministic
9.2	Were study results sensitive to changes in the values (within the assumed range for sensitivity analysis, or within the confidence interval around the ratio of costs to consequences)?	N/A	The cost-effectiveness of the programme was relatively unaffected by most of the parameter variations. Sensitive to discount rate and in MC analysis 95% CI= $1612 – 9010 per QALY gained
10	**Did the presentation and discussion of study results include all issues of concern to users?**		

		Goldfield, 2001	Wang, 2003
10.1	Were the conclusions of the analysis based on some overall index or ratio of costs to consequences (for example, cost-effectiveness ratio)? If so, was the index interpreted intelligently or in a mechanistic fashion?	Not true incremental analysis – divided the change in effects (ZBMI or % overweight) by the total cost of treatment at 12 month follow up – gave a measure of improvement per dollar spent. The presentation and interpretation of these ratios was however unclear.	Yes – see section 9
10.2	Were the results compared with those of others who have investigated the same question? If so, were allowances made for potential differences in study methodology?	The results of other studies in the same general area were mentioned briefly, but little detail was provided. There was no discussion of potential differences in study methodology.	No comparisons with other studies as no other studies looking at this particular topic were identified by the authors but did compare cost-effectiveness ratios with other prevention strategies for other disease areas
10.3	Did the study discuss the generalisability of the results to other settings and patient/client groups?	Did not address issues of generalisability of setting, did discuss the need for further research to generalise to more obese children. Also based on small number of families (n=24).	Assessed generalisability of findings to different age groups and setting locations through use of sensitivity analysis – impact on results of variation of trainers' and teachers' stipends/pay.
10.4	Did the study allude to, or take account of, other important factors in the choice or decision under consideration (for example, distribution of costs and consequences, or relevant ethical issues)?	Some limitations were discussed, although this did not appear to be comprehensive.	Limitations were discussed in some depth, although no mention was made of distributional or ethical issues.
10.5	Did the study discuss issues of implementation, such as the feasibility of adopting the 'preferred' programme given existing financial or other constraints, and whether any freed resources could be redeployed to other worthwhile programmes?	There was no discussion of implementation.	Implementation was briefly mentioned, but not discussed in any great detail.
Overall assessment of the study			
How well was the study conducted? Code ++, + or -		-	+
Are the results of the study directly applicable to the patient group targeted by this guideline?		Problems: 1) Looking at family based rather than children alone. 2) No real implications of physical activity, as this intervention is combined with other interventions 3) How they analyse and report the results – use a ratio of the difference in effectiveness over the difference in costs 4) Lack of generalisability – sample consisted of white US population	Problems: 1) Effectiveness data was extrapolated from girls only to cover the whole population (both sexes), so these results may not be completely reliable. 2) The population was US based 3) The impact of physical activity is not obvious and would be difficult to decompose.